

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE
B722/01**

**GATEWAY SCIENCE
ADDITIONAL SCIENCE B**

**Additional Science modules B4, C4, P4
(Foundation Tier)**

FRIDAY 12 JUNE 2015: Afternoon

**DURATION: 1 hour 30 minutes
plus your additional time allowance
MODIFIED ENLARGED 24pt**

| | | | | | | | | | | |
|-------------------------------|--|--|--|--|--|------------------------------|--|--|--|--|
| Candidate forename | | | | | | Candidate surname | | | | |
| Centre number | | | | | | Candidate number | | | | |

**Candidates answer on the Question Paper.
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:
A copy of the Periodic Table**

**OTHER MATERIALS REQUIRED:
Pencil
Ruler (cm/mm)**

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

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).

INFORMATION FOR CANDIDATES

The quality of written communication is assessed in questions marked with a pencil ().

A list of equations can be found on pages 4–5.

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 85.

Any blank pages are indicated.

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EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

efficiency = $\frac{\text{useful energy output} (\times 100\%)}{\text{total energy input}}$

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

average speed = $\frac{\text{distance}}{\text{time}}$

distance = average speed × time

$$s = \frac{(u + v)}{2} \times t$$

acceleration = $\frac{\text{change in speed}}{\text{time taken}}$

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

power = $\frac{\text{work done}}{\text{time}}$

$$\text{power} = \text{force} \times \text{speed}$$

$$\text{KE} = \frac{1}{2}mv^2$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$\text{GPE} = mgh$$

$$mgh = \frac{1}{2}mv^2$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

Answer ALL the questions.

SECTION A – Module B4

1 Read the article.

THE MOST SALTY LAKE IN THE WORLD

Scientists have found a small lake in Antarctica.

Don Juan pond is the most salty lake in the world.

Temperatures in the lake are as low as -40°C .

However it does not freeze up.

This is because it is twelve times MORE salty than normal sea water.

Some scientists claim they have found bacteria living in the water.

Other scientists say that this is not possible.

(a) The bacteria in the lake may be able to use photosynthesis to make glucose.

They may use the same reaction as green plants.

Finish this word equation for photosynthesis.

carbon dioxide + _____

→ glucose + _____

[2]

(b) Some scientists think that it is not possible for bacteria to live in the lake.

Put ticks (✓) next to the TWO correct reasons that would support their view.

Temperatures would be too low for photosynthesis. ☐

It is never light in the Antarctic. ☐

Water would leave the bacteria by osmosis. ☐

There is no carbon dioxide in the Antarctic. ☐

The salt would enter the bacteria by osmosis. ☐

[2]

2 Harold is doing an experiment to investigate the loss of water from a plant.

(a) Which word describes the loss of water from the leaves of a plant?

Put a ring around the answer in this list.

photosynthesis

respiration

transpiration

translocation

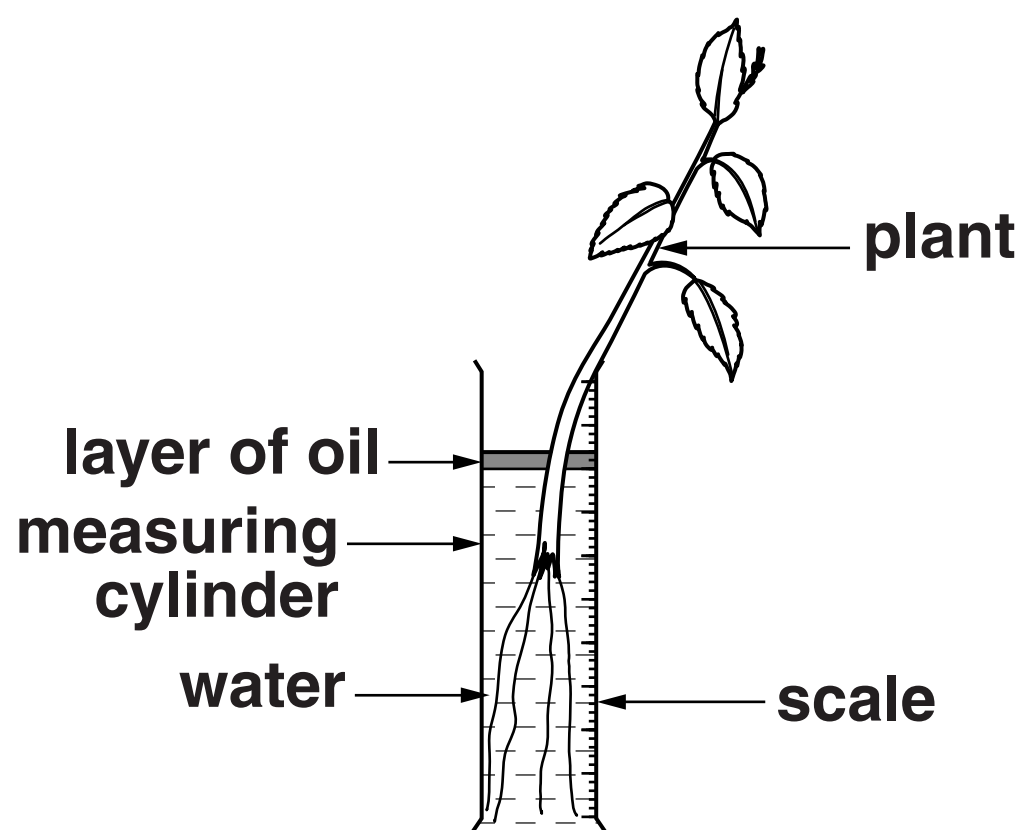
[1]

(b) Harold digs up a plant and puts it into a measuring cylinder with water.

