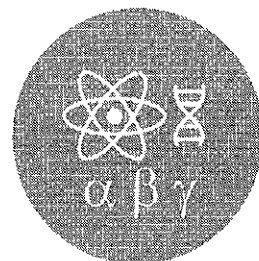
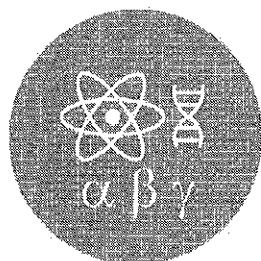


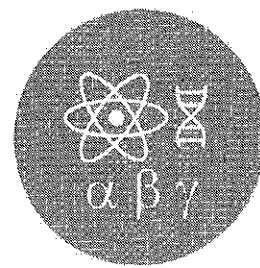
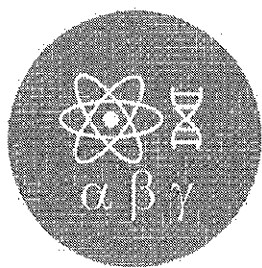
AQA

GCSE

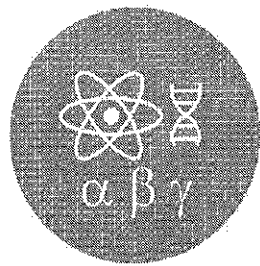
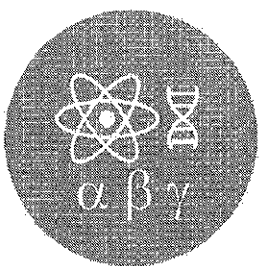
6 Mark

Question Bank





Biology

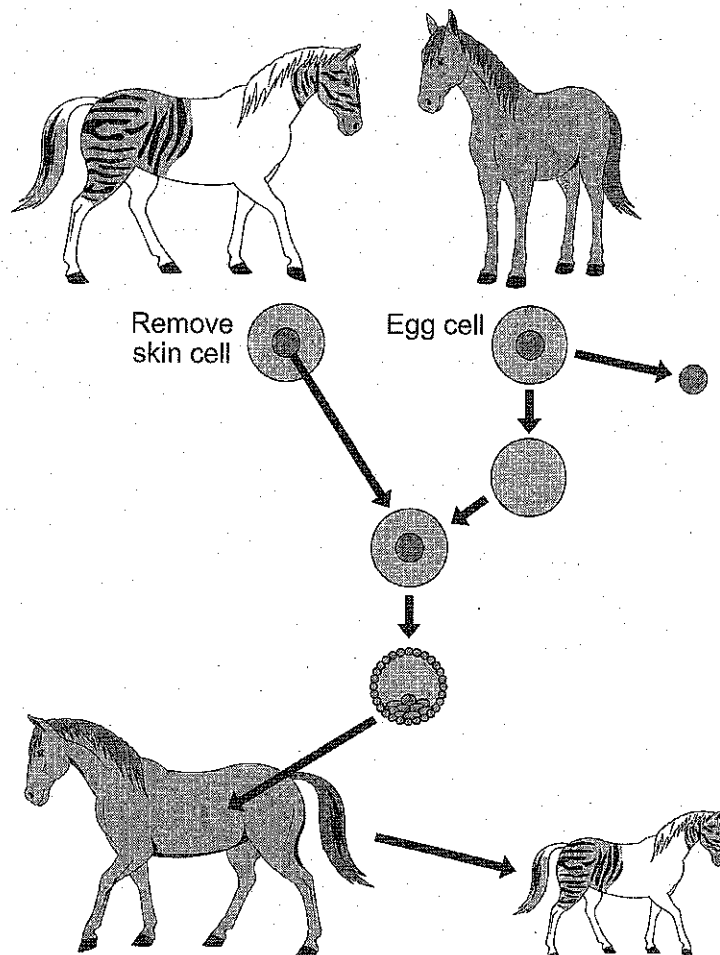


1 (b)

Zorses are **not** able to breed.

Scientists could produce more zorses from this zorse by adult cell cloning.

The diagram shows how the scientists might clone a zorse.



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Use information from the diagram and your own knowledge to describe how adult cell cloning could be used to clone a zorse.

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(6 marks)

9

Turn over for the next question

Turn over ►



BL1HP**Question 1 continued**

1(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.		
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	There is simple description of the early stages of adult cell cloning. However there is little other detail and the description may be confused or inaccurate.	There is an almost complete description of the early stages of the process and description of some aspects of the later stages. The description may show some confusion or inaccuracies.	There is a clear, detailed and accurate description of all the major points of how adult cell cloning is carried out.
Examples of Biology points made in the response could include: <ul style="list-style-type: none"> • skin cell from zorse • (unfertilised) egg cell from horse • remove nucleus from egg cell • take nucleus from skin cell • put into (empty) egg cell • (then give) electric shock • (causes) egg cell divides / embryo formed • (then) place (embryo) in womb / uterus 			6
Total			9

6 Drugs must be trialled before the drugs can be used on patients.

6 (a) (i) Before the clinical trials, drugs are tested in the laboratory.
The laboratory trials are **not** trials on people.

What is the drug tested on in these laboratory trials?

.....
(1 mark)

6 (a) (ii) Drugs must be trialled before the drugs can be used on patients.

Give **three** reasons why.

.....
(3 marks)

6 (b) Read the information about cholesterol and ways of treating high cholesterol levels.

Diet and inherited factors affect the level of cholesterol in a person's blood.
Too much cholesterol may cause deposits of fat to build up in blood vessels and reduce the flow of blood. This may cause the person to have a heart attack.
Some drugs can lower the amount of cholesterol in the blood.

The body needs cholesterol. Cells use cholesterol to make new cell membranes and some hormones. The liver makes cholesterol for the body.

Some drugs can help people with high cholesterol levels.

Statins block the enzyme in the liver that is used to produce cholesterol.
People will normally have to take statins for the rest of their lives. Statins can lead to muscle damage and kidney problems. Using some statins for a long time has caused high numbers of deaths.

Cholesterol blockers reduce the absorption of cholesterol from the intestine into the blood.
Cholesterol blockers can sometimes cause problems if the person is using other drugs.



[illegible]

10

Turn over ►



Question 6 continued

question	answers	extra information	mark
6(b)	<p>argued evaluation</p> <p>any six from:</p> <ul style="list-style-type: none"> • statin can damage / muscles / kidneys / organs but cholesterol blockers don't • statins can cause death but cholesterol blockers don't • cholesterol blockers can interfere with action of other drugs but statins don't • statins are for a life time but cholesterol blockers are not • statins (might) reduce cholesterol to zero but cholesterol blockers only reduce it or statins reduce cholesterol more • statins better for people with inherited high cholesterol • cholesterol blockers better for people with dietary cholesterol problems • taking/using statins/cholesterol blockers is better than dying from heart attack or build up of fat in blood vessels or reduced blood flow 	<p>comparison can be written anywhere in evaluation allow use of 'only' for implied comparison for each point eg only statins damage muscles / kidneys / organs</p> <p>ignore liver</p> <p>if neither of the first 2 points are given accept for 1 mark statins are more dangerous than cholesterol blockers or statins have more side effects</p> <p>allow statins (might) stop membrane / hormone production but cholesterol blockers don't</p>	6
Total			10

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Give examples of animals and plants adapted in the ways you describe.

[illegible]

6

[illegible]

BL1HP

Question 3

question	information			mark
3	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.			6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)	
No relevant content.	There is at least one example of an adaptation of either an animal or a plant. However it may not be clear how the adaptation helps the organism to avoid being eaten.	There is a description of an adaptation of at least one animal and at least one plant. It is clear how at least one of these adaptations helps the organism to avoid being eaten.	There are clear and detailed descriptions of a range of adaptations of named animals and named plants. It is clear how most of these adaptations help the organisms to avoid being eaten.	
examples of clear and detailed biology points made in response:				
<ul style="list-style-type: none">• camouflage – the method of camouflage should be described plus a statement that the predator is less likely to see the prey• mimicry / warning colouration – the method should be described plus a statement that the predator is likely to confuse the prey with e.g. a poisonous organism• thorns / prickles / spines / horns – a statement that these are sharp and are likely to hurt a predator• long limbs / streamlining – a statement that these increase speed and make it more likely that prey will outrun predator• bad taste / poison – a statement that predator will find this unpleasant and 'spit out' prey / not attack same prey again• large ears / position of eyes – a statement that predators will be detected earlier so the prey can escape sooner				
Total				6

3 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Describe how the student should prepare an uncontaminated culture of the bacterium in the Petri dish.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(6 marks)



BL1HP

Question 3

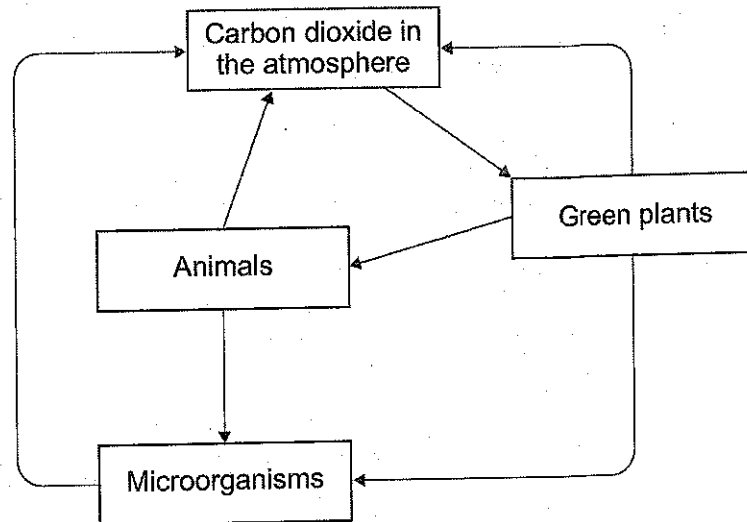
question	answers	extra information	mark
3(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a brief description of at least one of the stages (pre-inoculation, inoculation, post-inoculation).	There is a simple description of at least two stages and an explanation of at least one of them.	There is a clear description of all three stages and an explanation of at least two of them.
<p>examples of biology points made in the response:</p> <p>Pre-inoculation</p> <ul style="list-style-type: none"> • Petri dish and agar sterilised before use • to kill unwanted bacteria • inoculating loop passed through flame / sterile swab • to sterilise / kill (other) bacteria <p>Inoculation</p> <ul style="list-style-type: none"> • loop/swab used to spread/streak bacterium onto agar <p><i>allow other correct methods, eg bacterial lawns</i></p> <ul style="list-style-type: none"> • lid of Petri dish opened as little as possible • to prevent microbes from air entering <p>Post-inoculation</p> <ul style="list-style-type: none"> • sealed with tape • to prevent microbes from air entering • incubate • to allow growth of bacteria 			

Question 3 continues on the next page

3

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The diagram shows part of the carbon cycle.



Describe how living things are involved in the constant cycling of carbon.

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(6 marks)

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Turn over for the next question

Turn over ►



Question 3

question	Answers	extra information	Mark
3	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	For at least one process either the organism that carries it out or the carbon compound used or the carbon compound produced is described or for at least one organism either the carbon compound it uses or the carbon compound it produces is described or at least one process is named	For some processes (at least one of which is named) either the organisms involved or the carbon compounds used or the carbon compounds produced are described	For at least one named process an organism and either the carbon compound used for the process or the carbon compound produced by the process are described and for other processes (at least one of which is named) either the organism or the carbon compounds used or the carbon compounds produced are described (as in Level 2)
examples of biology points made in the response: <ul style="list-style-type: none"> • (green) plants photosynthesise • photosynthesis takes in carbon dioxide • (green) plants use carbon to make carbohydrate / protein / fat / organic compounds / named (e.g. enzymes / cellulose) • animals eat (green) plants (and other animals) • (green) plants respire • animals respire • respiration releases carbon dioxide • (green) plants and animals die • microorganisms decay / decompose / rot / break down / feed on dead organisms • microorganisms respire 			
Total			6

2

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Animals and plants have features (adaptations) that allow them to survive in the conditions in which they normally live.

Describe how animals and plants are adapted to survive in dry conditions such as deserts.

For each adaptation that you give, describe how the adaptation helps the animal or plant to survive in dry conditions.

To obtain full marks you should refer to **both** animals and plants.

[6 marks]

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Extra space

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Question	Answers	Extra information	Mark	AO / spec ref.
2	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.		6	AO1 1.4.1d,f
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)	
No relevant content.	At least one way in which animals and / or plants are adapted to survive.	A description of ways in which animals and / or plants are adapted and an attempt to link at least one adaptation to how it increases the chance of survival.	A description of ways in which animals and plants are adapted and a description of how at least one adaptation increases the chance of survival.	
examples of biology points made in the response: (animals) <ul style="list-style-type: none">• (A) change / decrease in surface area / example<ul style="list-style-type: none">◦ (decrease in surface area which) reduces area from which sweat / water may be lost• (A) hump with fat / fat stores<ul style="list-style-type: none">◦ (fat in hump) to convert to water (via respiration)• (A) long eyelashes<ul style="list-style-type: none">◦ (long eyelashes) to keep (wind-blown) dust out of eyes• (A) nocturnal / 'keep out of the sun'<ul style="list-style-type: none">◦ reduce sweat loss (in heat of the day) (plants) <ul style="list-style-type: none">• (A) decrease in surface area• (A) leaves are spikes<ul style="list-style-type: none">◦ (reduced area / leaves are spikes) reduces water loss / transpiration / evaporation• (A) long / wide spread / extensive roots<ul style="list-style-type: none">◦ (long / wide spread / extensive roots) to absorb (more) water• (A) fleshy / thick stem<ul style="list-style-type: none">◦ (fleshy / thick stem) to store water		extra information allow adaptations of specific animals to living in specified dry conditions, eg a desert <ul style="list-style-type: none">• (A) change / increase in surface area / example<ul style="list-style-type: none">◦ (increase in surface area which) increases area heat may be lost from (by radiation)• (A) changes to thickness of insulating coat<ul style="list-style-type: none">◦ (thicker coat on upper surface) increases insulation from sun's heat• (A) thin (layer) / reduced amount of body fat<ul style="list-style-type: none">◦ (reduced amount of body fat which) reduces insulating layer• (A) wide feet<ul style="list-style-type: none">◦ (wide feet) to reduce pressure / spread weight / prevent sinking allow adaptations of specific plants to living in specified dry conditions, eg a desert <ul style="list-style-type: none">• (A) thick wax<ul style="list-style-type: none">◦ (thick wax) to reduce evaporation / water loss / transpiration• (A) few(er) stomata<ul style="list-style-type: none">◦ (few stomata) to reduce evaporation / water loss / transpiration		
Total			6	

- 3 (b)** In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Plants respond to different environmental factors.

Describe how different environmental factors affect:

- the direction of growth of roots
- the direction of growth of shoots.

In your answer you should refer to the role of plant hormones.

Do **not** refer to the artificial use of plant hormones by gardeners or scientists.

[6 marks]

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Extra space

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Question	Answers	Extra information	Mark	AO / Spec. Ref
3(b)				6
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				AO1 1.2.3a/b/c
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	Reference to at least one environmental factor plants respond to or at least one response or a named hormone	Reference to at least one environmental factor plants respond to and at least one associated response or reference to a named hormone and at least one associated response	Reference to at least one environmental factor plants respond to and at least one associated response and reference to a named hormone	
examples of biology points made in the response: <i>environmental factors</i> <ul style="list-style-type: none">• light• (direction of the force of) gravity• moisture / water <i>effects on direction of growth</i> <ul style="list-style-type: none">• shoots grow upwards• shoots grow towards light• shoots grow against (the force of) gravity• roots grow downwards• roots grow towards moisture• roots grow towards (the force of) gravity <i>hormone</i> <ul style="list-style-type: none">• reference to auxin• unequal distribution of hormone causes unequal growth (rates)		extra information allow phototropism allow gravi/geotropism allow hydrotropism allow reference to 'positive' and 'negative' in terms of tropisms as indicating direction of growth allow other named hormone(s) allow higher concentration of hormone causes faster growth in shoots allow higher concentration of hormone causes slower growth in roots		
Total				10

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how the other components of the diet are important in keeping us healthy.

