Specimen paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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8	
9	
10	
11	
12	
TOTAL	

General Certificate of Secondary Education
Higher Tier

Additional Science 2
Unit 6

H

For this paper you must have:
- a ruler
- the Chemistry Data Sheet (enclosed)
- the Physics Equation Sheet (enclosed).

You may use a calculator.

Time allowed
- 90 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

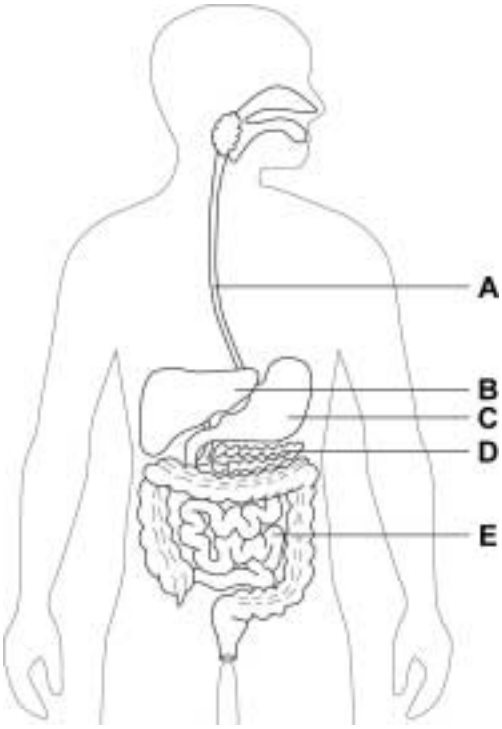
Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 5 (b) should be answered in continuous prose. In these questions you will be marked on your ability to:
  –use good English
  –organise information clearly
  –use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

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

Biology questions

1 The diagram shows the digestive system.



For each question write the correct letter in the box.

In which organ, **A**, **B**, **C**, **D** or **E**:

1 (a) (i) does the digestion of proteins begin ☐

(1 mark)

1 (a) (ii) is bile made ☐

(1 mark)

1 (a) (iii) does most absorption of soluble food occur? ☐

(1 mark)

1 (b) Explain the function of bile in digestion.

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(2 marks)

5

Turn over for the next question

2 Energy is obtained from both aerobic and anaerobic respiration during exercise.

2 (a) Give **three** differences between aerobic and anaerobic respiration.

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3 .....

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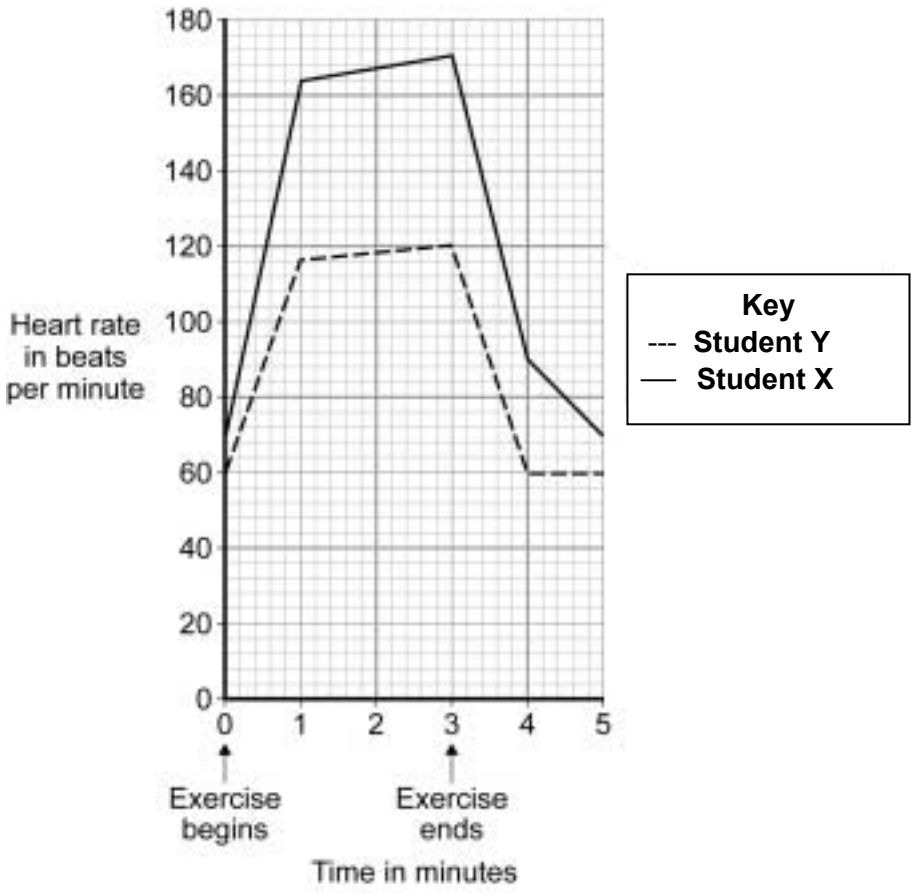
(3 marks)