He puts a small amount of oil on the surface of the water.

The oil stops the water evaporating from the measuring cylinder.

Harold measures the level of water in the measuring cylinder.



Harold leaves the plant in the measuring cylinder for six hours.

He then measures the level of water on the measuring cylinder.

His results are shown in the table.

| | |
|----------------------|--|
| Time | Reading on measuring cylinder in cm³ |
| Start | 80 |
| After 6 hours | 74 |

(i) Describe how water from the measuring cylinder enters the plant and reaches the leaves.

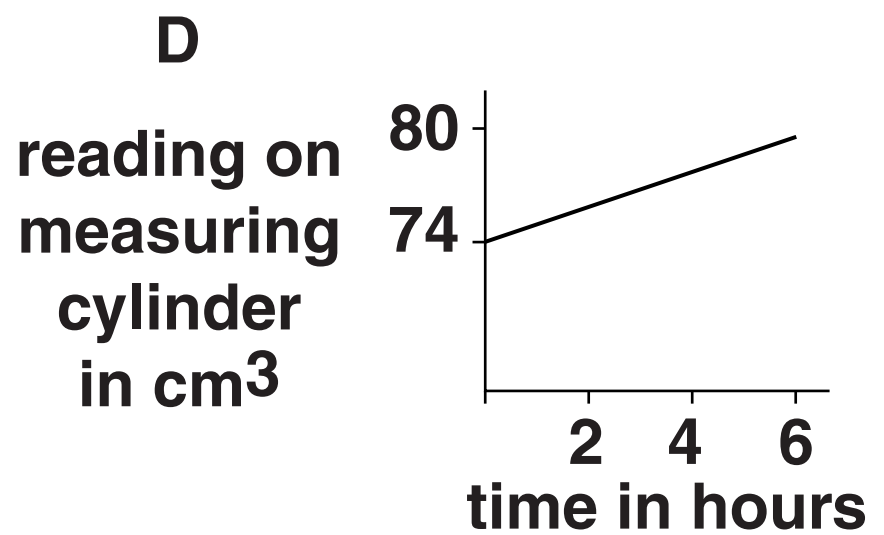
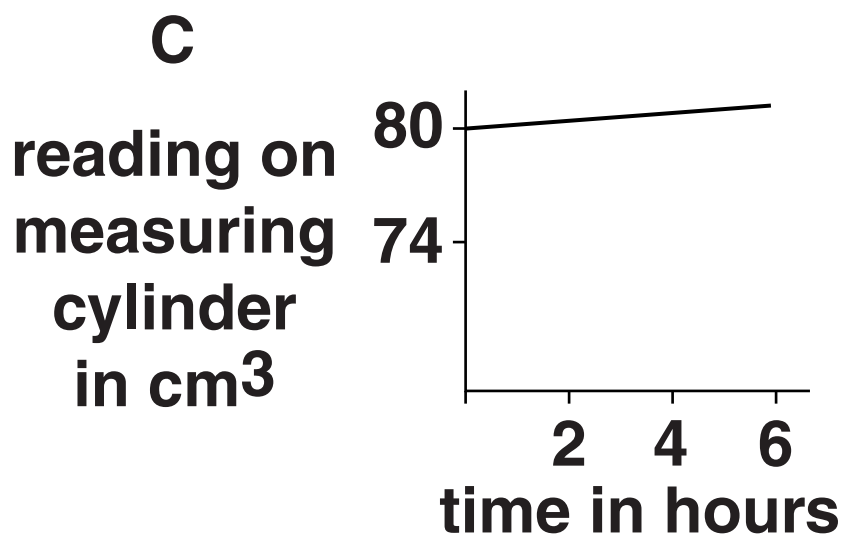
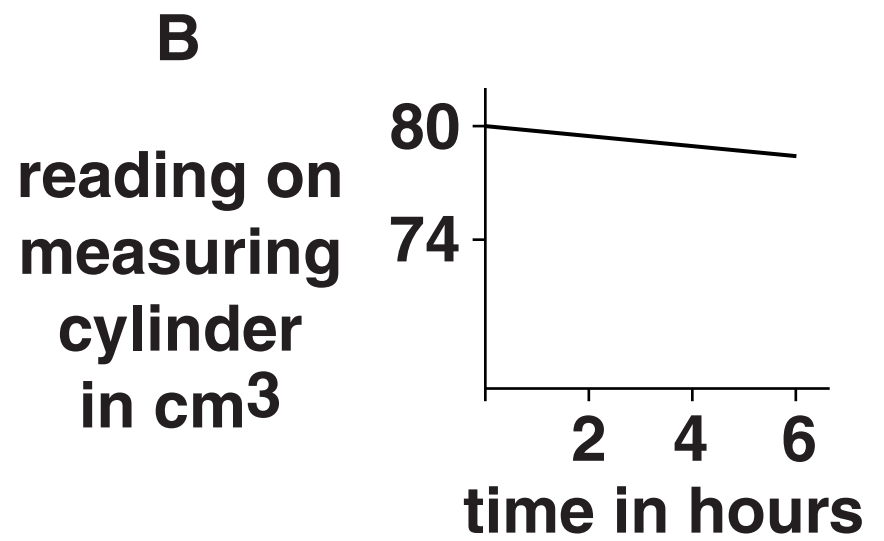
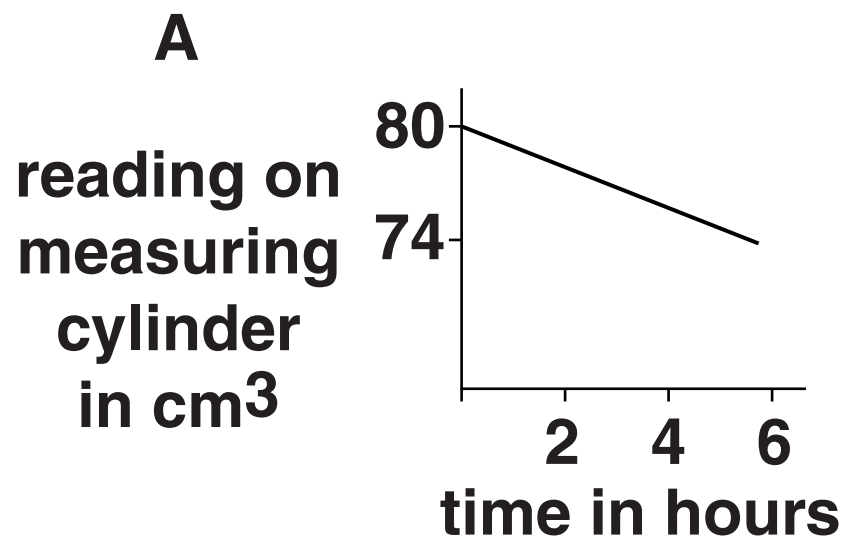
[3]

