Rewarding Learning

General Certificate of Secondary Education

Centre Number

Candidate Number

Single Award Science: Physics

Unit 3

Higher Tier

[GSA32]

GSA32

Assessment

TIME

1 hour.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **2(a)**.

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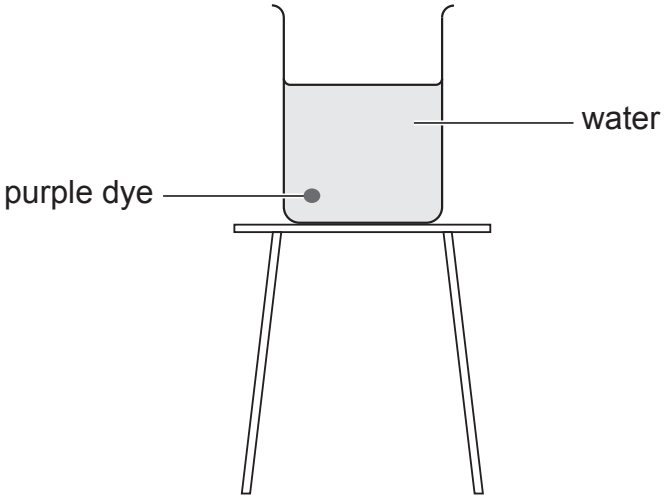
24GSA3201

1 The diagram below shows some of the apparatus which can be used to show how heat moves through a liquid.



Source: Principal Examiner

(a) Describe fully how a teacher would use this apparatus to show convection currents in water.

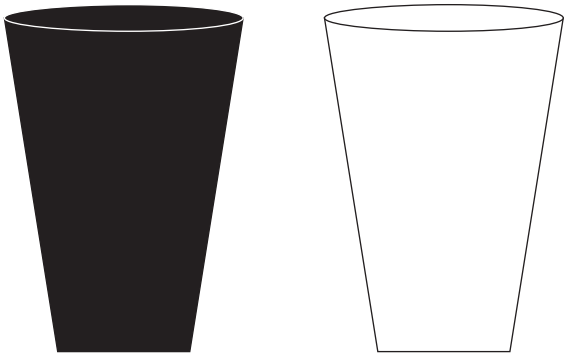
_____

_____

_____ [2]

(b) An investigation was carried out with two cups made from the same material but different colours.

Each cup was filled with an equal volume of boiling water and left for 5 minutes.



black
(dark matt)

white
(light shiny)

Source: Principal Examiner

(i) Complete the following sentence.

After 5 minutes the temperature of water in the black cup

will be _____ than the temperature of the water in the

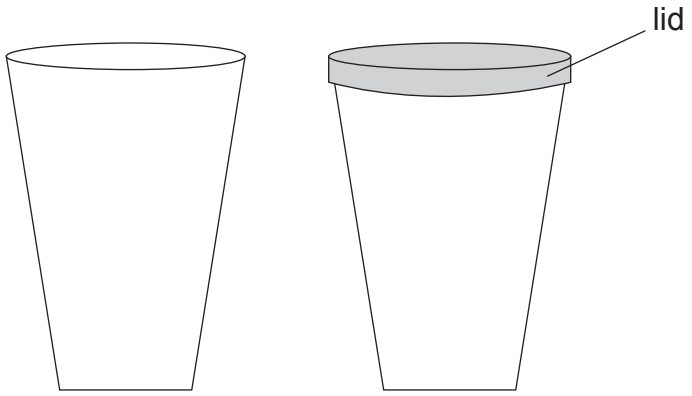
white cup. [1]

(ii) Give **one** thing that was done to make this a fair test.

_____ [1]

Another investigation used two white cups made from the same material but one had a lid.

Equal volumes of boiling water were put in each cup.