2 (b) Two students did the same step-up exercise for 3 minutes.

One of the students was fit. The other student was unfit.

The graph shows how the students' heart rate changed during the exercise and after the exercise.



Suggest which student was the fitter.

Draw a ring around your answer. **Student X / Student Y**

Give **three** reasons for your answer.

1 .....

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2 .....

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3 .....

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(3 marks)

Question 2 continues on the next page

Turn over▶

2 (c) Explain the advantage to the students of the change in heart rate during exercise.

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(4 marks)

10

Chemistry Questions

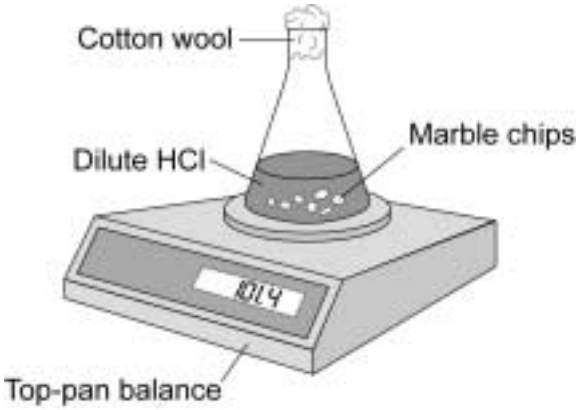
3 A student investigated the rate of reaction between marble and hydrochloric acid.

The student used an excess of marble.

The reaction can be represented by this equation:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

The student used the apparatus shown in the diagram.



The student measured the mass of the flask and contents for ten minutes.

3 (a) The mass of the flask and contents decreased during the experiment.

Use the equation to help you explain why.

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(2 marks)

Question 3 continues on the next page

3 (b) The balance used to measure the mass of the apparatus must be of high resolution for this experiment.

3 (b) (i) Which balance, **A**, **B**, or **C**, has the highest resolution?

Balance A **Balance B** **Balance C**

The balance with the highest resolution is balance ☐.

(*1 mark*)