(ii) Harold repeats his experiment but **TURNS OFF THE LIGHTS** in the room.

He takes measurements on the measuring cylinder every two hours.

He is going to plot a graph of his results.

Look at the graphs.



What will Harold's graph look like?

Choose from A, B, C or D.

answer _____

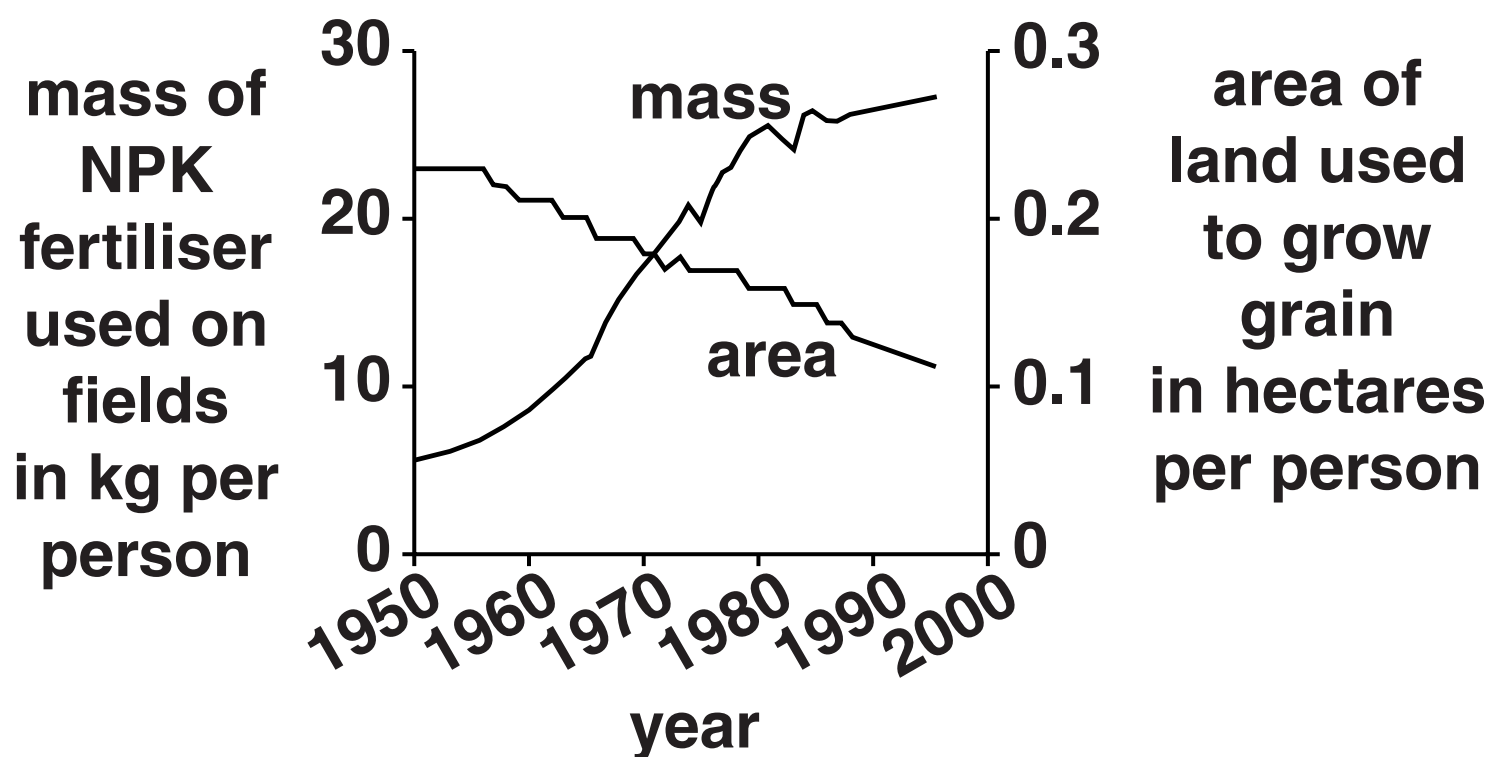
[1]

(iii) Explain your answer to part (ii).