A
white

B
white with lid

Source: Principal Examiner

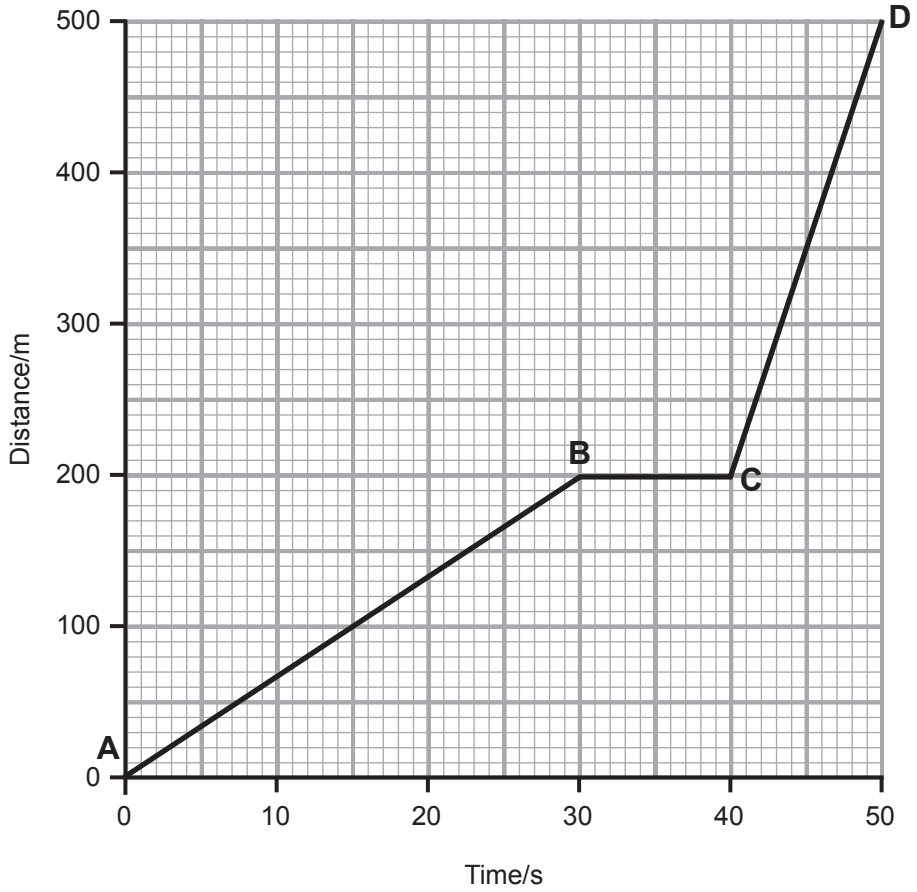
(c) Complete the following sentence.

After 5 minutes the temperature of water in cup **A** will be

_____ than the temperature of the water in cup **B**. [1]

[Turn over

2 Shown below is the distance-time graph for a motorbike travelling along a flat road.



(a) Describe the journey of the motorbike.

Your answer should include:

- a full description of each section, **A**–**B**, **B**–**C** and **C**–**D** including values from the graph; and
- a comparison of section **A**–**B** with section **C**–**D**.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

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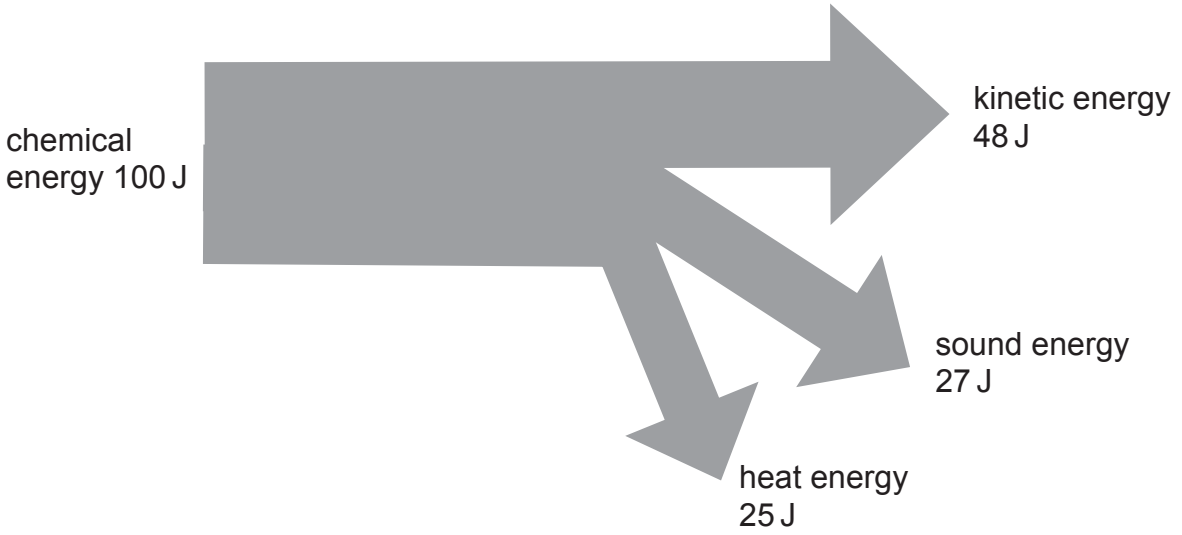
[6]