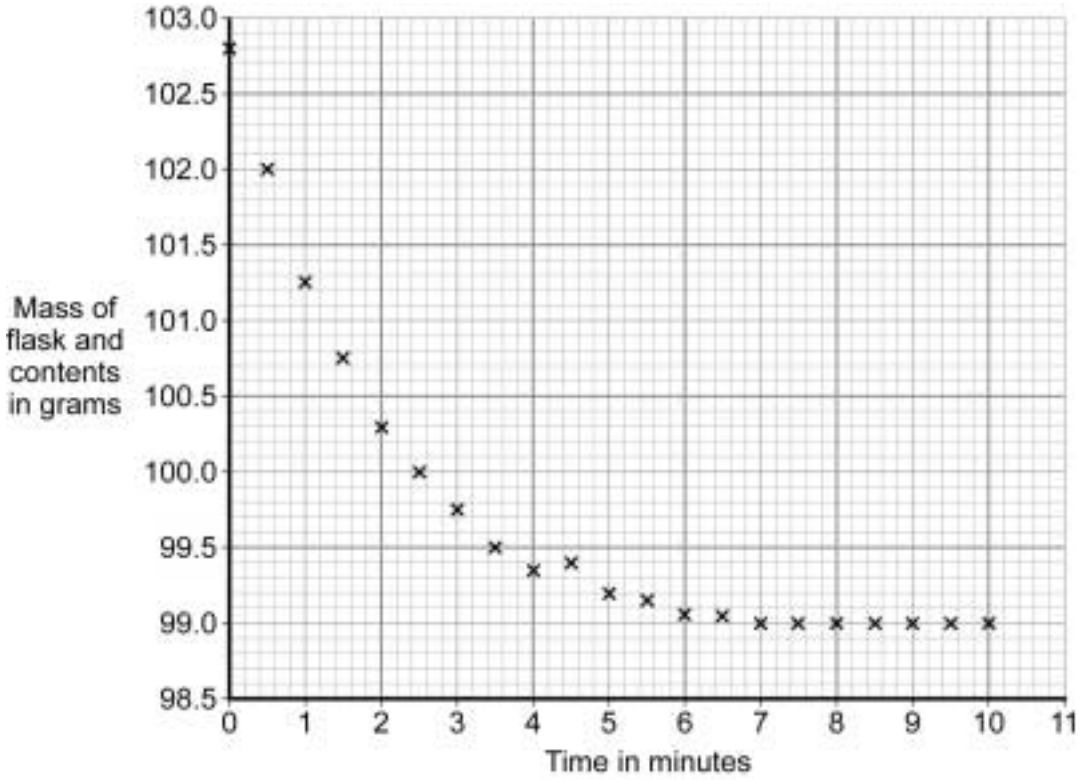
3 (b) (ii) Why should the balance used for this experiment have a high resolution?

Tick (✓) **one** box that gives the correct reason.

Reason	**Tick** (✓)
The balance is measuring a large mass.	
The balance is measuring a very small mass.	
The balance is measuring small changes in mass.	
The balance is the cheapest balance.	

(*1 mark*)

The results are shown on the graph. Use the graph to answer the questions.



3 (c) (i) Complete the graph by drawing a line of best fit.

(1 mark)

3 (c) (ii) After how many minutes had all the acid been used up?

..... minutes

(1 mark)

3 (c) (iii) Use the graph to find the mass of the flask and contents after 1.8 minutes.

..... grams

(1 mark)

3 (c) (iv) The rate of reaction can be measured by the steepness of the graph line.

Describe, as fully as you can, how the rate of reaction changes with time in this experiment.

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(2 marks)

Turn over▶

3 (d) The student repeated the experiment using powdered marble instead of marble chips.

The rate of reaction between the marble and hydrochloric acid particles was much faster with the powder.

Explain why.

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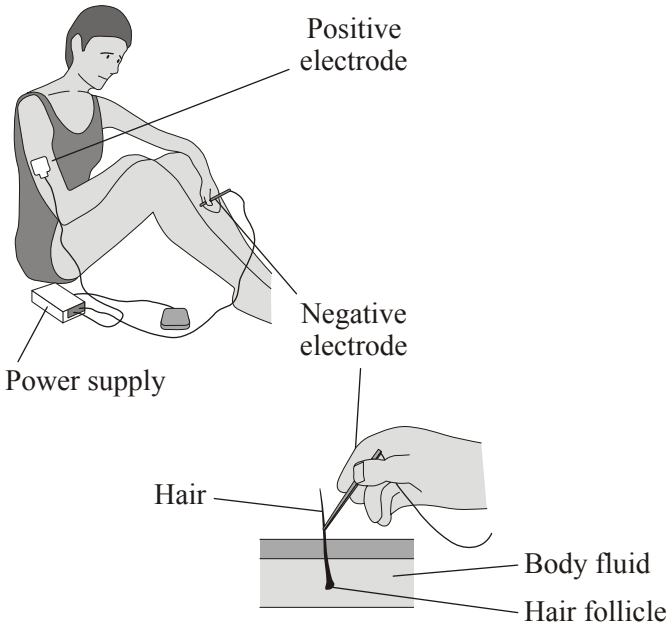
(2 marks)

11

4 Electrolysis can be used to remove unwanted hair from the skin.



The hair is first coated with a layer of gel containing ions in solution.

The positive electrode is connected by a patch to the skin.