_____ **[2]**

3 The graph shows the mass of NPK fertiliser used on land per person in the world.

It also shows the area of land used to grow grain crops per person in the world.



Heather is talking about the graph.

“I know that the same amount of grain was grown per person in 1995 as in 1950.

So why has the area of land used to grow this grain changed?”

Explain the effect of NPK fertiliser on crops.

Use the information in the graph to suggest an answer to Heather’s question.



The quality of written communication will be assessed in your answer to this question.

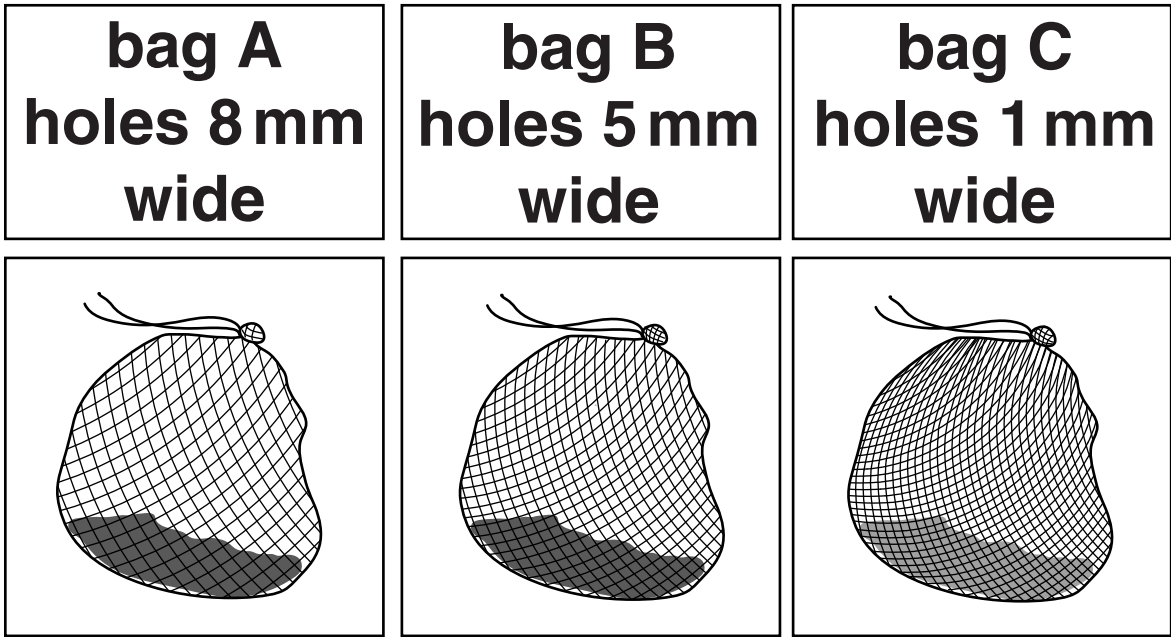
[6]

4 Some students did an experiment to see how quickly leaves decay.

They put some leaves into three different bags, A, B and C.

Each bag was made of material that had different size holes.

The bags are going to be buried in the soil.



(a) Different organisms have different roles in breaking down the leaves.

Bacteria and fungi which are less than 0.005 mm wide.

Woodlice which are about 4 mm wide.

Earthworms which are about 7 mm wide.

Complete this table.

| Organism | Role in breaking down the leaves | Can the organism get into bag A? | Can the organism get into bag B? | Can the organism get into bag C? |
|------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| bacteria | | yes | yes | |
| fungi | decomposers | yes | yes | yes |
| earthworms | detritivores | yes | | no |
| woodlice | | yes | | no |

(b) The students put 100 g of leaves in each bag.

They buried the bags in the soil.

After two months they dug up the bags and reweighed the leaves.

Their results are shown in the table.

| | Bag A | Bag B | Bag C |
|--------------------------------|-------|-------|-------|
| Mass at the start in grams | 100 | 100 | 100 |
| Mass after two months in grams | 75 | 85 | 95 |

(i) In which bag did the leaves decay fastest?

_____ [1]

(ii) Explain why decay was fastest in this bag.

_____ [2]

(iii) The students repeated this experiment in the winter.

They found that the leaves in all the bags decayed less than in the first experiment.

Suggest why.

_____ [2]

SECTION B – Module C4

5 Word equations are used to describe reactions.

Look at the word equations shown on page 17.

(a) One reaction is thermal decomposition.

Which one?

Choose from A, B, C, D or E.

answer _____ [1]

(b) One reaction makes a colourless gas and an alkaline solution.

Which one?

Choose from A, B, C, D or E.

answer _____ [1]

(c) One reaction makes a WHITE precipitate.

Which one?

