

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
APPLIED SCIENCE: DOUBLE AWARD**

**J649  
B482/02**

Unit 2: Science for the needs of society (Higher Tier)

Candidates answer on the question paper.  
A calculator may be used for this paper.

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Monday 17 January 2011  
Morning**

**Duration: 1 hour**



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**MODIFIED LANGUAGE**

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- The marks allocated and the spaces provided are a good indication of the length of answers required.
- This document consists of **16** pages. Any blank pages are indicated.


Answer **all** the questions.

1 Read the information about using mercury in low energy light bulbs.

In 2012, shops in the UK will stop selling filament light bulbs.

Only low energy light bulbs will be sold.

This will reduce the amount of carbon dioxide released into the atmosphere by 5 million tonnes every year.



low energy bulb

(a) How will using low energy light bulbs instead of filament bulbs reduce the amount of carbon dioxide going into the atmosphere?

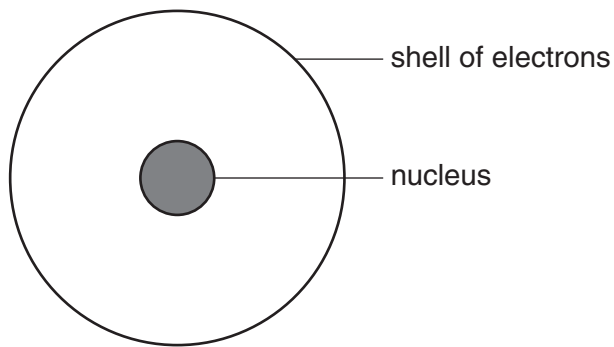
.....

.....

..... [2]

(b) However, low energy bulbs contain mercury.

The electrons in the mercury atom are involved in producing light in the bulb.



**mercury atom**

A mercury atom has 80 **protons** in its nucleus.

(i) Write down the name of the **other** type of particle in the nucleus.

..... [1]

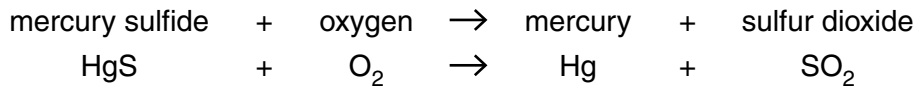
(ii) How many **electrons** are in a mercury atom?

..... [1]

- (c) Mercury is extracted from an ore called cinnabar. The ore contains mercury sulfide, HgS.

Cinnabar is heated in air to extract the mercury. Mercury is a shiny grey liquid that conducts electricity.

Sulfur dioxide gas is made at the same time.



Which of the statements about the chemicals in the reaction are **true** and which are **false**?

Put a tick (✓) in one box in each row.

	true	false
three of the chemicals are compounds		
mercury is a non-metal		
sulfur atoms react with oxygen atoms		
all the chemicals are inorganic		

[2]

- (d) Most of the mercury used to make light bulbs is mined in China.

Shen is talking about the effects of mining near where he lives.



All the land around the mine is poisoned because mercury is toxic. It's because the water runs out of the mine. It runs into the water supplies and the crops don't grow properly. The water buffaloes died. People who drink the water get sick. The factory where the ore is heated gives off toxic gases so people have breathing problems too.

The mercury mine causes environmental and health problems. Describe how the **mining company** could reduce the problems.

.....

.....

..... [2]

4

(e) The mining company employs some scientists to deal with the environment and safety.

What other jobs in the company need scientists?

Put a tick (✓) in **two** boxes next to the correct answers.

hiring people to dig in the mines

working out the best conditions for the heating process

organising transport for raw materials

checking the quality of the mercury that is made

managing the money for the company

[2]

[Total: 10]

2 In 2009 scientists announced a breakthrough in genetic engineering.

They had cured colour blindness (a genetic disease) in monkeys.

The scientists were able to restore full colour vision to adult monkeys born colour blind.

Colour blindness also occurs in humans.