- the different components
- why we need each component.

[illegible]

Extra space

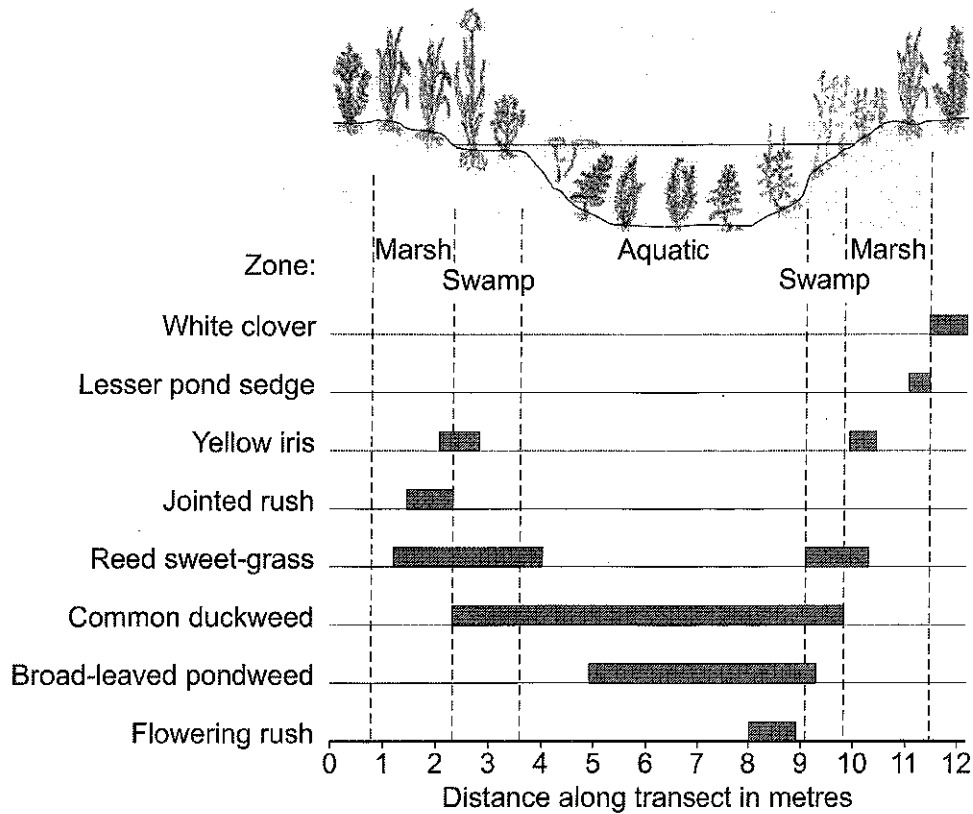
Turn over ►



Question	Answers		Extra information	Mark	AO / Spec. Ref.
2	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.			6	AO1 1.1.1a/b/c
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)		
No relevant content.	At least one component of the diet is given (C) or at least one reason why a component is required (R) or why a healthy diet is needed. (N)	Components of the diet are given (C) and for at least one of these components a reason why the component is required (R) or why a healthy diet is needed. (N)	Most components of the diet are given (C) and different reasons why components are required are given. (R)		
examples of biology points made in the response: <ul style="list-style-type: none">• (C) carbohydrate• (C) protein• (C) fat• (R) (carbohydrate / protein / fat) for energy (release)• (R) (carbohydrate / protein / fat) to build cells / growth / repair• (C) vitamins• (R) (vitamins) for healthy functioning of the body• (N) (balanced diet) contains right balance of different foods to meet needs or avoid malnourishment or avoid under / over weight• (N) (balanced diet) contains right amount of energy to meet needs		extra information: allow other components and needs, eg (C) fibre / roughage; (R) prevent constipation / bowel cancer (C) water; (R) transport / as solvent / part of cytoplasm / produce sweat allow correctly named vitamin (C) with correct reason (R) ignore ref to minerals / ions as a component of the diet and their use in the body			
Total				6	

- 3 Some students investigated the distribution of some of the plants growing in and around a shallow stream. They sampled along a transect line.

The diagram shows their results.



- 3 (a) (i) Name the **one** species that grew only in the driest conditions.

.....
(1 mark)

- 3 (a) (ii) Only **one** species grew in the marsh, the swamp and in the aquatic zones.

Which species?

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(1 mark)

- 3 (a) (iii) Duckweed grows floating in water. What evidence is there for this in the students' results?

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(1 mark)



[illegible]

9

Turn over ►



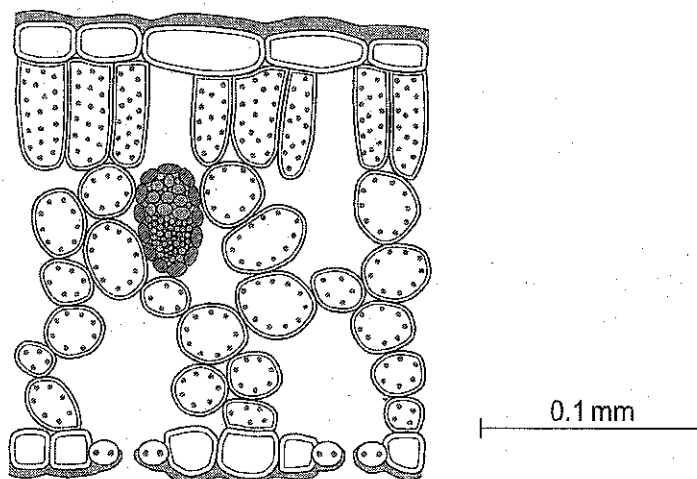
BL2HP**Question 3**

question	answers	extra information	mark
3(a)(i)	(white) clover		1
3(a)(ii)	reed sweet-grass	allow reed allow grass	1
3(a)(iii)	(only) found in swamp and aquatic zones or <u>only</u> found in water or doesn't grow in marsh	ignore wet conditions	1
3(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.		6
	0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)
	No relevant content.	There is a basic description which describes how a quadrat or a metre tape could be used to collect data	There is a clear description of how a quadrat and a metre tape could be used to collect data along a line
			Level 3 (5-6 marks)
			There is a clear, logical and detailed description of a method that will produce valid, repeatable results across / at intervals along the stream.
	examples of procedural points made in the response: <ul style="list-style-type: none"> • use of tape measure to produce transect • placing of quadrats • transect placed across stream • score presence of each plant species • use quadrat at regular intervals along tape • repeat transect several times (≥ 3) • along stream • at random or regular intervals 		
Total			9

- 1 (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Diagram 2 shows a section through a plant leaf.

Diagram 2



Describe the structure of the leaf and the functions of the tissues in the leaf.

You should use the names of the tissues in your answer.

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(6 marks)

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Turn over for the next question

Turn over ►



BL2HP
Question 1 continued . . .

question	Answers	extra information	mark
1(c)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6
	0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)
	No relevant content.	There is a brief description of at least 1 tissue or at least 1 function of an indicated part of the leaf. The account lacks clarity or detail.	There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.
			Level 3 (5-6 marks)
			There is a detailed description of most of the structures and their functions.
<p>examples of responses:</p> <ul style="list-style-type: none"> • epidermis • cover the plant • mesophyll / palisade • photosynthesises • phloem • xylem • transport. <p>The following points are all acceptable but beyond the scope of the specification:</p> <ul style="list-style-type: none"> • (waxy) cuticle – reduce water loss • epidermis – no chloroplasts so allows light to penetrate • stomata / guard cells – allow CO₂ in (and O₂ out) or controls water loss • palisade (mesophyll) – <u>many</u> chloroplasts to trap light <ul style="list-style-type: none"> – near top of leaf for receiving more light • spongy (mesophyll) – air spaces for rapid movement of gases 			
Total			9

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how.

- the enzyme and where the enzyme is produced
- the products of digestion
- any other chemicals involved.

[illegible][illegible]

Question 3 continued . . .

3(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.			6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)	
No relevant content.	There is a simple description of part of a process including a reference to at least one of: mechanical digestion, lipase, product of enzyme action, bile, site of production or site of digestion	There is a description of at least one process <u>linking</u> ideas.	There is a clear description of the process including reference to the majority of: mechanical digestion, lipase, bile, where they are produced, products, function of bile and site of digestion / absorption	
examples of biological points made in the response: <ul style="list-style-type: none"> • mechanical breakdown in mouth / stomach • fats → fatty acids and / or glycerol • by lipase • (produced by) pancreas • and small intestine • fat digestion occurs in small intestine • bile • produced by liver • neutralises acid from stomach • produces alkaline conditions in intestine • refs. to increased surface area related to emulsification or chewing • products are small molecules / water-soluble • products absorbed by small intestine 				
Total				9

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe why diffusion is important to animals and plants.

- animals
- plants
- examples of the diffusion of named substances.

[illegible]

6

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Question	Answers	Extra information	Mark	AO / spec ref.
2			6	AO1 2.1.2a,b, c, 2.2.1d, 2.3.1a,b, c,g, 2.6.1
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	An example is given of a named substance or a process or there is an idea of why diffusion is important eg definition.	At least one example of a substance is given and correctly linked to a process in either animals or plants.	There is a description of a process occurring in either animals or plants that is correctly linked to a substance and a process occurring in the other type of organism that is correctly linked to a substance.	
examples of points made in the response Importance of diffusion: <ul style="list-style-type: none"> to take in substances for use in cell processes products from cell processes removed Examples of processes and substances: <ul style="list-style-type: none"> for gas exchange / respiration: O₂ in / CO₂ out for gas exchange / photosynthesis: CO₂ in / O₂ out food molecules absorbed: glucose, amino acids, etc water absorption in the large intestine water lost from leaves / transpiration water absorption by roots mineral ions absorbed by roots 		extra information Description of processes might include: <ul style="list-style-type: none"> movement of particles / molecules / ions through a partially permeable membrane (movement of substance) down a concentration gradient osmosis: turgor / support / stomatal movements		
Total			6	

2

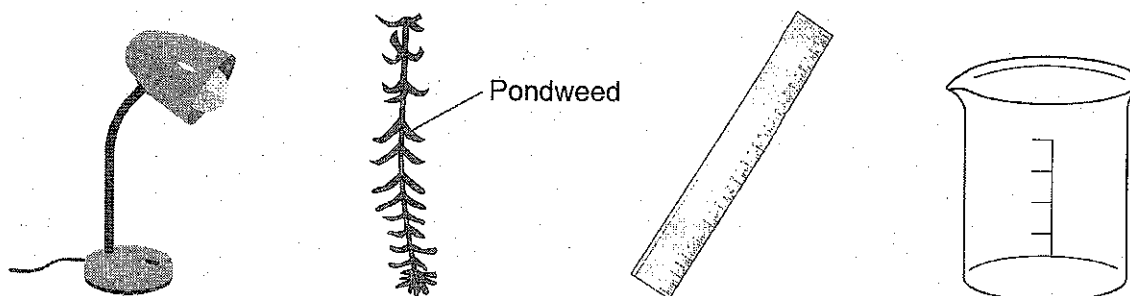
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Light intensity, carbon dioxide concentration and temperature are three factors that affect the rate of photosynthesis.

How would you investigate the effect of **light intensity** on the rate of photosynthesis?

Figure 3 shows some of the apparatus you might use.

Figure 3



Not to scale

You should include details of:

- how you would set up the apparatus and the materials you would use
- the measurements you would make
- how you could make this a fair test.

[6 marks]



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Extra space

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Turn over for the next question

Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
2			6	AO1/2/3 2.3.1a/b/c/d +prac
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	A partial description of how the apparatus is set up or a description of how light is supplied or a simple description of how photosynthesis can be measured. or a control variable	A description of how the apparatus is set up and a description of how photosynthesis can be measured. or a description of how light intensity is varied or a control variable or any other relevant point	A description of how the apparatus is used to measure the rate of photosynthesis at different light intensities is given. For full marks reference must be made to a control variable or repeats	
examples of the points made in the response <ul style="list-style-type: none"> apparatus set up: <ul style="list-style-type: none"> weed in water in beaker light shining on beaker method of varying the light intensity – eg changing distance of lamp from plant method of controlling other variables <ul style="list-style-type: none"> use same pond weed or same length of pond weed temperature: water bath or heat screen CO₂ leave sufficient time at each new light intensity before measurements taken method of measuring photosynthesis – eg counting bubbles of gas released or collecting gas & measuring volume in a syringe measuring rate of photosynthesis by counting bubbles for set period of time repetitions 		extra information allow information in the form of a diagram		
Total			6	

Give methods used in the factory farming of animals.
Explain the advantages and disadvantages of these methods.

[illegible]

8

09

Question 3 continued

3(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.			6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)	
No relevant content.	There is a basic description of at least one factory farming method or identification of an advantage or disadvantage of factory farming.	There is a description of at least one factory farming method and an advantage or disadvantage is <u>explained</u> .	There is a description of factory farming methods and advantage(s) and disadvantage(s) are explained.	
<p>examples of biology points made in the response:</p> <p>factory farming methods e.g.:</p> <ul style="list-style-type: none"> Kept in cramped conditions / battery hens / calf crates / pig barns / fish tanks Controlled temperature / heating Controlled feeding / modified food given / growth hormones Controlled lighting Treated with <u>prophylactic</u> antibiotics <p>Advantages e.g.:</p> <ul style="list-style-type: none"> Increased efficiency / profit / greater food production / cheaper food / faster growth Farmer can have more livestock Less energy is lost through movement Less energy is used keeping warm (Food is high in calories / protein) so animals will grow faster / lay more eggs Easier to vaccinate all the animals Easier to protect animals from predators Antibiotic treatment stops infections in animals <p>Disadvantages e.g.:</p> <ul style="list-style-type: none"> Stress / cruelty / inhumane / unethical Restricted movement / overcrowding Faster spread of diseases Antibiotics in the food chain / residual chemicals in the food chain Wasting fossil fuels / increasing global warming Increased pollution from animal waste and from additional transport 				
Total				8

2

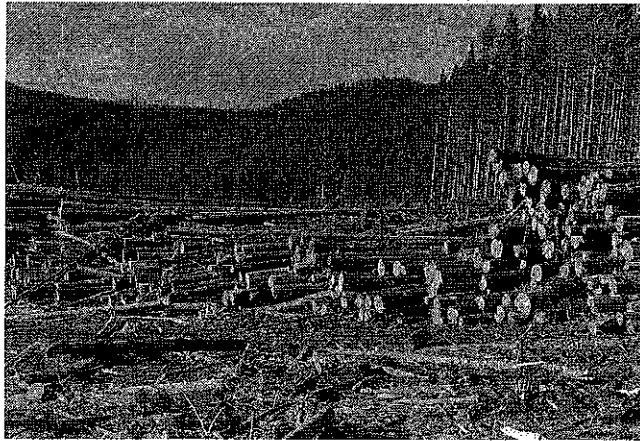
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Deforestation affects the environment.

Deforestation is causing a change in the amounts of different gases in the atmosphere. This change causes global warming and climate change.

Figure 2 shows an area of deforestation.

Figure 2



Give the reasons why deforestation is taking place.

Describe how deforestation is causing the change in the amounts of different gases in the atmosphere.

[6 marks]

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Extra space

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Turn over for the next question

Turn over ►



- 2 (c)** In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Every year, many patients need to have heart valve replacements.

Figure 2 gives information about two types of heart valve.

Figure 2

Living human heart valve	Cow tissue heart valve
<ul style="list-style-type: none"> It has been used for transplants for more than 12 years. It can take many years to find a suitable human donor. It is transplanted during an operation after a donor has been found. During the operation, the patient's chest is opened and the old valve is removed before the new valve is transplanted. 	<ul style="list-style-type: none"> It has been used since 2011. It is made from the artery tissue of a cow. It is attached to a stent and inserted inside the existing faulty valve. A doctor inserts the stent into a blood vessel in the leg and pushes it through the blood vessel to the heart.