Choose from A, B, C, D or E.

answer _____ [1]

(d) One reaction makes a BLUE precipitate.

Which one?

Choose from A, B, C, D or E.

answer _____ [1]

reaction A copper carbonate → copper oxide + carbon dioxide

reaction B potassium + chlorine → potassium chloride

reaction C potassium chloride + silver nitrate → silver chloride + potassium nitrate

17 reaction D sodium hydroxide + copper sulfate → copper hydroxide + sodium sulfate

reaction E sodium + water → sodium hydroxide + hydrogen

6 A factory makes potassium sulfate, K_2SO_4 .

(a) How many different elements are in the formula K_2SO_4 ?

[1]

(b) The factory produces a lot of waste water.

The waste water is pumped into a local river.

Sarah thinks the water is getting polluted with small amounts of potassium sulfate.

She tests samples of the river water.

Her results are shown in the table.

| TEST | RESULT |
|---------------------------------|--------------------------|
| flame test | yellow flame |
| barium chloride solution | white precipitate |

Describe how Sarah does the flame test.

Explain whether her results support the idea that the river water is polluted with potassium sulfate.



The quality of written communication will be assessed in your answer to this question.

[6]

7 The United Kingdom uses many water resources such as seawater and water from lakes.

(a) Write down the name of one OTHER water resource.

_____ [1]

(b) Look at the table. It shows some information about water resources.

| Region | Volume of water available each day in m ³ | Volume of water needed each day in m ³ | Difference between water available and water needed in m ³ |
|--------|--|---|---|
| A | 1000 | 600 | 400 |
| B | 2500 | 2500 | |
| C | 3000 | 1500 | |
| D | 4000 | 2000 | 2000 |
| E | 500 | 400 | |

(i) Complete the table by calculating the last column for the three remaining regions. [1]

(ii) It is important that people living in region B conserve water.

Suggest why. Use information from the table.

_____ [1]

8 The properties of four metals are shown in the table.

Look at the table.

| Metal | Melting point in °C | Density in g/cm³ | Reaction with water |
|--------------|--------------------------------|--|--------------------------------|
| W | 1540 | 7.9 | rusts rapidly |
| X | 98 | 1.0 | reacts violently |
| Y | 660 | 2.7 | no visible reaction |
| Z | 840 | 1.6 | slowly reacts |

(a) Oskar's grandad wants to buy Oskar a new watering can.

Which metal, W, X, Y or Z would be best to use to make the watering can?

Write down ONE reason for your answer.

[2]

(b) The table shows some properties of metals.

Write down THREE OTHER properties of metals.

[3]

9 Many scientists helped to develop the theory of atomic structure.

Dalton's theory stated that atoms could not be split.

Later, scientists such as Rutherford and Bohr developed theories that had particles smaller than an atom.

Now even more detailed theories of atomic structure are being developed.

(a) Explain why all theories of atomic structure are only provisional and keep changing.

[2]

(b) An atom has both an ATOMIC NUMBER and a MASS NUMBER.

What do these TWO terms mean?

[2]

(c) An element has the electronic structure of 2.8.6.

Identify the element.

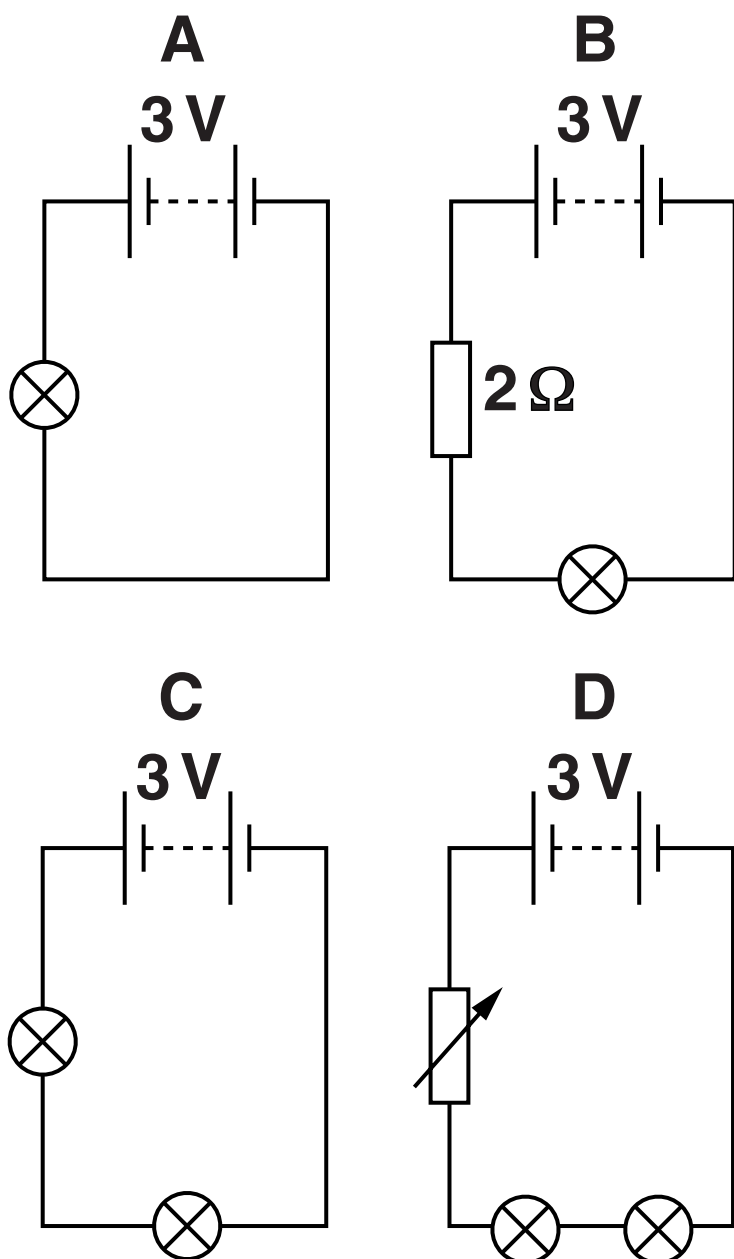
Explain your answer.