The negative electrode is connected to the hair. Electricity flows through the gel and causes electrolysis of the body fluid around the hair follicle.

4 (a) Explain why the gel containing ions in solution can conduct electricity.

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(1 mark)

Question 4 continues on the next page

4 (b) The body fluid is a solution that contains sodium chloride. The electricity causes the electrolysis of a small amount of this solution.

This solution contains hydrogen ions that move to the negative electrode.

4 (b) (i) Describe what happens to the hydrogen ions that move to the negative electrode.

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(2 marks)

4 (b) (ii) As a result of the electrolysis of sodium chloride solution, an alkali forms which kills the hair follicle.

What is the name of this alkali?

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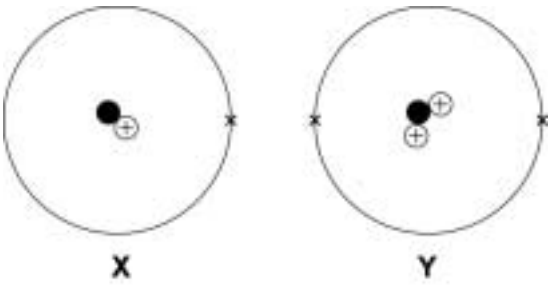
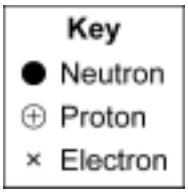
(1 mark)

4

Physics questions

5 The diagrams represent two atoms, **X** and **Y**.





5 (a) In a star, nuclei of atom **X** join to form nuclei of atom **Y**.

Complete the sentences.

The process by which nuclei join to form a larger nucleus is called

nuclear ..... .

This is the process by which a star releases ..... .

(2 marks)

Question 5 continues on the next page

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

A star goes through a lifecycle.

Describe the lifecycle of a star like the Sun.

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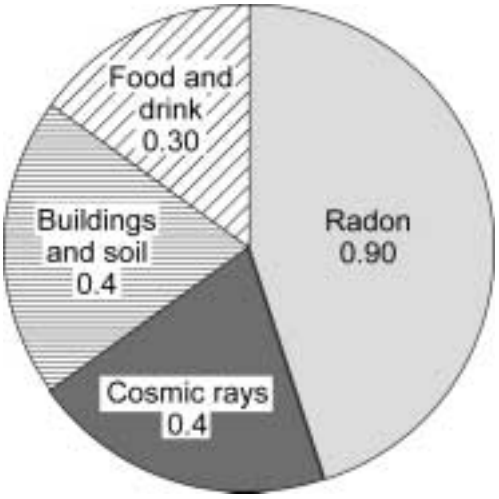
(6 marks)

8

6 The pie chart shows the average radiation dose that a person in the UK receives each year from natural background radiation.

The doses are measured in millisieverts (mSv).



6 (a) Some types of job increase the radiation dose a worker receives.
People working as aircrew receive an increased radiation dose due to flying at high altitude.

6 (a) (i) The radiation dose from which source of background radiation is increased by flying?

.....

(1 mark)

Question 6 continues on the next page

6 (a) (ii) The following table gives the average additional radiation dose received by aircrew flying to various destinations from London.

Destination	Flight time in hours	Average additional radiation dose in mSv
Edinburgh	1	0.004
Istanbul	5	0.025
Toronto	8	0.050
Los Angeles	11	0.065
Tokyo	13	0.075

What is the relationship between flight time and average additional radiation dose?

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(1 mark)

6 (a) (iii) A flight from London to Jamaica takes 10 hours.

Estimate the likely value for the average additional radiation dose received by people on this flight.

Average additional radiation dose = ... mSv

Give a reason for your answer.

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(2 marks)

6 (b) The following table gives the effects of different radiation doses on the human body.

Radiation dose in mSv	Effects
10 000	Immediate illness; death within a few weeks
1 000	Radiation sickness; unlikely to cause death
100	Lowest dose with evidence of causing cancer

A businessman makes 10 return flights a year from London to Tokyo.

Explain whether the businessman should be concerned about the additional radiation dose received during the flights.

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(2 marks)

6 (c) In a study of 3900 aircrew it was found that 169 had developed leukaemia, a form of cancer. In a similar sized sample of non-aircrew the number of leukaemia cases was 156.