A patient needs a heart valve replacement. A doctor recommends the use of a cow tissue heart valve.

Give the advantages and disadvantages of using a cow tissue heart valve compared with using a living human heart valve.

Use information from **Figure 2** and your own knowledge in your answer.

[6 marks]

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Extra space

11

Turn over for the next question

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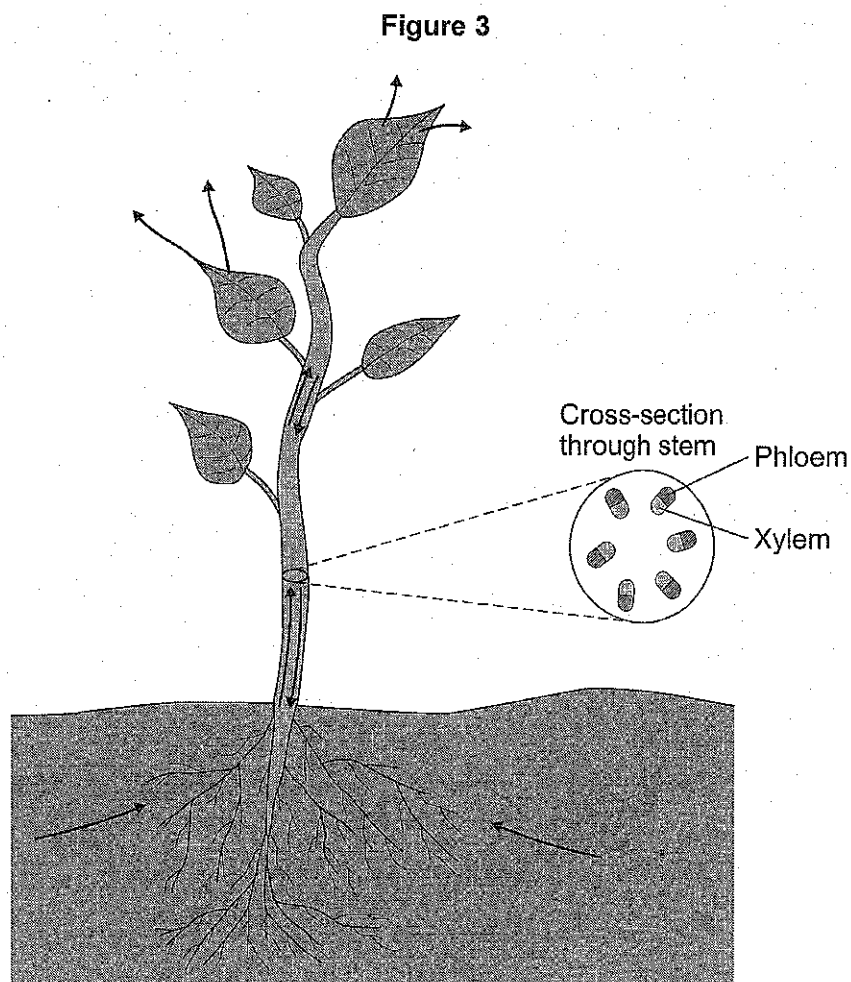
Question	Answers	Extra Information	Mark	AO / Spec. Ref
2(c)			6	AO3 32, 321f
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content	There is a description of at least one advantage of the cow tissue valve or a description of at least one disadvantage of the cow tissue valve.	There is a description of at least one advantage of the cow tissue valve and at least one disadvantage of the cow tissue valve.	There is a description of the advantages and disadvantages of the cow tissue valve or a description of several advantages of the cow tissue valve and at least one disadvantage.	
examples of the points made in the response Advantages of cow tissue valve: <ul style="list-style-type: none"> abundant supply of cows so shorter waiting time no need for tissue typing quicker operation less invasive or shorter recovery time cheaper operation costs less operation / anaesthetic risks Disadvantages of cow tissue valve: <ul style="list-style-type: none"> made from cow so possible objections on religious grounds new procedure so could be unknown risks risks of using a stent eg. blood clots, stent breaking or valve tearing not proven as a long term treatment may be rejected 		extra information ignore information copied directly from the table without value added ignore can take many years to find a suitable human donor ignore ethical arguments allow possible transfer of disease from cow		
Total				11

3

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Plants transport many substances between their leaves and roots.

Figure 3 shows the direction of movement of substances through a plant.



Describe how **ions**, **water** and **sugar** are obtained and transported through plants.

In your answer you should refer to materials moving upwards in a plant and to materials moving downwards in a plant.

[6 marks]

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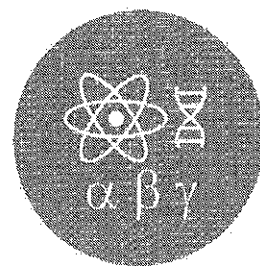
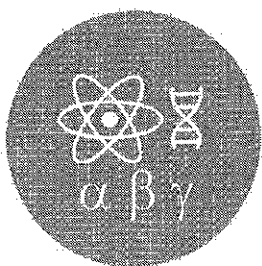
Extra space

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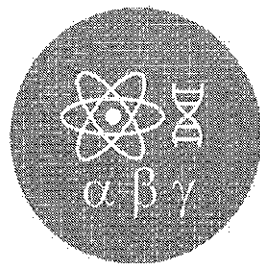
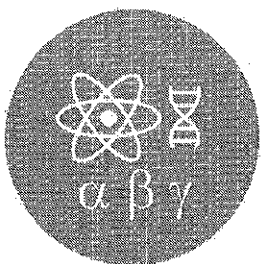
Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
3			6	AO1
<p>Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.</p>				<p>3.1.1a/b/g 3.1.1a/d 3.2.3a</p>
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant points are made	<p>At least one process (P) for obtaining a material is given or at least one vessel (V) and the material it carries is given or there is a description of the direction of movement (M) for at least one material</p>	<p>At least one process for obtaining a specified material is given and is correctly linked to the vessel that the material is transported in or correctly linked to a description of the direction of movement of the material</p>	<p>Processes used for obtaining specified materials are given. and correctly linked to the vessels that the materials are transported in or correctly linked to a description of the direction of movement of the materials. For full credit, in addition to the above descriptors at least one of the processes must be linked to the vessel that the material is transported in and the direction of the movement of the material.</p>	
<p>examples of points made in the response</p> <p>ions: (P) taken up by diffusion or active transport</p> <ul style="list-style-type: none"> from an area of high to low concentration (diffusion) or an area of low to high concentration (active transport) <p>(V) travels in the xylem (M) to the leaves or from the roots / soil</p> <p>Water: (P) taken up by osmosis</p> <ul style="list-style-type: none"> from an area of low to high concentration <p>(V) travels in the xylem (M) to the leaves or from the roots / soil (P) transpiration stream</p> <ul style="list-style-type: none"> movement replaces water as it evaporates from leaves <p>(V) in the xylem</p> <p>Sugar: (P) made during photosynthesis (V) travels in the phloem (M) to other parts of the plant or to storage organs or travels up and down</p>		<p>extra information</p> <p>allow high concentration of water to low concentration of water allow from high water potential to low water potential ignore along a concentration gradient</p>		
Total		6		

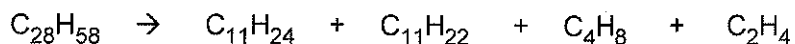


Chemistry



- 7** Ethene is used as a starting material for the production of many other substances, including ethanol.

- 7 (a)** Ethene is produced when hydrocarbons are cracked. To do this hydrocarbons are heated to vaporise them. The vapours are then passed over a hot catalyst. The symbol equation shows the reaction for one hydrocarbon.



- 7 (a) (i)** One of the products is a different type of hydrocarbon to the other products.

Complete the sentences.

The formula of the product that is a different type of hydrocarbon is

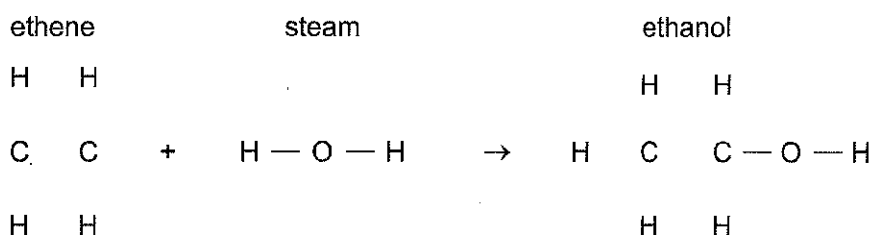
The chemical structure of this product is different to the other products because

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(2 marks)

- 7 (a) (ii)** Ethanol is produced when ethene reacts with steam in the presence of a hot catalyst.

Draw the missing bonds to complete the displayed structures in the equation.



(2 marks)

- 7 (b)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

In 1970, the Brazilian Government had stated that all petrol must contain more than 25% ethanol. The reasons for this statement in 1970 were:

- the oilfields in Brazil at that time only supplied 20% of the crude oil needed to make petrol
- Brazil has a climate suitable for growing sugar cane.

To produce ethanol the sugar cane plants are crushed and soaked in water for one day. The sugar solution is separated from the plant material by filtration. Yeast is added to the sugar solution and fermented for three days. The yeast is separated from the solution of water and ethanol by filtration. Ethanol is separated from water by fractional distillation.



- the demand for ethanol and the price of ethanol had greatly increased
- very large offshore oilfields had been discovered. These offshore oilfields would make Brazil one of the biggest crude oil producers in the world.

You should include environmental and economic or social factors in your evaluation.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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[illegible]

CH1HP

Question 7

question	answers	extra information	mark
7(a)(i)	$C_{11}H_{24}$		1
	it does not have a (carbon carbon) double bond or it has only single (carbon carbon) bonds.	linked to first mark point accept it is an alkane or it is (a) saturated (hydrocarbon) accept converse statement	1
7(a)(ii)	ethene 4 x single C-H bonds 1 x double C=C bond		1
	ethanol 5 x single C-H bonds 1 x single C-C bond	if additional bonds are given on water molecule then both ethene and ethanol must be correct for 1 mark	1
7(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.		6

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a simple description of advantages and / or disadvantages of environmental or economic or social factors why Brazil should produce ethanol from crude oil or from sugar cane. There is a weak or no conclusion.	There a clear description of advantages and / or disadvantages of environmental and economic or social factors why Brazil should produce ethanol from crude oil or from sugar cane. There is a conclusion based on the factors described.	There is a detailed description of the advantages and / or disadvantages of environmental and economic or social factors why Brazil should produce ethanol from crude oil or from sugar cane, considering both processes. There is a justified conclusion.

examples of the chemistry points made in the response			
<p style="text-align: center;">Sugar cane</p> <p><u>Advantage</u></p> <p>Environmental:</p> <ul style="list-style-type: none"> it is renewable / sustainable it grows absorbing CO₂ which makes it 'carbon neutral' <p>Economical / Social:</p> <ul style="list-style-type: none"> growing it is labour intensive so provides (local, rural) employment low amount of energy / fuel needed so process costs are low simple / low technology process so process / investment costs are low <p><u>Disadvantage</u></p> <p>Environmental:</p> <ul style="list-style-type: none"> destruction of habitats / biodiversity to provide land to grow sugar cane <p>Economical / Social:</p> <ul style="list-style-type: none"> land should be used to grow food (shortage / cost / population increase) growing or process is slow / batch / unreliable (crop failure) 		<p style="text-align: center;">Crude oil</p> <p><u>Disadvantage</u></p> <p>Environmental:</p> <ul style="list-style-type: none"> it is non-renewable / will run out it contains 'locked up' carbon / CO₂ or when released increases global warming destruction of marine habitats caused by accidents / spillages <p>Economical / Social:</p> <ul style="list-style-type: none"> process requires small number of trained workers high amount of energy / fuel needed so process costs are high complex / high tech process so process / investment costs are high <p><u>Advantage</u></p> <p>Environmental:</p> <ul style="list-style-type: none"> does not use land as it is offshore <p>Economical / Social:</p> <ul style="list-style-type: none"> no loss of food crops extracting or process is fast / continuous / reliable 	
Total			10

UMS Conversion Calculator www.aqa.org.uk/umsconversion

[illegible]

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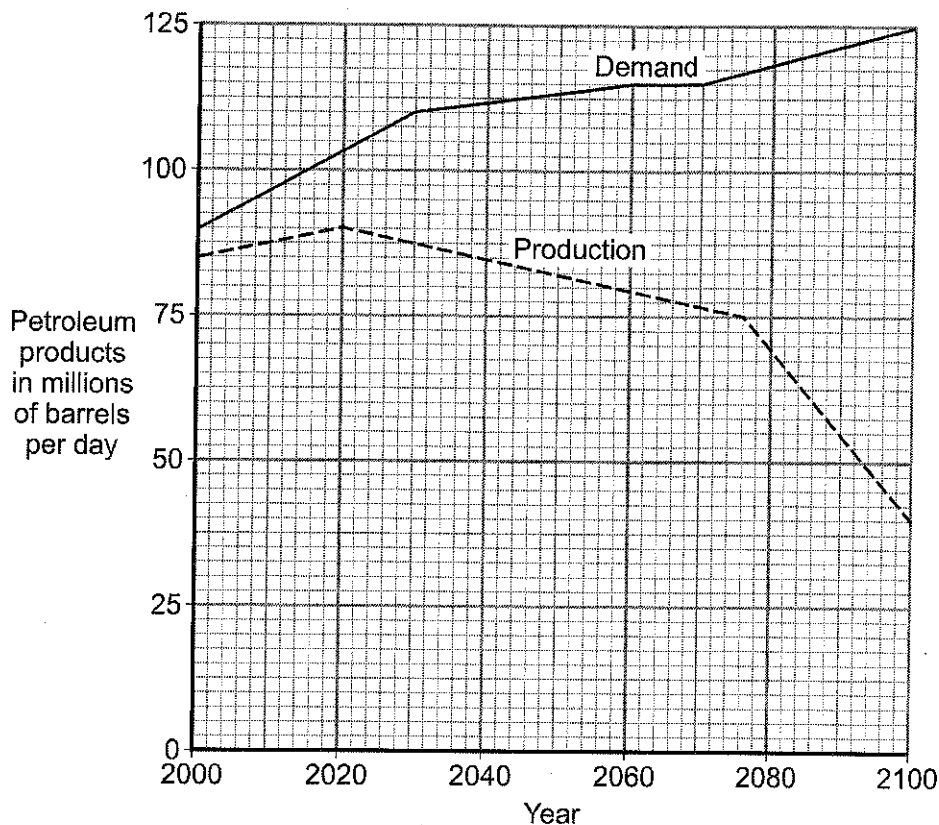
CH1HP

Question 3 cont'd...

question	answers	extra information	mark
3(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2 , and apply a 'best-fit' approach to the marking.		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a basic description of at least one advantage or one disadvantage caused by using plastic shopping bags made from poly(ethene).	There is a clear description of both an advantage and a disadvantage caused by using plastic shopping bags made from poly(ethene).	There is a detailed description of both advantages and disadvantages caused by using plastic shopping bags made from poly(ethene).
<p>examples of the chemistry/social points made in the response: ignore cost unqualified</p> <p>Advantages:</p> <ul style="list-style-type: none"> • Simple properties eg strong / low density / water resistant • Bags can be reused (for shopping) or another <u>specified</u> use eg bin liners • Money charged for bags can go to good causes or encourage reuse • Poly(ethene) bags can be recycled eg made into milk bottle crates • Poly(ethene) bags can be burned to provide heat for buildings/generation of electricity • New bags are now made that can biodegrade <p>Disadvantages:</p> <ul style="list-style-type: none"> • (Older) bags can take many years to biodegrade • There is a <u>shortage</u> of landfill space • Bags are made from (crude) <u>oil</u> which is a non-renewable resource/running out • Large amounts of energy/fuel are used for the production of poly(ethene) • <u>Production</u> of poly(ethene) releases carbon dioxide/causes global warming • Specified issue caused by litter eg visual pollution or effect on wildlife • <u>Burning bags</u> release carbon dioxide / causes global warming 			
Total			10

- 3 (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Petroleum products, such as petrol, are produced from crude oil. The graph shows the possible future production of petroleum products from crude oil and the expected demand for petroleum products.