(a) (i) Describe what is meant by **genetic engineering**.

.....  
..... [2]

(ii) Explain how a genetic disease is different from other infectious diseases.

.....  
..... [2]

(b) Some scientists have said that this cure for colour blindness could be used on humans.

Some people think it is right to use genetic engineering to cure colour blindness.

Some people are against using genetic engineering to cure colour blindness.

(i) Give one reason **for** and one reason **against** using genetic engineering to cure colour blindness to give full colour vision.

for .....  
.....  
against .....  
..... [2]

(ii) Which two of the following are genetic diseases in humans?

Put ticks (✓) in the boxes next to the **two** correct answers.

cystic fibrosis	<input type="checkbox"/>
rubella	<input type="checkbox"/>
tuberculosis	<input type="checkbox"/>
Huntington's chorea	<input type="checkbox"/>
polio	<input type="checkbox"/>

[2]

(c) Read the following sentences about how colour blindness can be passed on to the next generation.

Two words, labelled **A** and **B**, can be used to fill in the spaces to complete the sentences.

The colour blindness characteristic is controlled by .....**A**..... .

Each parent passes on the .....**A**..... during .....**B**..... reproduction.

Whether the offspring is colour blind or not depends on these .....**A**..... from the parents.

Write down the missing words **A** and **B**.

**A** .....

**B** .....

[2]

[Total: 10]

3 Troy thinks he would like to be a scientist.

He finds out what different scientists do.

(a) Meteorologists study the weather. They use information about the atmosphere.

(i) The Earth's atmosphere maintains the conditions needed for life.

Which of the following help provide the conditions necessary for life?

Put ticks (✓) in the boxes next to the correct conditions.

- maintains the natural greenhouse effect
- produces acid rain to help trees grow
- contains oxygen for aerobic respiration
- reflects visible light so nights are dark
- contains 80% nitrogen

[2]

(ii) The original composition of the Earth's atmosphere was very different from today.

The appearance of plant life on Earth caused a big change in the Earth's atmosphere.

What was the change?

Explain the change and how plants caused it.

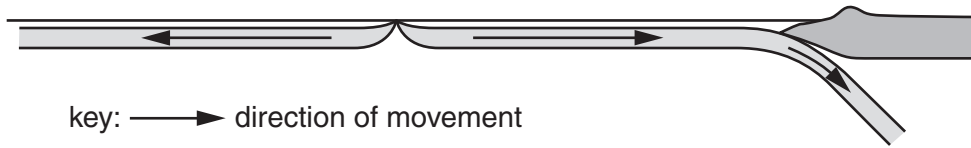
.....

.....

..... [3]

(b) Geologists study the Earth and its structure.

The diagram shows the movement of tectonic plates.



Explain what causes the movement of tectonic plates.

.....

.....

.....

..... [3]

(c) Astronomers study the stars and the Universe.

In 2006 astronomers decided that Pluto should no longer be called a planet.

Which of the statements are reasons for this?

Put ticks (✓) in the boxes next to the **two** correct answers.

- Pluto is visible by reflected light.
- Pluto is too small.
- Infrared telescopes have shown Pluto is very cold.
- Pluto is shaped like a sphere.
- Neptune is sometimes further from the Sun than Pluto.

[2]

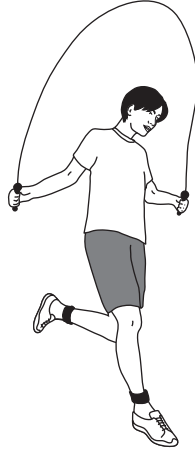
[Total: 10]



4 Tom wants to be fit.

He exercises every day.

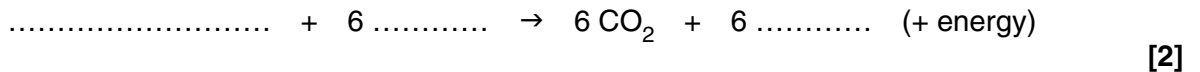
When he exercises, his breathing rate increases.