(b) The diagram below shows how 100 J of chemical energy is used by a motorbike.



Source: Principal Examiner

(i) Use the equation:

$$\textbf{efficiency} = \frac{\textbf{useful energy out}}{\textbf{total energy in}}$$

to calculate the efficiency of the motorbike.

(Show your working out.)

_____ [2]

(ii) State the Principle of Conservation of Energy.

_____

_____

_____ [2]

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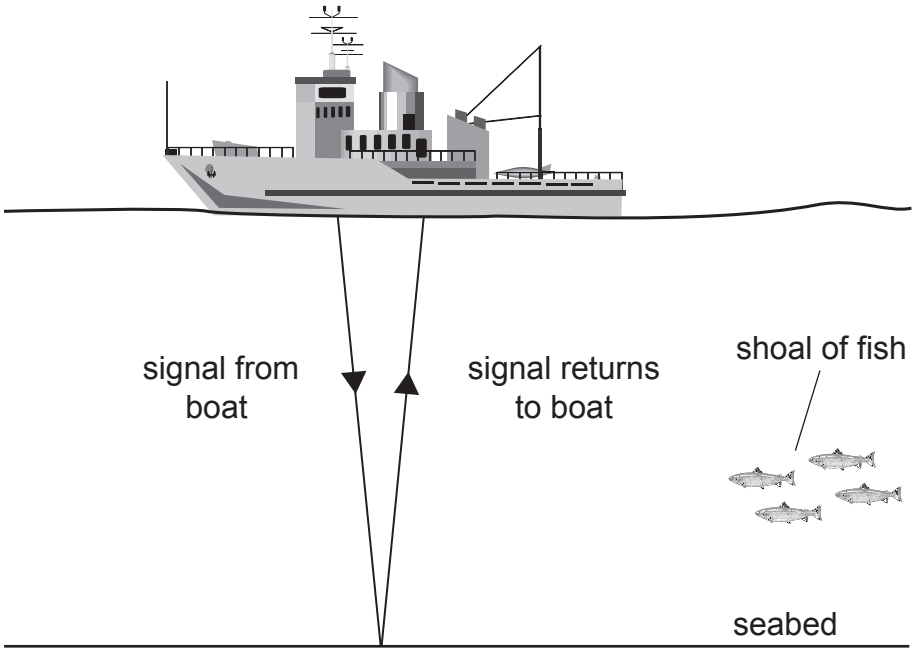
(Questions continue overleaf)

3 **(a)** The diagram below shows a fishing boat using ultrasound to find fish.



Source: Principal Examiner

(i) What is meant by the term **ultrasound**?

_____

_____ [2]

(ii) How will the fishermen know when the shoal of fish is under the boat?

_____

_____ [1]

The table below shows the speed of sound in different materials at different temperatures.

Material	Temperature/ °C	Speed of Sound/ m/s
air	0	331
	20	343
water	0	1410
	20	1480
steel	0	5200
	20	5960

(b) Give **two** conclusions that can be made from this information.