Canada's oil sands hold about 20% of the world's known crude oil reserves.

The oil sands contain between 10 to 15% of crude oil. This crude oil is mainly bitumen.

In Canada the oil sands are found in the ground underneath a very large area of forest. The trees are removed. Then large diggers and trucks remove 30 metres depth of soil and rock to reach the oil sands. The oil sands are quarried. Boiling water is mixed with the quarried oil sands to separate the bitumen from the sand. Methane (natural gas) is burned to heat the water.

The mixture can be separated because bitumen floats on water and the sand sinks to the bottom of the water. The bitumen is cracked and the products are separated by fractional distillation.



This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

11

09

CH1HP

question	mark		
<p>3(c)</p> <p>Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.</p>	6		
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a basic description of at least one advantage or one disadvantage of extracting petroleum products from oil sands.	There is a clear description of an advantage and a disadvantage of extracting petroleum products from oil sands.	There is a detailed description of both advantages and disadvantages of extracting petroleum products from oil sands.
<p>examples of the chemistry/environmental/economic/social points made in the response</p> <p>Advantages:</p> <ul style="list-style-type: none"> the oil sands are needed because crude oil is running out this crude oil is needed because demand is increasing the oil sands contain a <u>large</u> amount of crude oil the oil sands could improve Canada's economy the oil sands provide employment for a lot of people the trees / forest are used for wood products / fuel <p>Disadvantages:</p> <ul style="list-style-type: none"> destruction of environment / habitats fewer trees / forests to absorb carbon dioxide specified pollution, for example, visual, noise, atmospheric (including dust), water (including river or drinking) with cause, e.g. gases/particulates from burning diesel <u>large amounts</u> of methane(natural gas) are used to provide energy energy / fuel needed for cracking and fractional distillation burning fuel releases carbon dioxide crude oil / natural gas contains locked up carbon crude oil is non-renewable 			
Total			11

3 Crude oil is a mixture of many different chemical compounds.

3 (a) Fuels, such as petrol (gasoline), can be produced from crude oil.

3 (a) (i) Fuels react with oxygen to release energy.

Name the type of reaction that releases energy from a fuel.

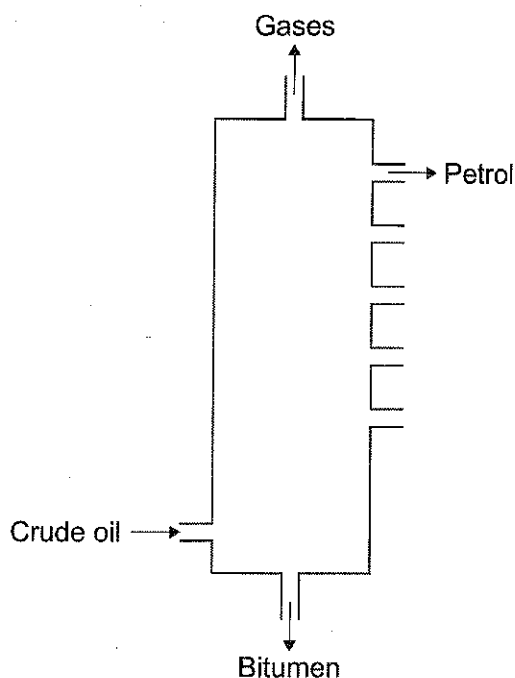
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(1 mark)

3 (a) (ii) Fuels react with oxygen to produce carbon dioxide.
The reaction of a fuel with oxygen can produce a different oxide of carbon.

Name this different oxide of carbon and explain why it is produced.

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(2 marks)

3 (b) Most of the compounds in crude oil are hydrocarbons.
Hydrocarbons with the smallest molecules are very volatile.



Use the diagram and your knowledge to answer this question.

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, which is otherwise blank.

9

07

Question 3 continued

question	Answers	extra information	Mark
3(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a statement that crude oil is heated or that substances are cooled. However there is little detail and any description may be confused or inaccurate.	There is some description of heating / evaporating crude oil and either fractions have different boiling points or there is an indication of a temperature difference in the column.	There is a reasonable explanation of how petrol is or fractions are separated from crude oil using evaporating and condensing.
<p>If cracking is given as a preliminary or subsequent process to fractional distillation then ignore.</p> <p>However, if cracking / catalyst is given as part of the process, maximum is level 2</p> <p>examples of chemistry points made in the response could include:</p> <ul style="list-style-type: none"> • Some / most of the hydrocarbons (or petrol) evaporate / form vapours or gases • When some of / a fraction of the hydrocarbons (or petrol) cool to their boiling point they condense • Hydrocarbons (or petrol) that have (relatively) low boiling points and are collected near the top of the fractionating column or hydrocarbons with (relatively) high boiling points are collected near the bottom of the fractionating column • The process is fractional distillation • Heat the crude oil / mixture of hydrocarbons or crude oil / mixture is heated to about 350°C • Some of the hydrocarbons remain as liquids • Liquids flow to the bottom of the fractionating column • Vapours / gases rise up the fractionating column • Vapours / gases cool as they rise up the fractionating column • The condensed fraction (or petrol) separates from the vapours / gases and flows out through a pipe • Some of the hydrocarbons remain as vapours / gases • Some vapours / gases rise out of the top of the fractionating column • There is a temperature gradient in the fractionating column or the fractionating column is cool at the top and hot at the bottom 			
Total			9

- 2 (b)** In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Crude oil is separated to produce the fraction petroleum diesel.

Worries about low supplies of crude oil have led to the growing of large areas of crops to produce vegetable oil.

Vegetable oils are used to produce biodiesel.

There are economic, ethical and environmental issues about the use of biodiesel.

Biodiesel and petroleum diesel are used as a fuel for cars. In a car engine the fuel burns and releases waste products through the car exhaust system.

Table 1 shows the amount of waste products formed by biodiesel compared with the amount of waste products formed by petroleum diesel.

(Note that ppm is parts per million.)

Table 1

	Carbon dioxide in ppm	Nitrogen oxides in ppm	Sulfur dioxide in ppm	Particulates in g per m ³
Biodiesel	20 000	760	0	0.3
Petroleum diesel	80 000	700	300	0.6

Use this information and your knowledge and understanding to give advantages and disadvantages of using biodiesel instead of petroleum diesel.

[6 marks]

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Extra space

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Turn over ►



0 5

2(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.				1+2+3 / 1.4.3e	E
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)		
No relevant content	There is a stated advantage or disadvantage of using biodiesel or petroleum diesel.	There is a stated advantage or disadvantage of using biodiesel or petroleum diesel with a linked consequence.	There is at least one stated advantage and at least one stated disadvantage of using biodiesel or petroleum diesel with a linked consequence for each.		
Examples of points made in the response could include: Advantages of biodiesel: <ul style="list-style-type: none">• Produces less carbon dioxide• Produces no sulfur dioxide• Produces less particulates• Sustainable / renewable• Growing crops absorb carbon dioxide• Carbon neutral• Produces less acid rain• Conserves the limited amount of petroleum diesel Disadvantages of biodiesel: <ul style="list-style-type: none">• Produces more nitrogen oxides• Deforestation for land• Destruction of habitats for land• Uses land that could be used for food crops• Creates food shortages• Crops are not reliable					
Total					
				9	

3 This question is about life, the Earth and its atmosphere.

3 (a) There are many theories about how life was formed on Earth.

Suggest **one** reason why there are many theories.

[1 mark]

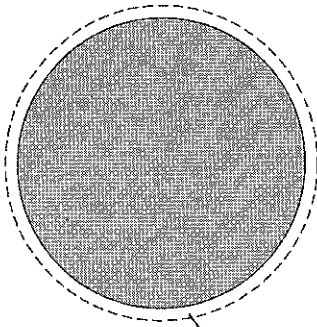
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3 (b) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

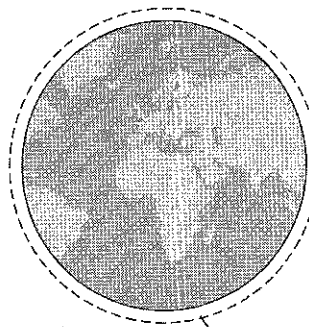
This Earth and its atmosphere today are not like the early Earth and its atmosphere.

The early Earth
Most of the surface
was covered by volcanoes



Most of the atmosphere
was carbon dioxide and
water vapour

The Earth today
Most of the surface
is covered by oceans



Most of the atmosphere
is nitrogen and oxygen

Describe and explain how the surface of the early Earth and its atmosphere have changed to form the surface of the Earth and its atmosphere today.

[6 marks]

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Extra space

7

Turn over for the next question

Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	any one from: <ul style="list-style-type: none"> not enough evidence or proof (life and the Earth were created) billions of years ago 	allow no evidence or no proof allow a long time ago ignore different beliefs or no one was there	1	2 / 1.7.2d
3(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.				1+2+3 / 1.7.1a/b/c / 1.7.2a/b/c/f/g/h
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content	Statements based on diagrams	Description of how one change occurred	Descriptions of how at least two changes occurred	
Examples of chemistry points made in the response could include: Main changes <ul style="list-style-type: none"> oxygen increased because plants / algae developed and used carbon dioxide for photosynthesis / growth producing oxygen; carbon dioxide decreased because of this carbon dioxide decreased because oceans formed and dissolved / absorbed carbon dioxide; carbon dioxide became locked up in sedimentary / carbonate rocks and / or fossil fuels oceans formed because the Earth / water vapour cooled and water vapour in the atmosphere condensed continents formed because the Earth cooled forming a supercontinent / Pangaea which formed the separate continents volcanoes reduced because the Earth cooled forming a crust Other changes <ul style="list-style-type: none"> nitrogen formed because ammonia in the Earth's early atmosphere reacted with oxygen / denitrifying bacteria 				
Total			7	

- 2 (c) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Most car engines use petrol as a fuel.

- Petrol is produced from the fractional distillation of crude oil.
- Crude oil is a mixture of hydrocarbons.
- Sulfur is an impurity in crude oil.

Car engines could be developed to burn hydrogen as a fuel.

- Hydrogen is produced from natural gas.
- Natural gas is mainly methane.

Table 2 shows information about petrol and hydrogen.

Table 2

	Petrol	Hydrogen
State of fuel at room temperature	Liquid	Gas
Word equation for combustion of the fuel	petrol + oxygen \longrightarrow carbon dioxide + water	hydrogen + oxygen \longrightarrow water
Energy released from combustion of 1 g of the fuel	47 kJ	142 kJ

Describe the **advantages** and **disadvantages** of using hydrogen instead of petrol in car engines.

Use the information given and your knowledge and understanding to answer this question.

[6 marks]



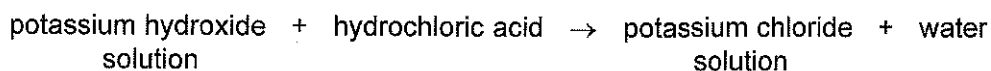
18

09

QWC Mark Scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(c)			6	AO1+AO2+ AO3 1.1.3b; 1.4.1b/c; 1.4.3a/b/c/d ;1.7.2h/i
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content	Statements made from the information that indicate whether at least one statement is an advantage or a disadvantage or a linked advantage or disadvantage	Descriptions of an advantage and a disadvantage with some use of their knowledge to add value.	Descriptions of advantages and disadvantages that are linked to their own knowledge.	
<p>Examples of the added value statements and links made in the response could include:</p> <p>Note that link words are in bold; links can be either way round.</p> <p>Accept reverse arguments and ignore cost throughout.</p> <p>Advantages of using hydrogen:</p> <ul style="list-style-type: none">Combustion only produces water so causes no pollutionCombustion does not produce carbon dioxide so this does not contribute to global warming or climate changeCombustion does not produce sulfur dioxide so this does not contribute to acid rainIncomplete combustion of petrol produces carbon monoxide that is toxicIncomplete combustion of petrol produces particulates that contribute to global dimmingPetrol comes from a non-renewable resource but there are renewable/other methods of producing hydrogenHydrogen releases more energy so less fuel needed or more efficient <p>Disadvantages of using hydrogen:</p> <ul style="list-style-type: none">Hydrogen is a gas so is difficult to store or transfer to vehiclesHydrogen gas is very flammable so leaks cause a greater risk of explosionMost hydrogen is produced from fossil fuels which are running outCannot be used in existing car engines so modification / development or replacement is neededLack of filling stations so difficult to refuel your vehicle				
Total			18	

The salt called potassium chloride is made when potassium hydroxide solution reacts with hydrochloric acid.



In this method you should:

- describe how you will add the correct amount of the hydrochloric acid to neutralise the potassium hydroxide solution
- describe how you will get crystals of potassium chloride.

(6 marks)

Question 2 continues on the next page

Turn over ►



CH2HP

Question 2

question	answers	extra information	mark
2(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a simple description of a laboratory procedure for obtaining potassium chloride.	There is a clear description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that does not necessarily allow the procedure to be completed successfully by another person. The answer must include the use of an indicator / pH meter or a method of obtaining crystals.	There is a detailed description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that can be followed by another person. The answer must include the use an indicator / pH meter and a method of obtaining crystals
<p>examples of the chemistry points made in the response:</p> <ul style="list-style-type: none"> • One reagent in beaker (or similar) • Add (any named) indicator • Add other reagent • Swirl or mix • Add dropwise near end point • Stop addition at change of indicator colour • Note volume of reagent added • Repeat without indicator, adding same volume of reagent or remove indicator using charcoal • Pour solution into basin / dish • Heat (using Bunsen burner) • Leave to crystallise / leave for water to evaporate / boil off water <p>Accept any answers based on titration</p>			

Question 2 continues on the next page ...

- 2 (d)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The electrolysis of sodium chloride solution also produces chlorine and sodium hydroxide.

In industry, the electrolysis of sodium chloride solution can be done in several types of electrolysis cell.

Some information about two different types of electrolysis cell is given below.

	Mercury cell	Membrane cell
Cost of construction	Expensive	Relatively cheap
Additional substances used	Mercury, which is recycled. Mercury is toxic so any traces of mercury must be removed from the waste.	Membrane, which is made of a polymer. The membrane must be replaced every 3 years.
Amount of electricity used for each tonne of chlorine produced in kWh	3400	2950
Quality of chlorine produced	Pure	Needs to be liquefied and distilled to make it pure.
Quality of sodium hydroxide solution produced	50% concentration. Steam is used to concentrate the sodium hydroxide solution produced.	30% concentration. Steam is used to concentrate the sodium hydroxide solution produced.

Use the information and your knowledge and understanding to compare the environmental and economic advantages and disadvantages of these **two** types of electrolysis cell.

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Handwriting practice area with 25 horizontal dotted lines.

(6 marks)

12

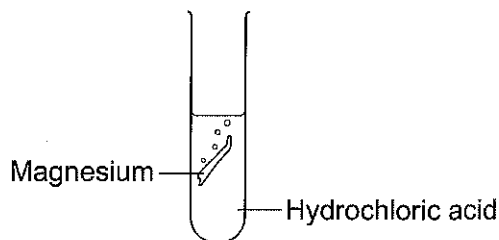
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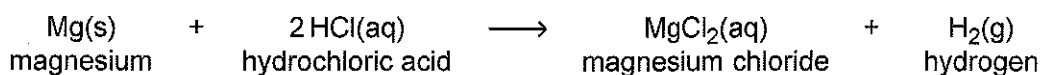
CH2HP

question	answers	extra information	mark
2(d)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There are basic descriptions of advantages or disadvantages of the electrolysis cells.	There are clear descriptions of environmental or economic advantages or disadvantages of the electrolysis cells. Comparisons may be implied.	There are detailed descriptions of environmental and economic advantages and disadvantages, comparing the electrolysis cells.
<p>examples of chemistry points made in the response:</p> <p>Accept converse where appropriate.</p> <ul style="list-style-type: none"> • mercury cell is more expensive to construct • mercury is recycled but membranes must be replaced • mercury is toxic but membrane / polymer is not • removing traces of mercury from waste is expensive • mercury cell uses more electricity • mercury cell produces chlorine that is purer • mercury cell produces higher concentration / better quality of sodium hydroxide (solution) 			
Total			12

- 2 A student investigated the reaction between magnesium and hydrochloric acid.