(a) Tom's breathing rate increases because his muscles are producing more carbon dioxide.

(i) His muscle cells are using aerobic respiration to produce energy.

Complete the balanced **symbol** equation for aerobic respiration.



(ii) Explain how producing more carbon dioxide causes an increase in the breathing rate.

.....  
 .....  
 ..... [2]

(iii) Why is it important to remove carbon dioxide from the body?

..... [1]

(b) During breathing, Tom inhales and exhales.

Complete the sentences to explain how **inhalation** happens.

During inhalation, the ribs are moved ..... and the diaphragm  
moves .....

The pressure in the lungs then becomes ..... than atmospheric pressure  
and therefore air ..... the lungs. [2]

(c) After exercising for a while, Tom finds his muscles get tired and do not produce as much energy.

Tom's muscles become fatigued and produce less energy.

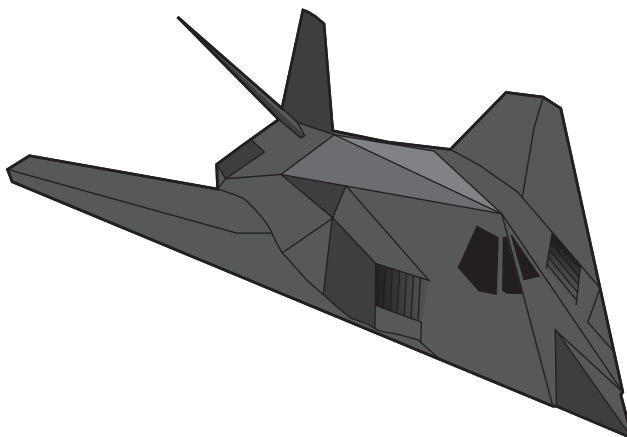
Explain why.

.....  
.....  
..... [2]

[Total: 9]

5 The bodies of fighter aircraft used to be made from metals.

Some are now made from composite materials such as metals bonded together with polymers.



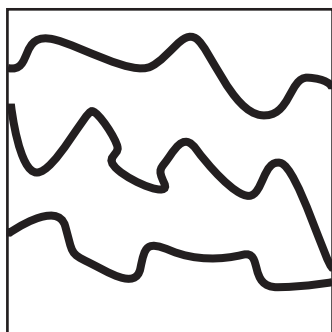
(a) What are the advantages of using composites rather than pure metals for building aircraft?

.....  
 ..... [2]

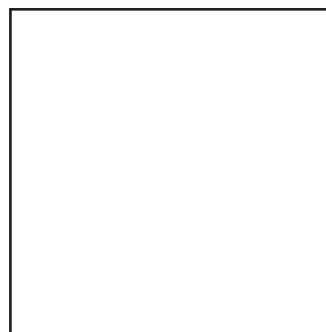
(b) Some of the polymers used to make the composites contain cross links.

(i) The diagram below shows a polymer without cross links (**polymer A**).

Draw a similar diagram in the second box to show a polymer with cross links (**polymer B**).



polymer A



polymer B

[1]

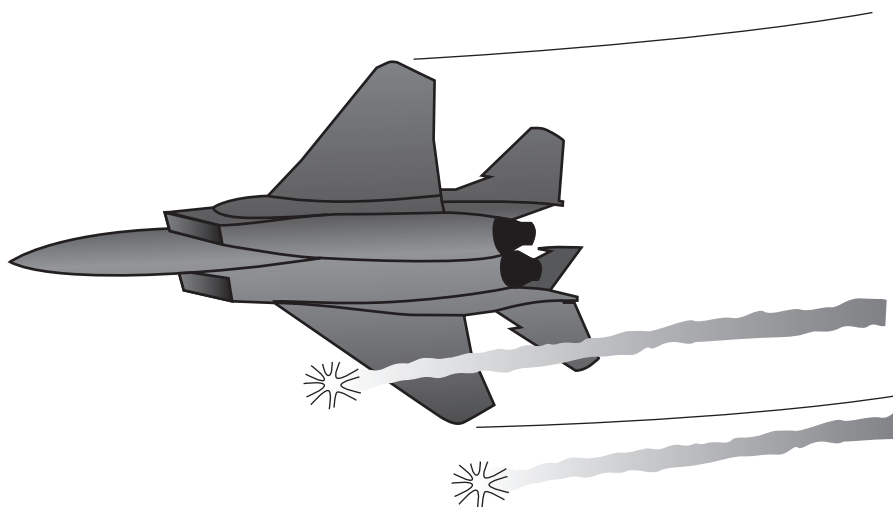
(ii) The two polymers behave differently when they are heated.