[2]

SECTION C – Module P4

10 Charles is investigating electrical circuits.

(a) Look at the four diagrams.



Electric charge flows round each circuit.

The lamps in each circuit are identical.

In which circuit is the flow of charge the **GREATEST**?

Choose from: **A** **B** **C** **D**

answer _____

[1]

(b) Charles connects an ammeter into circuit A.

The reading on the ammeter is 0.5 amps.

Calculate the resistance of the lamp.

answer = _____ ohms [2]

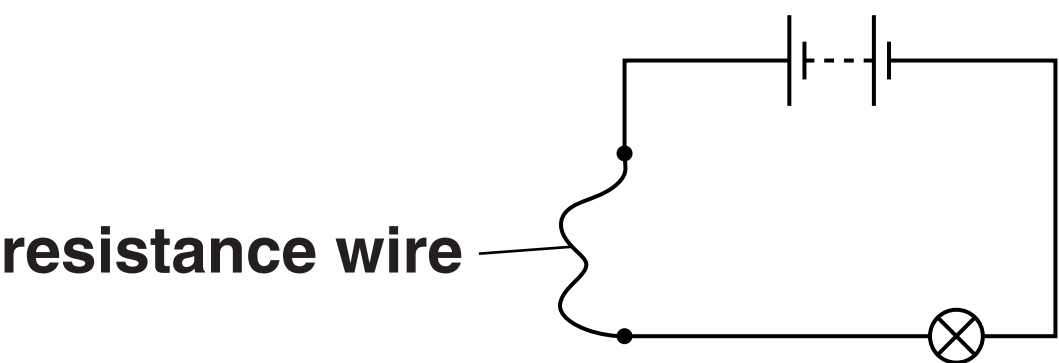
(c) What is the power of the lamp in circuit A?

Choose from: 0.5W 1.5W 3.0W 6.0W

answer = _____ [1]

(d) Charles investigates how changes to a circuit affect the brightness of a lamp.

He builds this circuit and notes that the lamp has normal brightness.



He makes changes to the circuit.


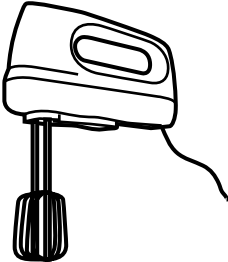

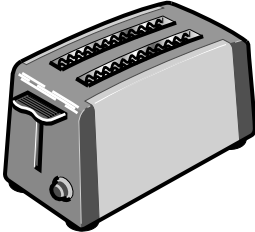
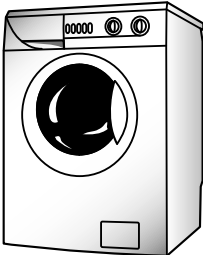
Put one tick (✓) on each row to show whether the lamp is brighter, is less bright, or has normal brightness.

| Change made | Lamp is brighter | Lamp is less bright | Lamp has normal brightness |
|--------------------------------|------------------|---------------------|----------------------------|
| Wire same length but thinner | | | |
| Wire made longer | | | |
| Lamp and wire change places | | | |
| Battery connected opposite way | | | |

[2]

(e) Some electrical appliances can be double insulated.

Look at the diagram.

| APPLIANCE | | MATERIAL FOR THE CASE | DOUBLE INSULATED |
|-----------------|---|--------------------------|--------------------------|
| kettle |  | stainless steel | <input type="checkbox"/> |
| food mixer |  | plastic | <input type="checkbox"/> |
| hairdryer |  | plastic | <input type="checkbox"/> |
| toaster |  | steel | <input type="checkbox"/> |
| washing machine |  | steel | <input type="checkbox"/> |

Put a tick (✓) in the box next to the TWO appliances that are double insulated. [2]

11 (a) Daisy knows that some materials can become charged when rubbed with a nylon cloth.

She has five rods.

The rods are made from

glass

plastic

copper

polythene

steel

She holds each rod in turn and rubs it with a nylon cloth.

How many of the rods can become charged?

answer _____

[1]

(b) Daisy's car has seats covered in a synthetic material.

Daisy gets an electric shock when she gets out of her car on a dry summer day.

Explain why.

[2]

(c) Static electricity can be useful.