The equation for the reaction is:



- 2 (a) Give **two** observations the student could make during the reaction.

1

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2

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(2 marks)

- 2 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The student investigated how the rate of this reaction changed when the concentration of hydrochloric acid was changed.

Write a plan the student could use.

In your plan you should:

- describe how you would carry out the investigation and make it a fair test
- describe the measurements you would make.

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Handwriting practice area with 20 horizontal dotted lines.

(6 marks)

8

Turn over ►

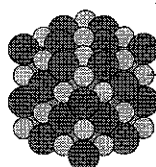


Question 2

question	answers	extra information	Mark
2(a)	any two from: <ul style="list-style-type: none"> effervescence / bubbles / fizzing magnesium disappears / dissolves heat given off / exothermic change in pH 	allow gas / hydrogen is given off allow volume of gas allow magnesium floats allow change in mass of magnesium allow temperature change do not accept temperature decreases do not accept pH decreases	2
2(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	A simple plan without reference to changing any variable but should include an attempt at measuring rate or an attempt at fair testing	A plan including change of concentration / 'volume' of acid and should include an attempt at measuring rate and / or an attempt at fair testing	A workable plan including change of concentration and measurement of rate and fair testing
examples of chemistry points made in the response could include: Plan: <ul style="list-style-type: none"> add magnesium to acid time reaction / 'count bubbles' / measure volume of gas change concentration / 'volume' of acid Control Variables: <ul style="list-style-type: none"> amount / mass / length / same 'size' of magnesium volume / amount of acid 			
Total			8

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Chlorine



- Chloride ion (Cl^-)

- Sodium ion (Na^+)

[6 marks]

Extra space

6

Turn over ►

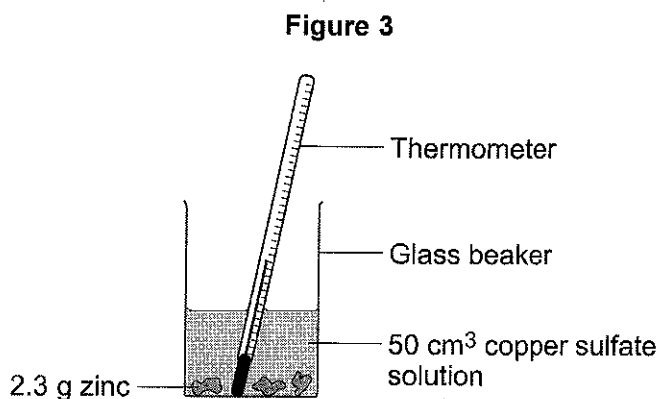


Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
<p>2 Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.</p>				1 + 2 / 2.1.1f/g 2.2.1a 2.2.2a	E
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)		
No relevant content	<i>There is a statement about the bonding and/or structure or melting / boiling point of chlorine or sodium chloride.</i>	<i>There are statements about the bonding and/or structure of chlorine or sodium chloride.</i>	<i>There are statements about the bonding and/or structure of chlorine and sodium chloride.</i> <i>There is an explanation of why chlorine is a gas or sodium chloride is a solid.</i>		
<p>Examples of chemistry points made in response:</p> <p>Chlorine:</p> <p>covalent bonds between atoms</p> <p>forming simple molecules</p> <p><i>no / weak attraction / bonds between molecules</i></p> <p>low boiling point</p> <p>Sodium chloride:</p> <p><i>ionic bonds or electrostatic attraction</i></p> <p>strong bonds</p> <p>in all directions</p> <p>between oppositely charged ions</p> <p>forming giant lattice</p> <p><i>large amounts of energy needed to break bonds</i></p> <p><i>high melting point</i></p>					
Total			6		

- 2 A student investigated the temperature change when zinc reacts with copper sulfate solution.

The student used a different concentration of copper sulfate solution for each experiment.

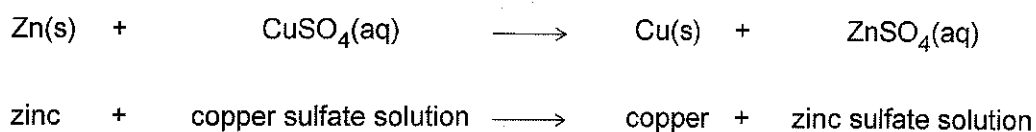
The student used the apparatus shown in **Figure 3**.



The student:

- measured 50 cm³ copper sulfate solution into a glass beaker
- measured the temperature of the copper sulfate solution
- added 2.3 g zinc
- measured the highest temperature
- repeated the experiment using copper sulfate solution with different concentrations.

The equation for the reaction is:



- 2 (a) The thermometer reading changes during the reaction.

Give **one** other change the student could **see** during the reaction.

[1 mark]

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Question 2 continues on the next page

Turn over ►



2 (b) Suggest **one** improvement the student could make to the apparatus in **Figure 3**.

Give a reason why this improves the investigation.

[2 marks]

Improvement

.....

Reason

.....

2 (c) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The student's results are shown in **Table 1**.

Table 1

Experiment number	Concentration of copper sulfate in moles per dm ³	Increase in temperature in °C
1	0.1	5
2	0.2	10
3	0.3	12
4	0.4	20
5	0.5	25
6	0.6	30
7	0.7	35
8	0.8	35
9	0.9	35
10	1.0	35



Describe **and** explain the trends shown in the student's results.

[6 marks]

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Extra space

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Question 2 continued

2(c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.				AO2/AO3 2.5.1a,b
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	There is a statement about the results.	There are statements about the results. These statements may be linked or may include data.	There are statements about the results with at least one link and an attempt at an explanation.	
Examples of chemistry points made in the response: Description: Statements Concentration of copper sulfate increases Temperature change increases There is an anomalous result The temperature change levels off Reaction is exothermic Linked Statements Temperature change increases as concentration of copper sulfate increases The temperature change increases, and then remains constant After experiment 7 the temperature change remains constant Statements including data The trend changes at experiment 7 Experiment 3 is anomalous Attempted Explanation: Temperature change increases because rate increases Temperature change levels off because the reaction is complete Explanation: As more copper sulfate reacts, more heat energy is given off Once copper sulfate is in excess, no further heat energy produced				
Total				

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- 2 (d) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

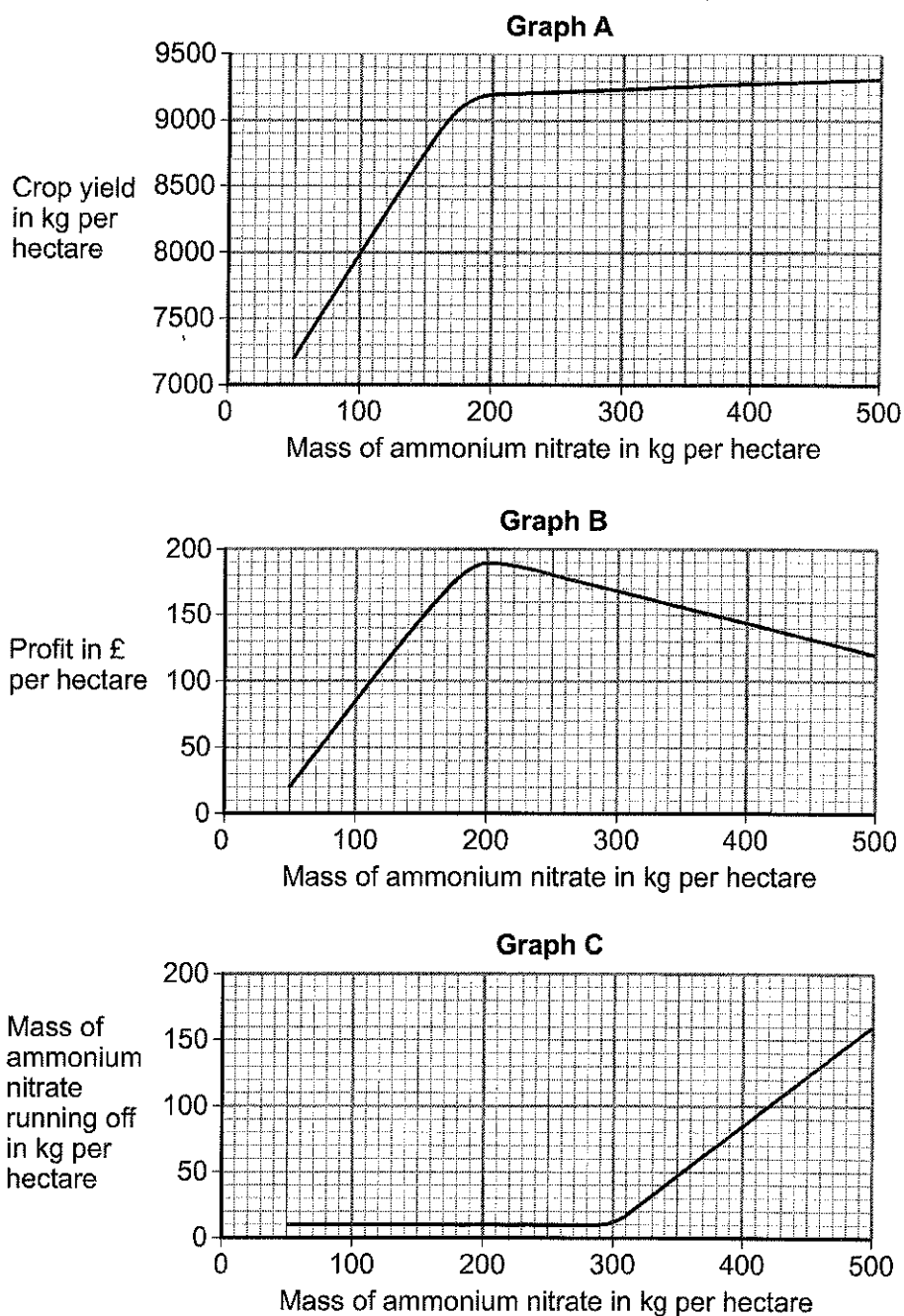
Farmers use ammonium nitrate as a fertiliser for crops.

Rainwater dissolves ammonium nitrate in the soil.

Some of the dissolved ammonium nitrate runs off into rivers and lakes.

Figure 2 shows three graphs **A**, **B** and **C**. The graphs show information about the use of ammonium nitrate as a fertiliser. A hectare is a measurement of an area of land.

Figure 2



[6 marks]

[illegible]

13

Turn over ►



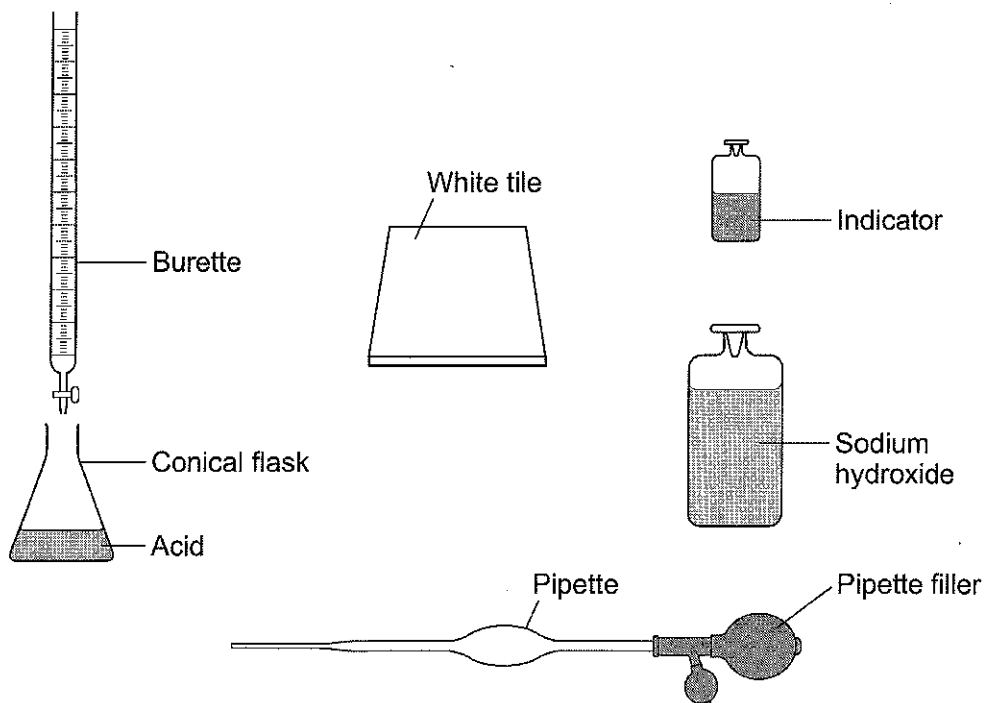
Question 2 continued

Question	Answers	Extra information	Mark	AO / SpecRef
2(d)			6	2AO2 / 4AO3 2.6.2c
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	Suggestion with a reference to a graph.	Suggestion with reasons referring to more than one graph.	Suggestion with reasons from all three graphs, and linking of ideas which may explain a compromise.	
<p>Examples of chemistry points made in response:</p> <p>A reasonable suggested amount of fertiliser would be in the region of 200 kg (per ha). Accept any suggestion from about 180 kg (per ha) to 500 kg (per ha).</p> <p>Yield:</p> <ul style="list-style-type: none">Using fertiliser improves yield.Yield improved most up to about 200 kg (per ha) of fertiliser.Yield only increased slightly above about 200 kg (per ha). <p>Profit:</p> <ul style="list-style-type: none">About 200 kg of fertiliser gives the most profit.Above about 200 kg (per ha) of fertiliser profit declines. <p>Run off:</p> <ul style="list-style-type: none">Run off is at low levels until about 300 kg (per ha) of fertiliser.Above about 300 kg (per ha) of fertiliser, run off increases. <p>Examples of linking of ideas:</p> <ul style="list-style-type: none">Overall 200 kg gives high crop yield and most profit.In conclusion 200 kg gives high crop yield and low run off.200 kg gives most profit and low run off. <p>Examples of compromise:</p> <ul style="list-style-type: none">Profits go down after about 200 kg (per ha) of fertiliser because cost of fertiliser is not covered by increased yield.200 kg gives the highest profit although it is not the highest yield.500 kg gives the best yield but has the most runoff.				
Total			13	

3

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student used the equipment shown to do a titration.



Describe how a student should use this equipment to find the volume of sodium hydroxide solution that reacts with a known volume of acid. Include any measurements the student should make.

Do **not** describe how to do any calculations.

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(6 marks)

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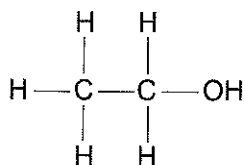


Question 3

question	answers	extra information	Mark
3	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a simple description of using some of the equipment.	There is a description of an experimental method involving a measurement, or including addition of alkali to acid (or vice versa).	There is a description of a titration that would allow a successful result to be obtained.
examples of chemistry points made in the response could include: <ul style="list-style-type: none"> acid in (conical) flask volume of acid measured using pipette indicator in (conical) flask sodium hydroxide in burette white tile under flask slow addition swirling colour change volume of sodium hydroxide added Extra information <ul style="list-style-type: none"> allow acid in the burette to be added to sodium hydroxide in the (conical) flask allow any specified indicator colour change need not be specified			
Total			6

- 2 (a) The structure of an alcohol is shown in **Figure 2**.

Figure 2



- 2 (a) (i) Draw a circle around the functional group in the structure of the alcohol.