Use ideas about cross links to explain why the polymers behave differently when heated.

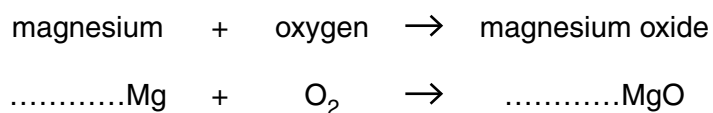
.....  
 .....  
 ..... [2]

(c) When they are attacked, some fighter aircraft send out flares of burning magnesium.

This makes it more difficult for heat seeking missiles to find the aircraft.



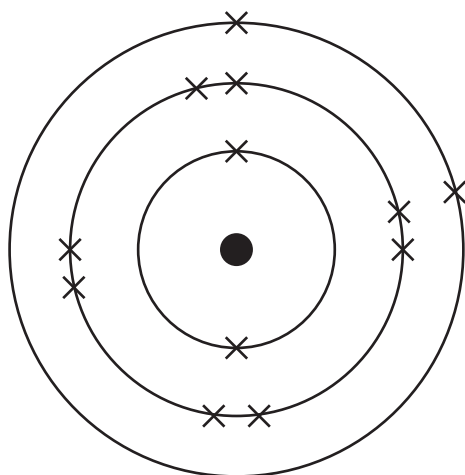
(i) Balance the symbol equation to show what happens when magnesium burns.



[1]

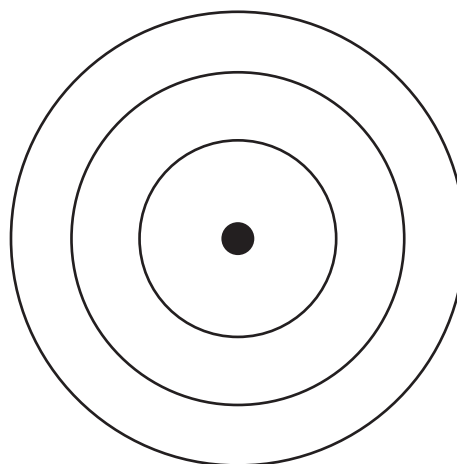
(ii) The diagram of a magnesium **atom** shows the arrangement of electrons in the atom.

Complete the second diagram to show the **arrangement of electrons** and the **symbol** for a magnesium **ion**.



magnesium atom

symbol: Mg



magnesium ion

symbol: .....

[2]

(iii) The magnesium oxide that forms when the magnesium burns is an **ionic compound**.

Which of the following statements about magnesium oxide are true and which are false?