Put a ring around each of the two items in the list that use static electricity to make them work.

paint sprayers

electric motors

smoke detectors using alpha sources

defibrillators

CD players

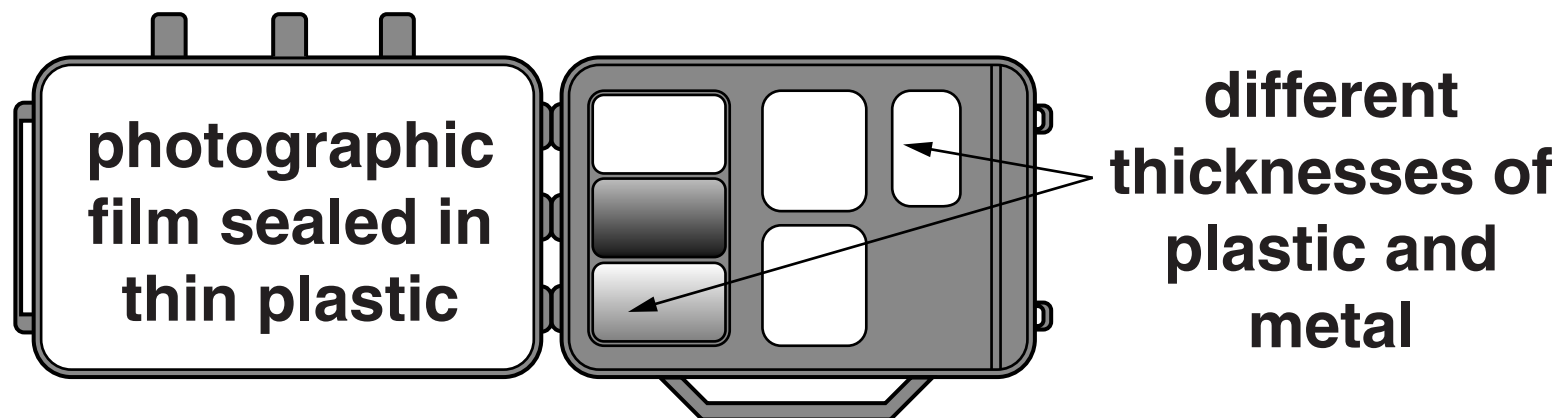
[1]

12 Edward works as a radiographer in a hospital.

He has to wear a radiation film badge while he is working.

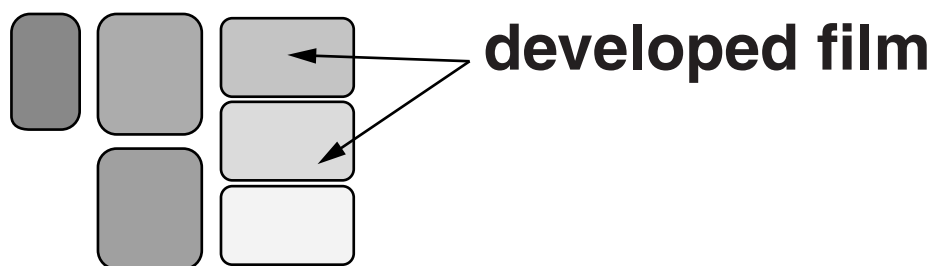
The badge has different thicknesses of plastic and metal covering a photographic film.

Look at the diagram of a film badge.



Radiation absorbed by the film causes the film to darken when developed.

Look at the diagram of the developed film from the badge.



[6]

13 (a) Doctors use a radioactive tracer.

Fay drinks some radioactive liquid and the radiation is monitored on the outside of her body.

Look at the data for some radioactive isotopes.

| Radioactive isotope | Radiation given out | Half-life |
|---------------------|---------------------|-----------|
| A | Gamma | 3 years |
| B | Beta | 6 weeks |
| C | Alpha | 2 days |
| D | Gamma | 1 day |
| E | Gamma | 2 weeks |

Which radioactive isotope should the doctor choose?

Explain your answer.

[3]

(b) There are two ways of obtaining energy from nuclear reactions.

These can be explained by the fission model and the fusion model.

Describe these two models.

[2]

(c) There is radiation all around us.

This is called background radiation.

Write down ONE of the main sources of background radiation and explain why this radiation varies from place to place.

[2]

SECTION D

14 This question is about different materials.

(a) Table 1 shows the strength of several materials.

**It also shows the density of each material
(the mass of 1 cm³).**

TABLE 1

| MATERIAL | IMPACT STRENGTH IN MPa | DENSITY IN GRAMS PER cm³ |
|--------------------|-----------------------------------|--|
| steel | 500 | 7.8 |
| nylon | 75 | 1.1 |
| spider silk | 1000 | 1.3 |

(i) Special jackets are worn by soldiers.



They are designed to have enough impact strength to stop bullets but they also have to be comfortable.

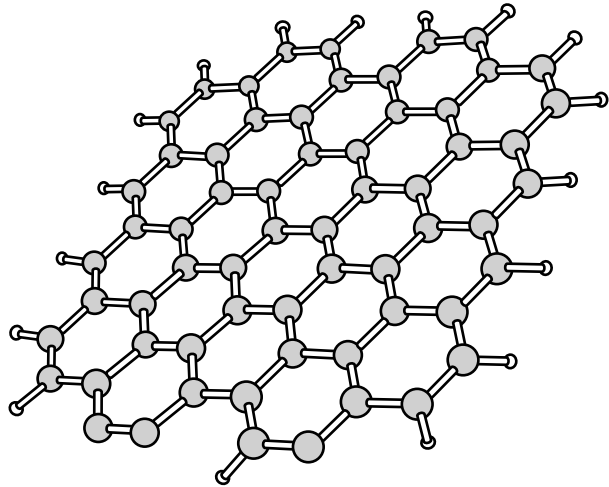
Spider silk would be a good material to use to make these jackets.