[1 mark]

- 2 (a) (ii) What is the chemical name of this alcohol?

[1 mark]

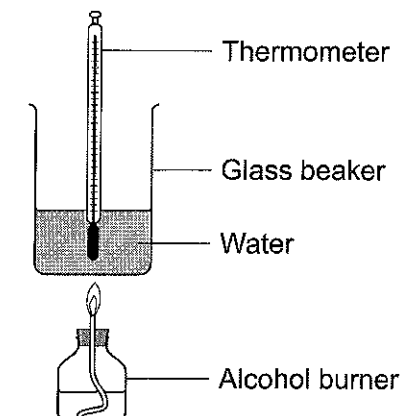
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- 2 (b) Alcohols are used as fuels.

A student plans an experiment to find the energy released per gram of alcohol burned.

The student uses the apparatus shown in **Figure 3**.

Figure 3



- 2 (b) (i) Suggest **two** ways that this apparatus could be improved to obtain accurate results.

[2 marks]

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10

05

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(b)(ii) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.				1 + 3 / 3.3.1a	E
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)		
No relevant content	<i>There is a description of part of an experimental method or a measurement which should be taken.</i>	<i>There is a description of some parts of an experimental method and a measurement which should be taken.</i>	<i>There is a description of an experimental method and measurements which should be taken.</i>		
Examples of the points that may be made in the response					
<ul style="list-style-type: none">• <i>light ethanol and heat water</i>• <i>extinguish ethanol</i>• <i>after suitable temperature rise or after a suitable time</i>• <i>stir water</i>• <i>measure mass / volume of water</i>• <i>measure initial temperature of water</i>• <i>measure final temperature of water</i>• <i>measure temperature rise</i>• <i>measure initial mass of ethanol (and burner)</i>• <i>measure final mass of ethanol (and burner)</i>• <i>measure change in mass of ethanol</i>					
Total			9		

4 This question is about water.

4 (a) Rainwater is soft.

How is hard water produced from rainwater?

[2 marks]

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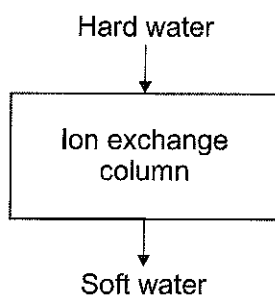
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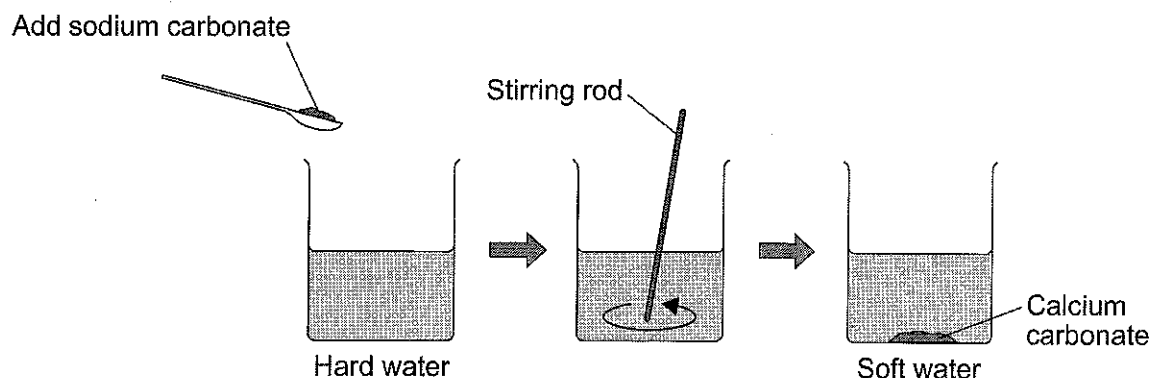
4 (b) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Hard water can be softened by two different methods.

Method 1: Ion exchange



Method 2: Adding sodium carbonate (washing soda)



Describe how each method softens water **and** compare the advantages of these two methods.

[6 marks]

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Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	(calcium or magnesium) ions causing water hardness are dissolved	ignore named anions	1	AO1/ AO2 3.2.1.b
	from rocks	allow limestone	1	
4(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.				AO1/ AO3 3.2.1.g 3.2.2.b
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content	There is a statement about one of the methods or one advantage of one of the methods	There is a description of one method of water softening and one advantage of a method is given	There is a description of both methods of water softening and a comparison of the two methods by giving an advantage of at least one of them	
general: <ul style="list-style-type: none"> hard water contains calcium/magnesium (ions) softening water involves removal of calcium/magnesium (ions) ion exchange: <ul style="list-style-type: none"> resin contains sodium/hydrogen ions which are exchanged with calcium/magnesium ions resin needs periodic replenishment with sodium ions/hydrogen ions or sodium chloride (disadvantage) increases sodium content of water (if sodium ions used) (disadvantage) easy/quick method to use (advantage) continuous process (advantage) sodium carbonate: <ul style="list-style-type: none"> sodium carbonate is added to hard water calcium/magnesium ions precipitate out as calcium/magnesium carbonate batch process (disadvantage) leaves a residue of precipitated carbonate in the water (disadvantage) increases sodium content of water (disadvantage) easy method to use (advantage) relatively cheap (advantage) 				
Total			8	

2

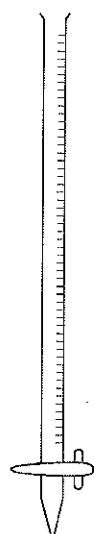
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student has to check if two samples of hydrochloric acid, **A** and **B**, are the same concentration.

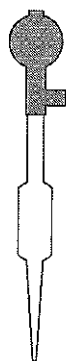
Describe how the student could use the apparatus and the solutions in **Figure 3** to carry out titrations.

[6 marks]

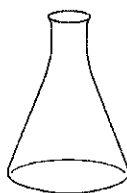
Figure 3



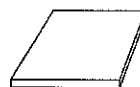
Burette



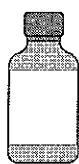
Pipette



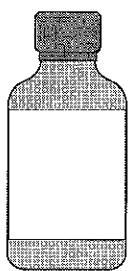
Conical flask



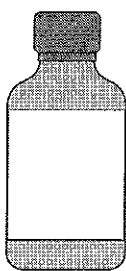
White tile



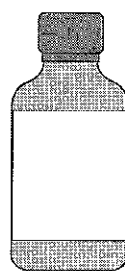
Indicator



Hydrochloric
acid **A**



Hydrochloric
acid **B**



Sodium
hydroxide
solution

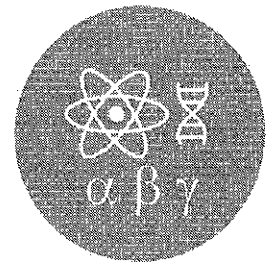
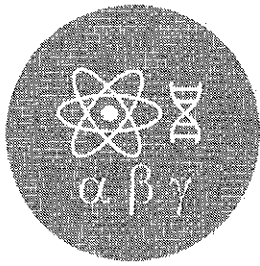


Extra space

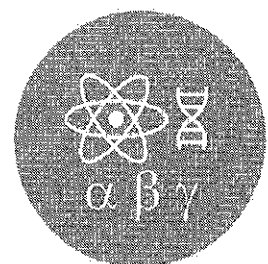
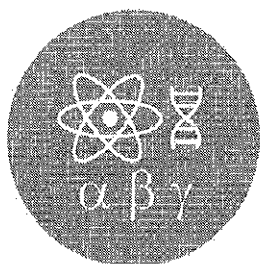
6

Turn over for the next question**Turn over ►**

Question	Answers	Extra information	Mark	AO / SpecRef
2			6	2AO1 / 3AO2 / 1AO3 3.4.1g
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	There is a simple description of using some of the apparatus.	There is a description of an experimental method including addition of acid to alkali which may include an indicator or colour change and may include a measurement of volume.	There is a description of titrations that would allow a comparison to be made between the two solutions of hydrochloric acid.	
examples of chemistry points made in the response could include: <ul style="list-style-type: none">• acid in burette or flask• alkali/sodium hydroxide or acid in burette or flask• volume of acid or alkali measured using the pipette• indicator in flask• white tile under the flask• slow addition• swirling/mixing• colour change of indicator• burette volume measured				
Total			6	



Physics



- 2 (b)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Over the next 10 years, more than 300 kilometres of new high voltage transmission cables are to be added to the National Grid. Most of the new cables will be suspended from pylons and run overhead while the rest will be buried underground.

Outline the advantages and disadvantages of both overhead transmission cables and underground transmission cables.

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(6 marks)

Question 2 continues on the next page

Turn over ►



PH1HP

Question 2

question	answers	extra information	mark
2(a)	increases the voltage (across the cables) or decreases the current (through the cables)		1
	reducing energy losses (in cables) or increases efficiency of (electricity / energy) transmission	accept heat for energy do not accept electricity for energy do not accept no energy loss accept wires do not get as hot ignore reference to travel faster	1

2(b)				6
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4, and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content	There is a brief description of one advantage or disadvantage of using either overhead or underground cables.	There is a description of some of the advantages and / or disadvantages for both overhead and underground cables, with a minimum of three points made. There must be at least one point for each type of cable.	There is a clear and detailed description of the advantages and disadvantages of overhead and underground cables, with a minimum of five points made. At least one advantage and one disadvantage for each type of cable.	

Question 2 continues on the next page . . .

PH1HP**Question 2 continued . . .**

question	answers	extra information	mark
	<p>examples of the points made in the response</p> <p>Overhead</p> <p>Advantages:</p> <ul style="list-style-type: none"> • (relatively) quick / easy to repair / maintain / access • less expensive to install / repair / maintain • cables cooled by the air • air acts as <u>electrical</u> insulator • can use thinner cables <p>Disadvantages:</p> <ul style="list-style-type: none"> • spoil the landscape • greater risk of (fatal) electric shock • damaged / affected by (severe) weather • hazard to low flying aircraft / helicopters 	<p>extra information</p> <p>marks may be gained by linking an advantage for one type of cable with a disadvantage for the other type of cable eg</p> <p>eg</p> <p>overhead cables are easy to repair = 1 mark</p> <p>overhead cables are easier to repair = 1 mark</p> <p>overhead cables are easier to repair than underground cables = 2 marks</p> <p>easy to install is insufficient</p> <p>do not accept easy to spot / see a fault</p> <p>less expensive is insufficient</p> <p>accept thermal energy / heat removed by the air</p> <p>accept there is no need for electrical insulation (around the cables)</p> <p>difficult to reach is insufficient</p> <p>land beneath cables can still be used is insufficient</p> <p>accept specific examples eg high winds, ice</p> <p>more maintenance is insufficient</p> <p>kites / fishing lines can touch them is insufficient</p> <p>hazard to aircraft is insufficient</p>	

Question 2 continues on the next page . . .

PH1HP**Question 2 continued . . .**

question	answers	extra information	mark
Underground			
Advantages:			
<ul style="list-style-type: none"> cannot be seen no hazard to aircraft / helicopters unlikely to be / not damaged / affected by (severe) weather 		less maintenance is insufficient	
(normally) no / reduced shock hazard		installed in urban areas is insufficient	
Disadvantages:			
<ul style="list-style-type: none"> repairs take longer / are more expensive 		accept harder to repair / maintain have to dig up for repairs is insufficient	
<ul style="list-style-type: none"> (more) difficult to access (cables) 		hard to locate (cables) is insufficient faults hard to find is insufficient	
<ul style="list-style-type: none"> (very) expensive to install thicker cables required need cooling systems need layers of <u>electrical</u> insulation land disruption (to lay cables) 		accept damage to environment / habitat(s)	
or			
cannot use land either side of cable path		accept restricted land use	

Question 2 continues on the next page . . .

- 3 (a) Geothermal energy and the energy of falling water are two resources used to generate electricity.

- 3 (a) (i) What is geothermal energy?

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(1 mark)

- 3 (a) (ii) Hydroelectric systems generate electricity using the energy of falling water.

A pumped storage hydroelectric system can also be used as a way of storing energy for future use.

Explain how.

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(2 marks)

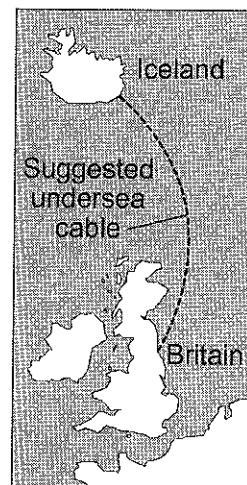
- 3 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Read the following extract from a newspaper.

Britain may be switched on by Iceland

Iceland is the only country in the world generating all of its electricity from a combination of geothermal and hydroelectric power stations. However, Iceland is using only a small fraction of its energy resources. It is estimated that using only these resources, the amount of electricity generated could be increased by up to four times.

To help supply the future demand for electricity in Britain, there are plans to build thousands of new offshore wind turbines. It has also been suggested that the National Grid in Britain could be linked to the electricity generating systems in Iceland. This would involve laying a 700 mile undersea electricity cable between Iceland and Britain.



This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

9

Turn over ►



PH1HP

Question 3

question	answers	extra information	mark
3(a)(i)	energy from hot rocks in the Earth	accept heat that occurs naturally in the Earth accept steam / hot water rising to the Earth's surface accept an answer in terms of the energy released by radioactive decay in the Earth heat energy is insufficient	1
3(a)(ii)	water is pumped / moved up (to a higher reservoir)	 this mark point only scores if first mark point is awarded	1 1
3(b)			6
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.			
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content	There is a brief description of at least one advantage or disadvantage for either the planned wind turbines or the suggested electricity power link.	There is a description of advantages and disadvantages for either the planned wind turbines or the suggested electricity power link. or A description of the advantages or disadvantages for both the planned wind turbines and the suggested electricity power link.	There is a clear and detailed description of at least one advantage and one disadvantage for both the planned wind turbines and suggested electricity power link.

Question 3 continues on the next page

PH1HP**Question 3 continued**

examples of the points made in the response	extra information
<p>Offshore wind turbines</p> <p>advantages</p> <ul style="list-style-type: none"> • renewable (energy resource) • low running costs • energy is free • no gas emissions (when in use) • land is not used (up) <p>disadvantages</p> <ul style="list-style-type: none"> • unreliable – accept wind does not always blow • hazard to birds / bats • visual pollution – do not accept noise pollution • difficulty of linking turbines to the National Grid • large initial cost • difficult to erect / maintain • CO₂ emissions in manufacture (of large number of turbines) 	<p>accept a named gas eg CO₂ accept no fuel is burned accept less dependent on fossil fuels</p> <p>ignore references to destroying or harming habitats</p> <p>do not allow if clearly referring to onshore wind turbines</p> <p>do not accept spoils landscape</p> <p>accept a lot of maintenance needed</p>

Question 3 continues on the next page

PH1HP**Question 3 continued**

<p>examples of the points made in the response</p> <p>Suggested Link</p> <p>advantages</p> <ul style="list-style-type: none">• income for Iceland• using Iceland's (available) energy (resources)• provide electricity when wind does not blow / reliable• provide electricity at times of peak demand• even out fluctuations in supply• excess electricity from Britain (windy days) to Iceland and used to pump water up to store energy• Britain less dependent on fossil fuels <p>disadvantages</p> <ul style="list-style-type: none">• large initial cost• power loss along a long cable• (engineering) difficulties in laying / maintaining the cable	<p>extra information</p> <p>accept using (Iceland's) renewable energy (resources)</p> <p>do not accept reduce the amount of Iceland's wasted energy</p> <p>accept Britain needs fewer (new) power stations</p> <p>accept conserves fossil fuels</p> <p>accept expensive (to lay cables)</p> <p>accept difficult to repair (if damaged)</p>		
<p>Total</p>			<p>9</p>

9

PH1HP

Question 3

question	answers	extra information	mark
3(a)	<p>any three from:</p> <ul style="list-style-type: none"> gas can be switched on (and off) quickly but nuclear cannot gas can be used to meet surges in demand gas can contribute to / meet the base load nuclear provides base load <p>or</p> <p>nuclear is used to generate all of the time</p>	<p>gas has a short start-up time alone is insufficient</p> <p>accept specific times from graph, anything from 1700 to 2200</p>	3
3(b)	<p>Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.</p>		6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	<p>There is a brief description of one advantage or disadvantage of using either biogas or wind</p> <p>or</p> <p>makes a conclusion with a reason.</p>	<p>There is a description of some advantages and / or disadvantages for biogas and / or wind</p> <p>or</p> <p>there is a direct comparison between the two systems and at least one advantage / disadvantage</p> <p>or</p> <p>a detailed evaluation of one system only with a conclusion.</p>	<p>There is a clear and detailed comparison of the two systems.</p> <p>There must be a clear conclusion of which system would be best with at least one comparative reason given for the choice made.</p>

Question 3 continues on the next page . . .