Suggest why it would be difficult to be certain that the leukaemia developed by the aircrew was caused by flying.

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(2 marks)

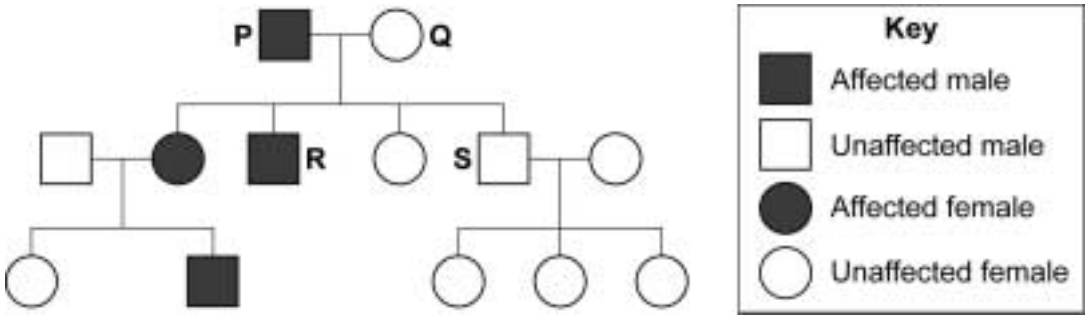
8

Biology questions

7 Sometimes babies are born with extra fingers or toes as shown in the photograph.

This condition is called polydactyly.

The diagram shows the inheritance of polydactyly in a family.



7 (a) Polydactyly is caused by a dominant allele, **D**.
The recessive allele of the gene is represented by **d**.

Use **one** genetic diagram to show the inheritance of the polydactyly gene by **R** and **S**.

(4 marks)

Question 7 continues on the next page

7 (b) Embryos can be screened for genetic disorders.

Many people would favour the use of embryo screening for cystic fibrosis but not for polydactyly.

Compare the issues involved in the use of embryo screening for cystic fibrosis and for polydactyly.

You should use your knowledge and understanding of the process and the two conditions.

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(4 marks)

8

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

8 (a) There is a large amount of evidence that evolution is taking place.

Scientists are uncertain about how life started on Earth.

Explain why.

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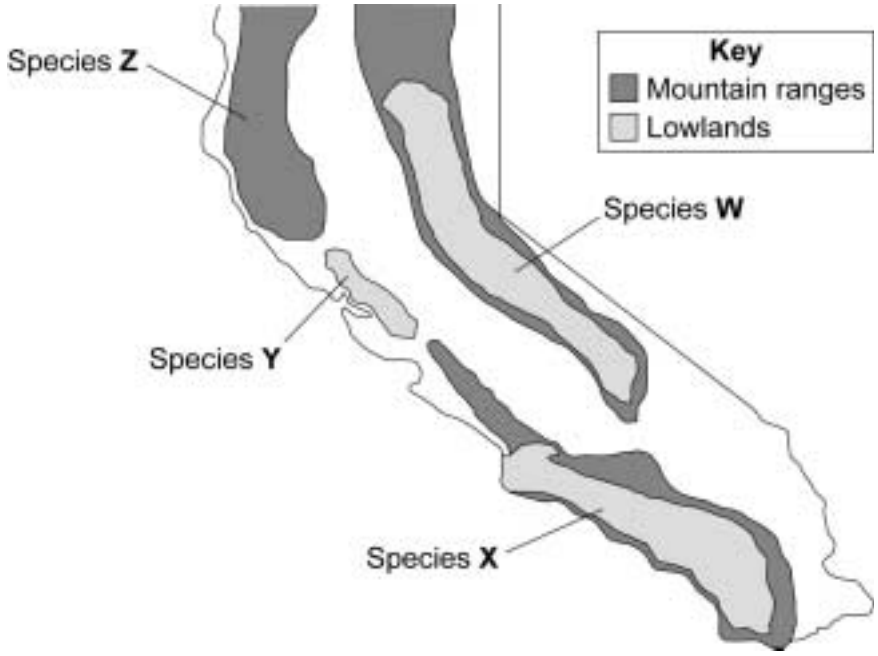
(2 marks)

8 (b) Salamanders are terrestrial amphibians.