Use information in Table 1 to explain why.

[2]

(ii) In 2004 a new material called graphene was made.

It is made from graphite.



Graphene is a single sheet of carbon atoms that is one atom thick.

Although it is very thin, it has an impact strength of 5000 MPa.

Use a calculation to compare the impact strength of graphene with steel.

[2]

(b) Computer touch screens are usually made from a metal called indium.

Scientists think that graphene made from graphite could be used instead.

(i) Table 2 contains some information about indium and graphite.

TABLE 2

| | World reserves in tonnes | World use in tonnes per year |
|-----------------|-------------------------------------|---|
| indium | 5 760 | 640 |
| graphite | 71 000 000 | 1 100 000 |

If INDIUM is used at the present rate it will run out.

Use the data to work out how long it will last before it runs out.

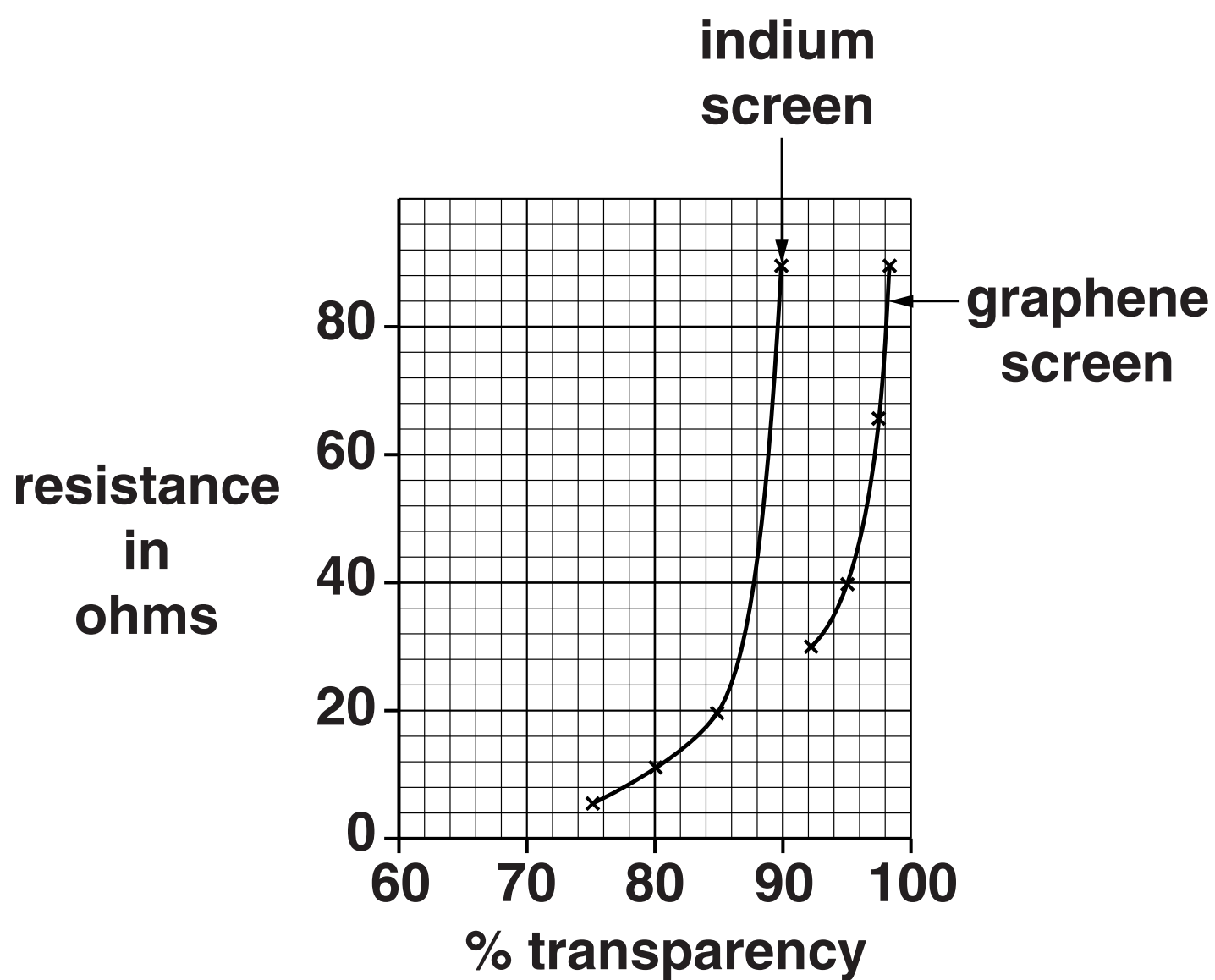
answer _____ years

[1]

- (ii) Computer touch screens need to be transparent and have a low electrical resistance.

Look at the graph.

It shows the range of transparency and resistance for screens made using graphene and screens made using indium.



A screen has a resistance of 40 ohms.

If it was made with indium it would be 88% transparent.

How transparent would it be if it was made with graphene?

answer = _____ % [1]

(iii) Scientists think the discovery of graphene is important.

Suggest reasons why this is.

Use information from Question 14 in your answer.

[4]

END OF QUESTION PAPER

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