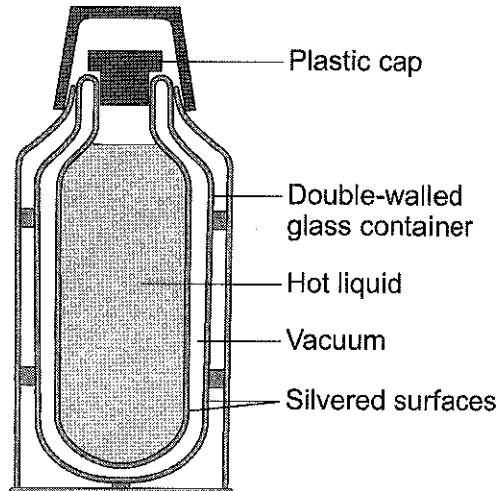
PH1HP

Question 3 continued . . .

examples of the points made in the response	extra information
<p>Biogas</p> <ul style="list-style-type: none"> • renewable • energy resource is free • reliable energy source • does not depend on the weather • uses up (animal) waste products • concentrated energy source • cheaper (to buy and install) • shorter payback-time (than wind) • adds carbon dioxide to the atmosphere <p>• contributes to the greenhouse effect or contributes to global warming</p> <ul style="list-style-type: none"> • no transport cost for fuels <p>Wind turbine</p> <ul style="list-style-type: none"> • renewable • energy resource is free • not reliable • depends on the weather / wind • will be times when not enough electricity generated for the farm's needs • dilute energy source • longer payback-time (than biogas) • more expensive (to buy and install) • does not produce any carbon dioxide 	<p>accept works all of the time</p> <p>accept once only</p> <p>when waste burns it produces carbon dioxide is insufficient</p> <p>accept once only accept pollutant gases for carbon dioxide accept does not pollute air</p> <p>produces visual or noise pollution is insufficient harmful gases is insufficient</p>
Total	9

- 4 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The diagram shows the structure of a vacuum flask.



A vacuum flask is designed to reduce the rate of energy transfer by heating processes.

Describe how the design of a vacuum flask keeps the liquid inside hot.

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PH1HP

Question 4

question	answers	extra information	mark	
4(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.			6
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	There is a basic explanation of one feature or a simple statement relating reduction in energy transfer to one feature.	There is a clear explanation of one feature or a simple statement relating reduction in energy transfer to two features.	There is a detailed explanation of at least two features or a simple statement relating reduction in energy transfer to all four features.	
examples of the points made in response		extra information		
<p>plastic cap:</p> <ul style="list-style-type: none"> plastic is a poor conductor stops convection currents forming at the top of the flask so stopping energy transfer by convection molecules / particles evaporating from the (hot) liquid cannot move into the (surrounding) air so stops energy transfer by evaporation plastic cap reduces / stops energy transfer by conduction / convection / evaporation <p>glass container:</p> <ul style="list-style-type: none"> glass is a poor conductor so reducing energy transfer by conduction glass reduces / stops energy transfer by conduction 		<p>accept throughout: heat for energy loss for transfer</p> <p>accept insulator for poor conductor</p>		

Question 4 continues on the next page . . .

PH1HP
Question 4 continued . . .

question	answers	extra information	mark
	vacuum: <ul style="list-style-type: none"> both conduction and convection require a medium / particles so stops energy transfer between the two walls by conduction and convection vacuum stops energy transfer by conduction / convection silvered surfaces: <ul style="list-style-type: none"> silvered surfaces reflect infrared radiation silvered surfaces are poor emitters of infrared radiation infrared radiation (partly) reflected back (towards hot liquid) silvered surfaces reduce / stop energy transfer by radiation 	accept heat for infrared	
4(b)	(the ears have a) small <u>surface area</u> so reducing energy radiated / transferred (from the fox)	ears are small is insufficient accept heat lost for energy radiated do not accept stops heat loss	1 1
Total			8

2

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The information in the box is about the properties of solids and gases.

Solids:

- have a fixed shape
- are difficult to compress (to squash).

Gases:

- will spread and fill the entire container
- are easy to compress (to squash).

Use your knowledge of kinetic theory to explain the information given in the box.

You should consider:

- the spacing between the particles
- the movement of individual particles
- the forces between the particles.

[6 marks]

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Extra space

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[illegible]

6

[illegible]

Question	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		Mark	AO spec ref
2			6	AO1 1.1.2a
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	<p>Considers either solid or gas and describes at least one aspect of the particles.</p> <p>or</p> <p>Considers both solids and gases and describes an aspect of each.</p>	<p>Considers both solids and gases and describes aspects of the particles.</p> <p>or</p> <p>Considers one state and describes aspects of the particles and explains at least one of the properties.</p> <p>or</p> <p>Considers both states and describes an aspect of the particles for both and explains a property for solids or gases.</p>	<p>Considers both states of matter and describes the spacing and movement / forces between the particles. Explains a property of both solids and gases.</p>	
examples of the points made in the response Solids <ul style="list-style-type: none"> • (particles) close together • (so) no room for particles to move closer (so hard to compress) • vibrate about fixed point • strong forces of attraction (at a distance) • the forces become repulsive if the particles get closer • particles strongly held together/not free to move around (shape is fixed) Gases <ul style="list-style-type: none"> • (particles) far apart • space between particles (so easy to compress) • move randomly • negligible/no forces of attraction • spread out in all directions (to fill the container) 			extra information any explanation of a property must match with the given aspect(s) of the particles.	
Total				6

A householder wants to reduce her energy bills. She collected information about a number of ways of reducing energy used. The information is shown in **Table 1**.

Ways of reducing energy used	Cost to buy and install in £	Money saved per year in £
Install an energy-efficient boiler	2 000	320
Insulate the loft	400	200
Install double-glazed windows	12 000	120
Install cavity wall insulation	415	145

[6 marks]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 2** A small community of people live in an area in the mountains.
The houses are not connected to the National Grid.

The people plan to buy an electricity generating system that uses either the wind or the flowing water in a nearby river.

Figure 2 shows where these people live.

Figure 2



- 2 (a)** It would not be economical to connect the houses to the National Grid.
Give **one** reason why.

[1 mark]

- 2 (b)** In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Information about the two electricity generation systems is given in **Figure 3**.

Figure 3

The wind turbine costs £50 000 to buy and install.
The hydroelectric generator costs £20 000 to buy and install.
The average power output from the wind turbine is 10 kW.
The hydroelectric generator will produce a constant power output of 8 kW.



Compare the advantages and disadvantages of the two methods of generating electricity.

Use your knowledge of energy sources as well as information from **Figure 3**.

[6 marks]

Extra space _____

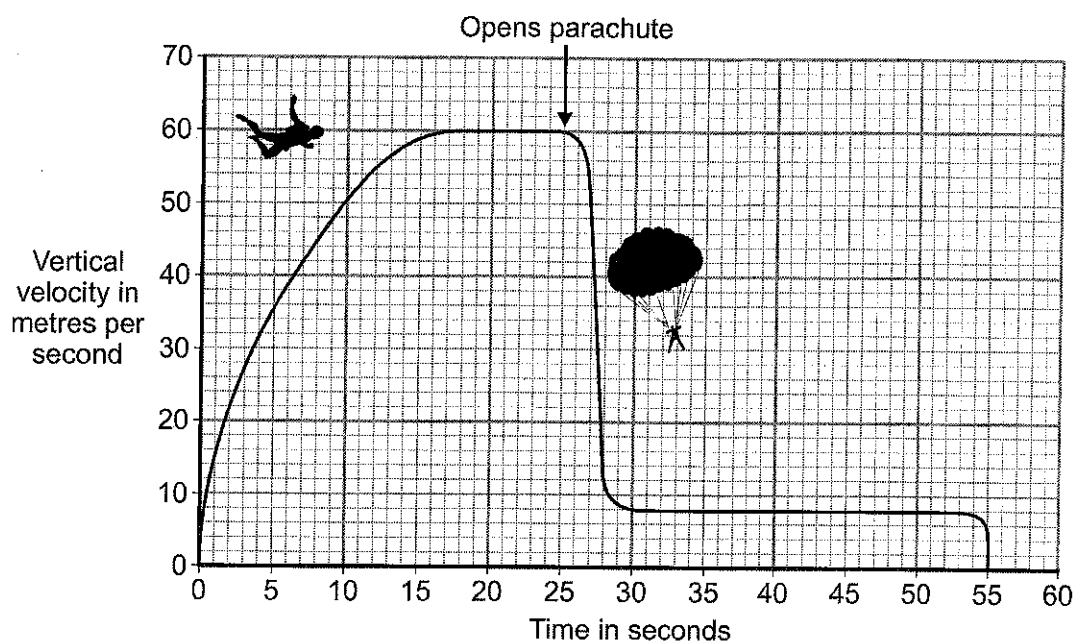
7

Turn over ►



- 3 (b)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The graph shows how the vertical velocity of a parachutist changes from the moment the parachutist jumps from the aircraft until landing on the ground.



Using the idea of forces, explain why the parachutist reaches a terminal velocity and why opening the parachute reduces the terminal velocity.

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(6 marks)

Question 3 continues on the next page

Turn over ►



PH2HP

Question 3

question	answers	extra information	mark
3(a)	750	allow 1 mark for correct substitution, ie 75 x 10 provided no subsequent steps shown	2
	newton(s) / N	do not accept n	1
3(b)			6
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.			
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a brief attempt to explain why the velocity / speed of the parachutist changes. or the effect of opening the parachute on velocity/speed is given.	The change in velocity/ speed is clearly explained in terms of force(s) or a reasoned argument for the open parachute producing a lower speed.	There is a clear and detailed explanation as to why the parachutist reaches terminal velocity and a reasoned argument for the open parachute producing a lower speed

Question 3 continues on the next page . . .

PH2HP

Question 3 continued

question	answers	extra information	mark
3(b) (cont)	<p>examples of the physics points made in the response to explain first terminal velocity</p> <ul style="list-style-type: none"> on leaving the plane the only force acting is weight (downwards) as parachutist falls air resistance acts (upwards) weight greater than air resistance or resultant force downwards (resultant force downwards) so parachutist accelerates as velocity / speed increases so does air resistance terminal velocity reached when air resistance = weight <p>to explain second lower terminal velocity</p> <ul style="list-style-type: none"> opening parachute increases surface area opening parachute increases air resistance air resistance is greater than weight resultant force acts upwards / opposite direction to motion parachutist decelerates / slows down the lower velocity means a reduced air resistance air resistance and weight become equal but at a lower (terminal) velocity 	<p>accept gravity for weight throughout</p> <p>accept drag / friction for air resistance</p> <p>accept terminal velocity reached when forces are balanced</p>	

Question 3 continues on the next page . . .

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Your answer should include the names of the stages the star passes through.

[illegible]

12

[illegible]

question	answers	extra information	mark
3(c)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	There is a basic description of what happens to a star much larger than the Sun after the 'main sequence' period. OR Two stages are correctly named and are in the correct sequence.	There is a clear description of what happens to a star much larger than the Sun after the 'main sequence' period. AND At least two stages are correctly named and are in the correct sequence.	There is a detailed description of what happens to a star much larger than the Sun after the 'main sequence' period. AND At least three stages are named, in the correct sequence. There are no additional incorrect stages given.
Examples of the points made in the response: <ul style="list-style-type: none"> • (the core of the) star runs out of hydrogen • (the star) expands (to form) • (the star) cools (to form) • a red supergiant <ul style="list-style-type: none"> • (outer layers) explode • as a supernova <ul style="list-style-type: none"> • elements heavier than iron are formed • core shrinks • becoming a neutron star . <ul style="list-style-type: none"> • if mass large enough (core collapses) • (to form) a black hole 		extra information <ul style="list-style-type: none"> • the core shrinks • helium starts to fuse to form other elements accept super red giant do not accept red giant <ul style="list-style-type: none"> • fusion of lighter elements to form heavier elements (up to iron) accept heaviest elements are formed <p>if a correct description and sequence for a star the same size as the Sun and much bigger than the Sun given without clearly indicating which is which is limited to Level 2</p>	
Total			12

The table gives data about two types of light bulb people may use in their homes.

Type of light bulb	Energy efficiency	Cost of one light bulb	Average lifetime in hours
Halogen	10 %	£1.95	2 000
Light Emitting Diode (LED)	32 %	£11.70	36 000

To gain full marks you must compare both types of light bulb and conclude which light bulb would be the best to use.

[illegible]

11

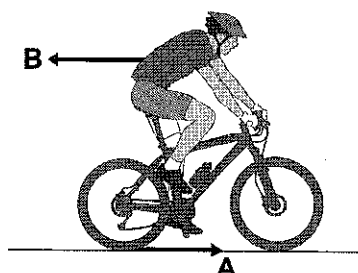
[illegible]

PH2HP
Question 2 continued . . .

question	answers	extra information	mark
2(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	There is a basic comparison of either a cost aspect or an energy efficiency aspect.	There is a clear comparison of either the cost aspect or energy efficiency aspect OR a basic comparison of both cost and energy efficiency aspects.	There is a detailed comparison of both the cost aspect and the energy efficiency aspect. For full marks the comparisons made should support a conclusion as to which type of bulb is preferable.
Examples of the points made in the response: cost <ul style="list-style-type: none"> • halogen are cheaper to buy • 6 halogen lamps cost the same as one LED • LEDs last longer • need to buy 18 / more halogen lamps to last the same time as one LED • 18 halogens cost £35.10 • costs more to run a halogen than LED • LED has lower maintenance cost (where many used, eg large departmental store lighting) energy efficiency <ul style="list-style-type: none"> • LED works using a smaller current • LED wastes less energy • LEDs are more efficient • LED is 22% more energy efficient • LED produces less heat • LED requires smaller input (power) for same output (power) 			simply giving cost figures is insufficient
Total			11

- 3 (a) Figure 2 shows the horizontal forces acting on a moving bicycle and cyclist.

Figure 2



- 3 (a) (i) What causes force A?

Draw a ring around the correct answer.

[1 mark]

friction

gravity

weight

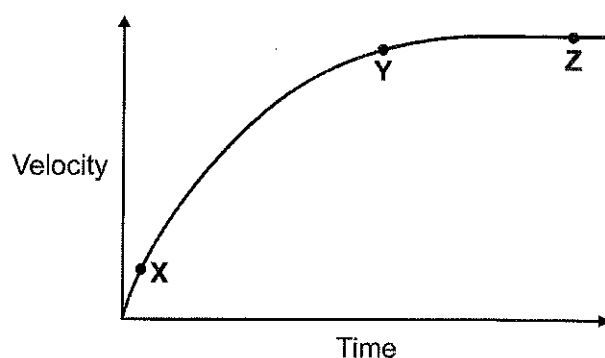
- 3 (a) (ii) What causes force B?

[1 mark]

- 3 (a) (iii) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Figure 3 shows how the velocity of the cyclist changes during the first part of a journey along a straight and level road. During this part of the journey the force applied by the cyclist to the bicycle pedals is constant.

Figure 3



Describe how **and** explain, in terms of the forces **A** and **B**, why the velocity of the cyclist changes:

- between the points **X** and **Y**
- and between the points **Y** and **Z**, marked on the graph in **Figure 3**.