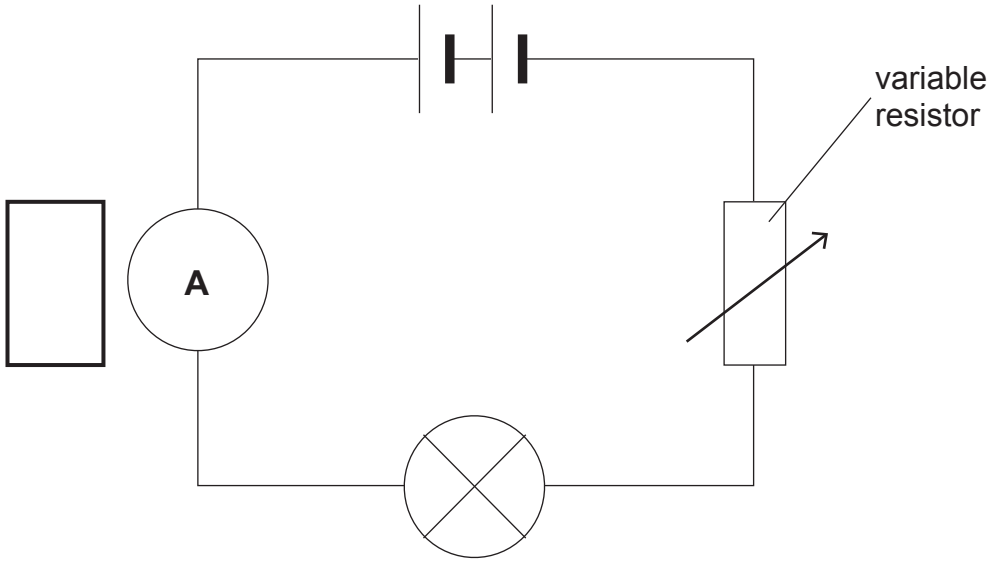
1 _____

_____

2 _____

_____ [2]

4 **(a)** The diagram below shows a simple electrical circuit.



Source: Principal Examiner

(i) Draw an arrow in the box above to show the direction of **conventional** current through the ammeter. [1]

(ii) Name the particles that move around a circuit when an electric current flows.

_____ [1]

(iii) Complete the following sentence about the circuit.

When the variable resistor is used to increase the resistance in the circuit,

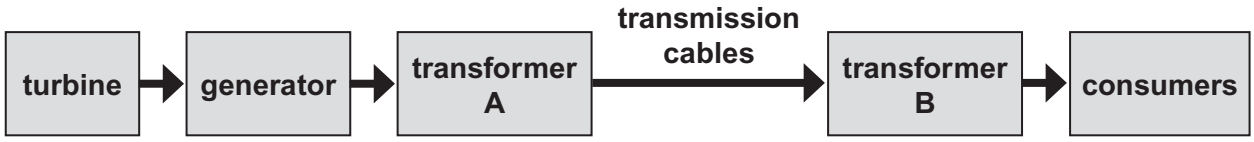
the reading on the ammeter will _____ and the brightness of

the bulb will _____ . [1]

(b) Apart from a dimmer switch, give **one** other use for a variable resistor in the home.

_____ [1]

(c) The diagram below represents the main stages involved in the generation and distribution of electricity.



Source: Principal Examiner

(i) Explain fully how a generator produces electricity.

_____

_____

_____ [2]

(ii) Explain fully how transformer **A** increases the efficiency of transmission of electricity through the cables.