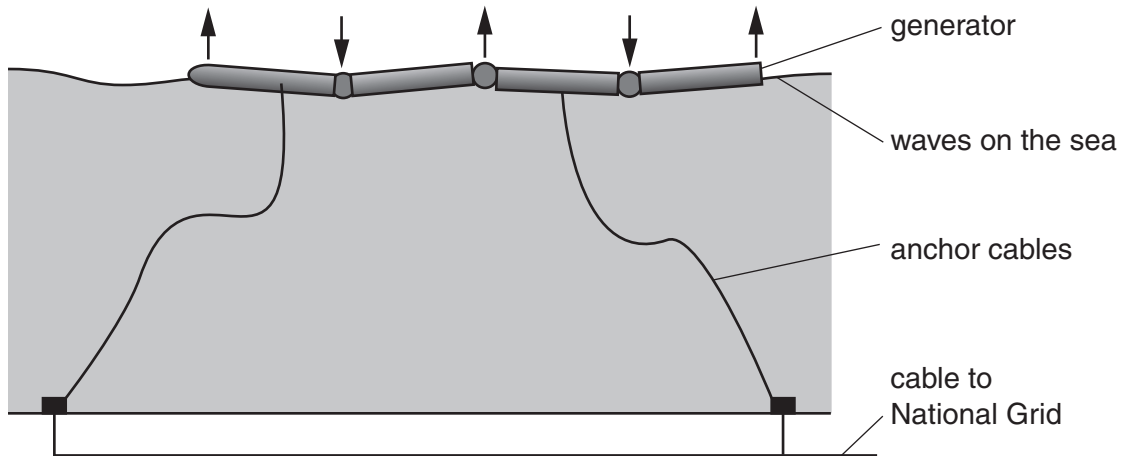
Put a tick (✓) in one box in each row.

	true	false
magnesium oxide is likely to be a solid		
magnesium oxide conducts electricity at room temperature		
magnesium oxide contains all the same type of atoms		
magnesium oxide has a low boiling point		

[2]

[Total: 10]

6 A type of wave power generator is being tested in the North Sea.



As the waves pass the generator they make it bend.

This bending movement is used to produce electricity.

The electricity can then be distributed using the National Grid.

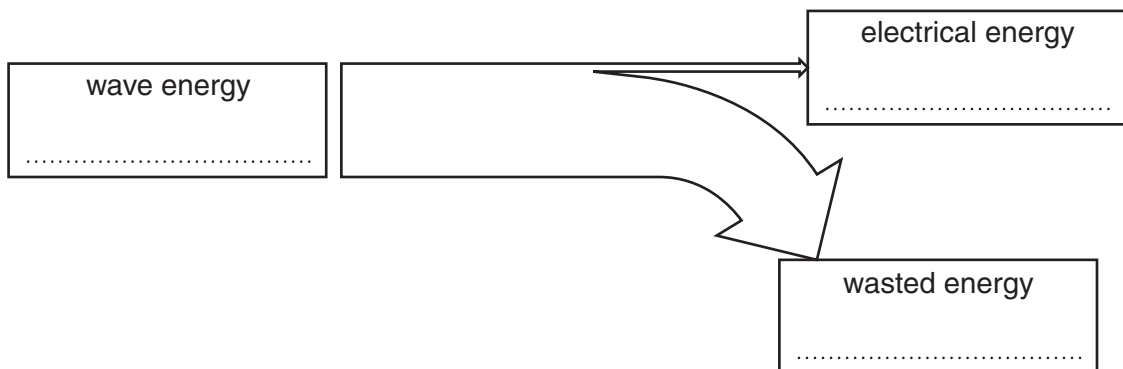
(a) Waves are a renewable energy source.

What is meant by renewable energy source?

.....  
 ..... [1]

(b) The 150m long wave generator produces 750kJ of electrical energy from a wave energy input of 8250 kJ each second.

(i) Complete the Sankey diagram for the generator.



[2]

(ii) Calculate the efficiency of the generator.

Show your calculation.

efficiency = ..... % [2]

(c) Waves passing the generator have a frequency of 0.6 Hz and a wavelength of 4 m.

Calculate the speed of the wave.

Show your calculation.

speed of wave = ..... m/s [2]

(d) The power output of the generator is 750 kW.

(i) How much energy will it produce in a day?

Give your answer in kilowatt hours.

Show your calculation.

energy ..... kWh [2]

(ii) The generator produces electricity at 11 000 volts.

What will be the current when the voltage is 11 000V?

Show your calculation.

current = ..... amps [2]

[Total: 11]

**END OF QUESTION PAPER**

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