The diagram shows the distribution of four different species of salamander in a country.



Originally, there was only one species of salamander in the country.

Suggest an explanation for the development of the four different species.

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(5 marks)

7

Turn over▶

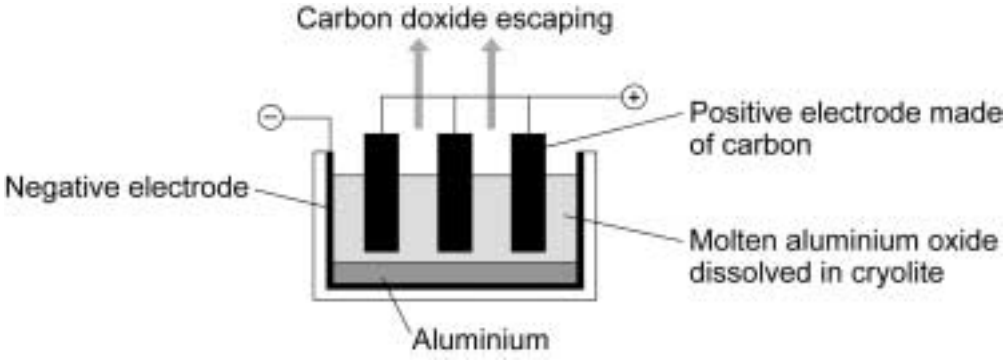
Chemistry questions

9 Read the information in the box and then answer the question.

Aluminium is made by the electrolysis of aluminium oxide.

Aluminium oxide is an ionic compound containing aluminium ions ($\mathbf{Al^{3+}}$) and oxide ions ($\mathbf{O^{2-}}$).

The diagram below shows the apparatus used to electrolyse aluminium oxide.



9 (a) Use information in the box and your knowledge of this process to answer this question.

Describe how aluminium and carbon dioxide are formed in this process.

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(5 marks)

9 (b) Aluminium is a metal.

Explain why it conducts electricity.

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(4 marks)

9

Turn over for the next question

10 Photographic film often contains silver bromide. Silver bromide is changed by light to form silver which appears as a black solid. This darkens the photographic film.

A photographic film can be made by coating thin transparent plastic with a gel containing silver bromide.

The main steps in making this photographic film are as follows:

Step 1 Gelatine is dissolved in warm water to make a solution.

Step 2 Compound **A**, a soluble compound which contains bromide ions, is dissolved into this solution.

Step 3 The lights are turned out in the darkroom.

Step 4 Compound **B**, a soluble compound which contains silver ions, is dissolved in water.

Step 5 The solution of compound **B** is added to the solution containing compound **A** and gelatine. Solid silver bromide is formed.

Step 6 The warm mixture is poured onto thin, transparent plastic film.

Step 7 The mixture sets to form a gel containing solid silver bromide.

10 (a) The table below gives information about the solubility of some compounds.

Soluble	Insoluble
All sodium and potassium salts	
All nitrates	
Most chlorides, bromides and iodides	Silver and lead chlorides, bromides and iodides
Most sulfates	Lead sulfate and barium sulfate
Sodium, potassium and ammonium carbonates	Most other carbonates

Use information from the table to name suitable compounds for **A** and **B**.

Compound **A** .....

Compound **B** .....

(2 marks)

10 (b) Suggest why the lights are turned out at **step 3** in this method of making a photographic film.

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(1 mark)

10 (c) What type of chemical reaction takes place when the compounds are mixed in **step 5**?

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(1 mark)

10 (d) The photographic film is placed in a camera and a picture is taken. Where light hits the photographic film the silver ions (Ag^+) are changed into silver metal (Ag).

Explain why this reaction is a reduction.

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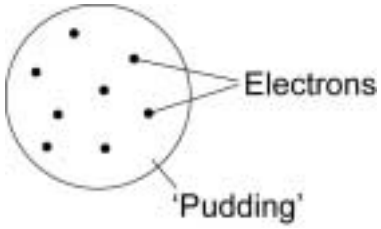
(2 marks)

6

Turn over for the next question

Physics questions

11 In the early part of the 20th century scientists used the 'plum pudding' model to explain the structure of the atom.



11 (a) What did scientists think that the 'pudding' part of the atom was?