[6 marks]

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Extra space

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Turn over ►



Question	Answers	Extra information	Mark	AO spec ref
3(a)(i)	friction		1	AO1 2.1.3a
3(a)(ii)	air resistance	accept drag friction is insufficient	1	AO1 2.1.3a
3(a)(iii)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6	AO spec ref
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	AO2 AO3 2.1.4c
No relevant content	There is an attempt to explain in terms of forces A and B why the velocity of the cyclist changes between any two points or a description of how the velocity changes between any two points.	There is an explanation in terms of forces A and B of how the velocity changes between X and Y and between Y and Z or a complete description of how the velocity changes from X to Z. or an explanation and description of velocity change for either X to Y or Y to Z	There is a clear explanation in terms of forces A and B of how the velocity changes between X and Z and a description of the change in velocity between X and Z.	

examples of the points made in the response	extra information
<p>X to Y</p> <ul style="list-style-type: none"> • at X force A is greater than force B • cyclist accelerates • and velocity increases • as cyclist moves toward Y, force B (air resistance) increases (with increasing velocity) • resultant force decreases • cyclist continues to accelerate but at a smaller value • so velocity continues to increase but at a lower rate <p>Y to Z</p> <ul style="list-style-type: none"> • from Y to Z force B (air resistance) increases • acceleration decreases • force B becomes equal to force A • resultant force is now zero • acceleration becomes zero • velocity increases until... • cyclist travels at constant / terminal velocity 	<p>accept speed for velocity throughout</p>

- 2 (b)** Two scientists named Rutherford and Marsden devised an experiment to investigate the plum pudding model of the atom. The experiment involved firing alpha particles at a thin sheet of gold. The scientists measured how many of the alpha particles were scattered.

Using the plum pudding model, the scientists predicted that only a few of the alpha particles would be scattered by more than 4° .

Over several months, more than 100 000 measurements were made.

- 2 (b) (i)** The results from this experiment caused the plum pudding model to be replaced by a new model of the atom.

Explain why.

[2 marks]

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- 2 (b) (ii)** Suggest **one** reason why other scientists thought this experiment provided valid evidence for a new model of the atom.

[1 mark]

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In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

In your answer you should:

- give details of the individual particles that make up an atom
- include the relative masses and relative charges of these particles.

Do **not** include a diagram in your answer.

[illegible]

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Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(c)			6	AO1 2.5.1a/b/c	E
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.					
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)		
no relevant content	A brief description is given with some particles correctly named	A description is given with all three particles named and either the polarity of charge associated with the three particles or the relative mass of the three particles or the relative mass for one particle and the relative charge for one particle given	A more detailed description is given, naming the particles and polarity of charge and either the relative mass is given for at least two particles or the relative charge is given for at least two particles		

<p>examples of the points made in the response</p> <p>brief description contains protons, neutrons and electrons</p> <p>protons are positive electrons are negative neutrons are uncharged</p> <p>has a nucleus</p> <p>relative charge proton +1 electron – 1 neutron 0</p> <p>relative mass proton 1 neutron 1 electron (about) 1/2000</p> <p>more detailed description protons and neutrons make up the nucleus electrons orbit the nucleus electrons are in shells most of the atom is empty space nucleus occupies a very small fraction of the volume of the atom electrons orbit at a relatively large distance from the nucleus most of the mass of the atom is contained in the nucleus the nucleus as a whole is positively charged total number of protons in the nucleus equals the total number of electrons orbiting it in an atom</p>	<p>extra information</p> <p>accept protons and neutrons have the same mass</p> <p>accept electrons have tiny / negligible mass zero mass is neutral</p>		
Total		10	

The type of radiation emitted from a radioactive source can be identified by comparing the properties of the radiation to the properties of alpha, beta and gamma radiation.

- penetration through materials
- range in air
- deflection in a magnetic field.

[illegible][illegible]

Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(d)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.		6	AO1 2.5.2e 2.5.2f
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)	
No relevant information	There is a description of at least one type of radiation in terms of one or more properties.	There is a description of at least two types of radiation in terms of some properties or a full description of one type of radiation in terms of all three properties or the same property is described for all three radiations	There is a description of all three types of radiation in terms of at least two of their properties or a full description of two types of radiation in terms of all three properties.	
examples of physics points made in the response			extra information	
alpha particles <ul style="list-style-type: none"> are least penetrating are stopped by paper / card have the shortest range can travel (about) 5cm in air are (slightly) deflected by a magnetic field alpha particles are deflected in the opposite direction to beta particles by a magnetic field beta particles <ul style="list-style-type: none"> (some are) stopped by (about) 2mm (or more) of aluminium/metal can travel (about) 1 metre in air are deflected by a magnetic field beta particles are deflected in the opposite direction to alpha particles by a magnetic field gamma rays <ul style="list-style-type: none"> are the most penetrating are stopped by (about) 10cm of lead have the longest range can travel at least 1 km in air are not deflected by a magnetic field 			accept (some are) stopped by aluminium foil	
Total				10

Ultrasound and X-rays are waves used in hospitals to create images of the inside of the human body. To produce the images below, the waves must enter the human body.

X-ray of a broken bone



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

[illegible]

06

PH3HP

Question 3

question	answers	extra information	mark
3(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant / correct content.	There is a basic description of either wave OR What happens to either wave when they enter the body. However there is little other detail.	There is either: A clear description of BOTH waves OR A clear description as to what happens to BOTH waves inside the body OR A clear description of ONE of the waves with clear detail as to what happens to either wave inside the body.	There is a detailed description of BOTH of the waves AND A detailed description as to what happens to EITHER wave inside the body.

Question 3 continues on the next page . . .

PH3HP

Question 3 continued . . .

<p>Examples of the points made in the response:</p> <p><u>Description of an X-ray</u></p> <ul style="list-style-type: none"> • X-rays are electromagnetic waves / part of the electromagnetic spectrum • X-rays are (very) high frequency (waves) • X-rays are (very) high energy (waves) • X-rays have a (very) short wavelength • Wavelength (of X-rays) is of a similar size to (the diameter of) an atom • X-rays are a transverse wave • X-rays are ionising radiation <p><u>Description of ultrasound</u></p> <ul style="list-style-type: none"> • ultrasound has a <u>frequency</u> above 20 000 (hertz) <p>OR</p> <p>ultra sound is above 20 000 hertz</p> <ul style="list-style-type: none"> • ultrasound is above / beyond the human (upper) limit (of hearing) • ultrasound is a longitudinal wave <p><u>Statement(s) as to what happens to X-rays inside the human body:</u></p> <ul style="list-style-type: none"> • X-rays are absorbed by bone • X-rays travel through / are transmitted by tissue / skin <p><u>Statement as to what happens to ultrasound inside body:</u></p> <ul style="list-style-type: none"> • ultrasound is (partially) reflected at / when it meets a boundary between two different media • travel at different speeds through different media 	<p>do not allow a description of a property – eg X-rays travel through a vacuum / at the speed of light</p> <p>correct description acceptable – oscillations / vibrations are perpendicular (at 90°) to direction of energy transfer</p> <p>accept ultrasound cannot be heard by humans</p> <p>correct description acceptable – oscillations / vibrations (of particles) are parallel (in same direction) to direction of energy transfer</p>	
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Question 3 continues on the next page . . .

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe the similarities and differences between a step-up transformer and a step-down transformer.

- construction, including materials used
- the effect the transformer has on the input potential difference (p.d.).

[6 marks]

This image shows a single sheet of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Extra space

Turn over ►



Question	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.			Mark	AO spec ref
3(a)				6	
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	AO1 3.3.2	
No relevant / correct content.	Either there is an attempt at a description of the construction of a transformer or a correct statement of the effect of one type of transformer on the input p.d.	There is a description of the construction of a transformer and a correct statement of the effect of one type of transformer on the input p.d.	There is a clear description of the construction of a transformer and there is a correct description of how transformers affect the input p.d.		
details of construction: a (laminated) core core is made from a magnetic material / iron 2 coils the coils are made from an electrical conductor / copper the coils are covered in plastic / insulation the coils are (usually) on opposite sides step-up transformer has more turns on secondary coil than (its) primary (or vice versa) step-down transformer has less turns on secondary coil than (its) primary (or vice versa) effect on input p.d. : step-up transformer, the output p.d. is greater (than the input p.d.) step-down transformer, the output p.d. is lower (than the input p.d.)				extra information	
				accept voltage for p.d.	

Question 3 continues on the next page . . .

3 (a) Complete the following sentences.

[2 marks]

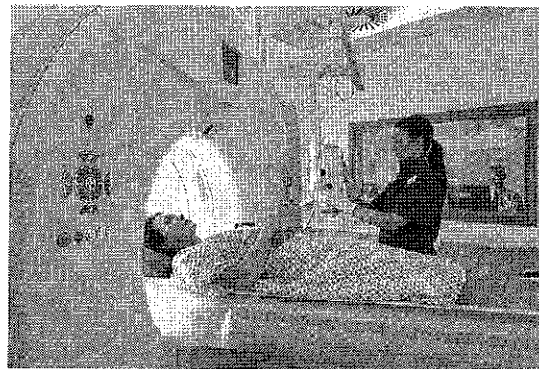
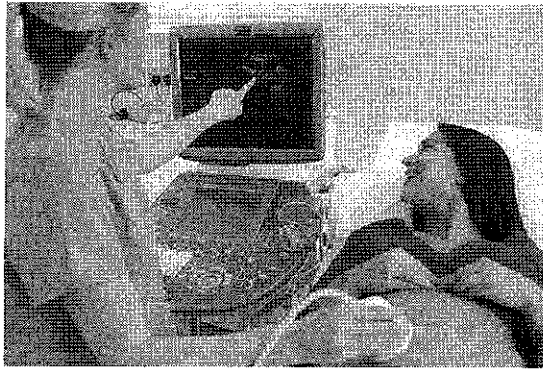
Ultrasound waves have a minimum frequency
of hertz.

The wavelength of an X-ray is about the same as
the diameter of

3 (b) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Figure 5 shows one medical use of ultrasound and one medical use of X-rays.

Figure 5



Compare the medical uses of ultrasound and X-rays.

Your answer should include the risks, if any, and precautions, if any, associated with the use of ultrasound and X-rays.

[6 marks]

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Extra space

8

Turn over for the next question

Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(b)			6	AO1 P3.1 P3.1.1c
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
no relevant content	At least one relevant statement is given for either type of wave	Either a use, risk and precaution is given for one type of wave Or A medical use is given for both types of wave plus a risk or precaution for one type of wave	At least one medical use is given for both types of wave linked to the risks and any precautions necessary	
examples of the points made in the response <u>Medical use of X-rays</u> Any one from: <ul style="list-style-type: none"> • Detecting bone fractures • Detecting dental problems • Killing cancer cells • CT scanning <u>Risks with X-rays</u> X-rays pose a risk / danger / hazard X-rays cause ionisation / damage to cells or mutate cells / cause mutations / increase chances of mutations or turn cells cancerous / produce abnormal growths / produce rapidly growing cells or kill cells		extra information Ignore details about how X-rays/ultrasound work accept any specific use of X-rays, eg <ul style="list-style-type: none"> • detecting heart/lung disorders (with chest X-rays) • mammograms / breast cancer detection • detecting stones / bowel disease (with abdominal X-rays) accept are harmful accept a description of what ionising is instead of cell, any of these words can be used: DNA / genes / chromosomes / nucleus accept (may) cause cancer		

<p><u>Operator precautions with X-rays</u></p> <p>The X-ray operator should go behind a (metal / glass) screen / leave the room when making an X-ray / wear a lead lined apron</p> <p><u>Medical use of ultrasound</u></p> <p>Any one from:</p> <ul style="list-style-type: none"> • Pre-natal scanning • Imaging (a named body part). • removal / destruction of kidney / gall stones • removing plaque from teeth • repair of damaged tissue / muscle <p><u>Risks with ultrasound</u></p> <p>Ultrasound poses no risk / danger / hazard (to the user / patient).</p> <p>Ultrasound is not ionising</p> <p>or</p> <p>Ultrasound does not damage (human) cells</p> <p><u>Precautions with ultrasound</u></p> <p>The operator needs to take no precautions when making an ultrasound scan.</p>	<p>accept appropriate precautions for the patient e.g. limit the total exposure/dose (in one year)</p> <p>wear a radiation badge is insufficient</p> <p>cleaning teeth is insufficient</p> <p>accept examples of repair, eg alleviating bruising, repair scar damage, ligament / tendon damage, joint inflammation</p> <p>accept physiotherapy</p> <p>accept curing prostate cancer or killing prostate cancer cells</p> <p>accept ultrasound is safer than using X-rays.</p> <p>this can be assumed if it is stated that ultrasound is harmless or it is safer than using x-rays or it is non-ionising</p>	
<p>Total</p>		<p>8</p>

Answer **all** questions in the spaces provided.

- 1 (a)** Electromagnets are often used at recycling centres to separate some types of metals from other materials.

Give **one** reason why an electromagnet would be used rather than a permanent magnet.

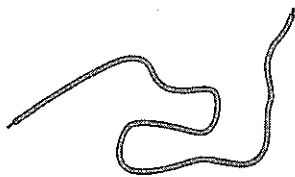
[1 mark]

- 1 (b)** In this question you will gain marks for using good English, organising information clearly and using scientific words correctly.

Some students want to build an electromagnet.

The students have the equipment shown in **Figure 1**.

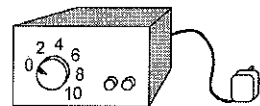
Figure 1



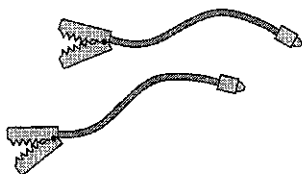
Insulated wire



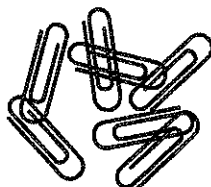
Iron nail



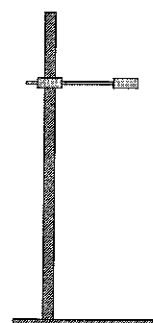
Power supply



Connecting leads



Steel paperclips



Wooden clamp
and stand



[6 marks]

[illegible]

Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	an electromagnet can be switched off or an electromagnet is stronger	accept a permanent magnet cannot be switched off accept control the strength	1	AO1 P3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.		6	AO1 AO2 P3.3.1a P3.3.1c
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant / correct content	there is a basic description of how to make an electromagnet or there is a basic description of how the strength of the electromagnet can be varied or there is a basic description of how the electromagnet can be tested	there is a description of how the electromagnet is made and either there is a description of how the strength of the electromagnet can be varied or there is a description of how the electromagnet can be tested	there is a description of how the electromagnet is made and there is a description of how the strength of the electromagnet can be varied and there is a description of how the strength of the electromagnet can be tested	

Question 1b continues on the next page . . .

<p>examples of the points made in the response</p> <p>Details of how to make an electromagnet</p> <ul style="list-style-type: none">• wrap the wire around the nail• connect the wire to the power supply (with connecting leads and croc clips)• switch on the power supply <p>Details of how to vary the strength of the electromagnet</p> <ul style="list-style-type: none">• change the number of turns (on the coil)• change the current (through the coil)• change the separation of the turns <p>Details of how to test the electromagnet</p> <ul style="list-style-type: none">• suspend paperclips from the electromagnet• the more paperclips suspended, the stronger the electromagnet is• clamp the electromagnet at different distances from the paperclip(s)• the further the distance from which paperclips can be attracted the stronger the electromagnet is• test before and after making alterations to change the strength• compare the results from before and after making alterations• use de-magnetised paper clips	<p>extra information</p> <p>accept a current should be sent along the wire</p> <p>allow change the potential difference (across the coil)</p> <p>accept wrap the coil more tightly</p> <p>accept count the number of paperclips with different current or p.d. or no. of turns or core and see if the number changes/increases</p>	
<p>Total</p>		7