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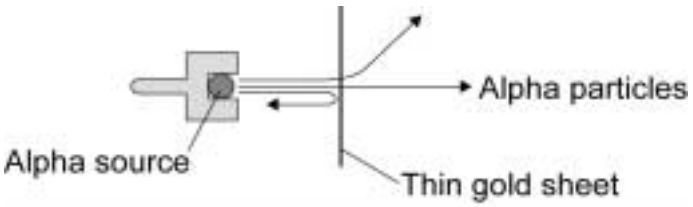
(1 mark)

11 (b) The scientists Geiger and Marsden devised an experiment to test the 'plum pudding' model. They fired positively charged alpha particles at a very thin sheet of gold foil. They then measured the different paths taken by the alpha particles.



List A gives some of the observations from the experiment. **List B** gives the conclusions reached from the observations.

Draw **one** line from each observation in **List A** to the conclusion reached in **List B**.

List A Observation	**List B Conclusion**
Most of the alpha particles go straight through the gold foil	Most of the atom is empty space
Some alpha particles are deflected through a big angle	The nucleus of the atom is very small
Only a very small number of alpha particles rebound backwards	The nucleus has a large positive charge

(2 marks)

11 (c) Following the work of Geiger and Marsden, the 'plum pudding' model of the atom was replaced by the 'nuclear model' of the atom.

Explain why it is sometimes necessary for scientists to replace a scientific model.

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(2 marks)

5

Turn over for the next question

12 In the UK mains electricity is a 230 volt a.c. supply.

12 (a) Explain the difference between an a.c. (alternating current) electricity supply and a d.c. (direct current) electricity supply.

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(2 marks)

12 (b) A householder has a 10.8 kW electric shower installed in the bathroom.

12 (b) (i) Calculate the current drawn from the mains electricity supply by the shower.

Write down the equation you use, then show clearly how you work out your answer and give the unit.

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Current = ...

(3 marks)

12 (b) (ii) The table gives the maximum current that can safely pass through electric cables of different cross-sectional area.

Cross-sectional area in mm^2	**Maximum safe current in amps**
1.0	11.5
2.5	20.0
4.0	27.0
6.0	34.0
10.0	46.0
16.0	62.0

The existing power sockets in the house are wired to the mains electricity supply using 2.5 mm^2 cable.

Use the data in the table to explain why the shower must **not** be connected to the mains electricity supply using 2.5 mm^2 cable.

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(2 marks)

12 (b) (iii) The circuit connecting the shower to the mains electricity supply must include a residual current circuit breaker (RCCB) and not a fuse.

Give **two** advantages of using a RCCB to protect a circuit rather than a fuse.

1 .....

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2 .....

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(2 marks)

END OF QUESTIONS

9

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AQA

GCSE Physics Equations Sheet

Unit 6 F and H

$a = \frac{F}{m}$ or $F = m \times a$	*F* resultant force *m* mass *a* acceleration
$a = \frac{v - u}{t}$	*a* acceleration *v* final velocity *u* initial velocity *t* time taken
$W = m \times g$	*W* weight *m* mass *g* gravitational field strength
$F = k \times e$	*F* force *k* spring constant *e* extension
$W = F \times d$	*W* work done *F* force applied *d* distance moved in the direction of the force
$P = \frac{E}{t}$	*P* power *E* energy transferred *t* time taken
$E_p = m \times g \times h$	E_p change in gravitational potential energy *m* mass *g* gravitational field strength *h* change in height
$E_k = {}^1/_2 \times m \times v^2$	E_k kinetic energy *m* mass *v* speed

$p = m \times v$	p momentum m mass v velocity
$I = \frac{Q}{t}$	I current Q charge t time
$V = \frac{W}{Q}$	V potential difference W work done Q charge
$V = I \times R$	V potential difference I current R resistance
$P = \frac{E}{t}$	P power E energy t time
$P = I \times V$	P power I current V potential difference
$E = V \times Q$	E energy V potential difference Q charge