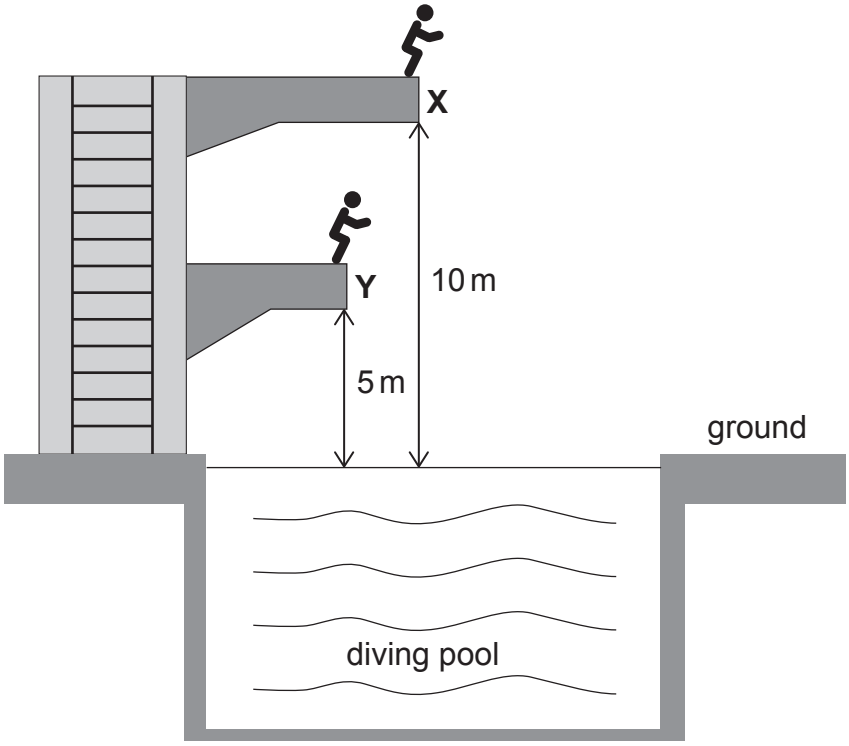
_____

_____

_____ [2]

[Turn over

5 The diagram below shows two platform positions (**X** and **Y**) used by a diver.



Source: Principal Examiner

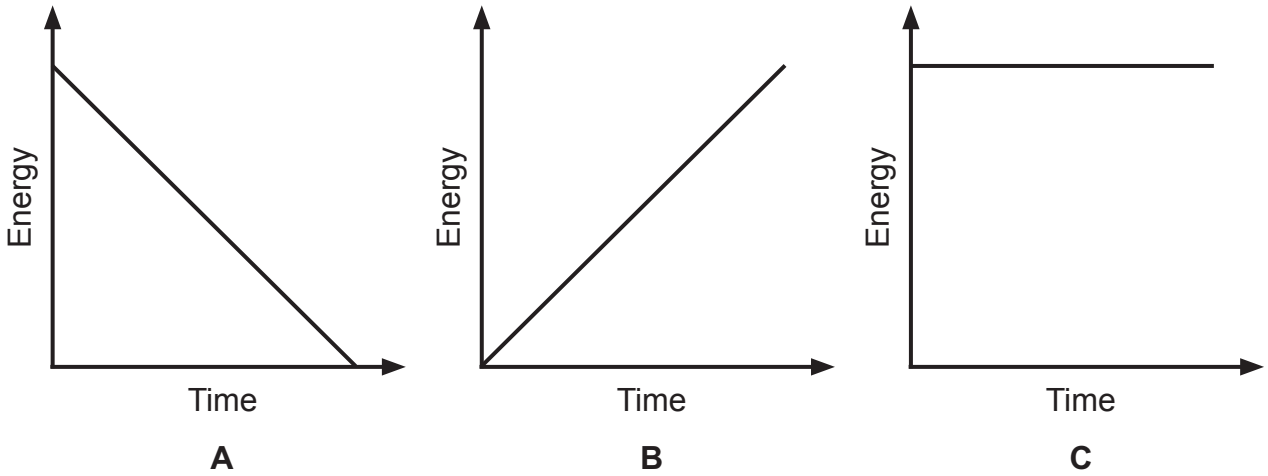
(a) Which platform (**X** or **Y**) gives the diver the greatest potential energy? Explain your answer.

Platform _____

_____ [1]

When a diver falls from platform **X** his potential energy is converted to kinetic energy.

(b) Which graph below (**A**, **B** or **C**) shows his **kinetic** energy as he falls from the platform to the pool?



Source: Principal Examiner

_____ [1]

(c) A diver with a mass (m) of 60 kg has 3000 J of kinetic energy (E_k) when he enters the water.

Use the equation:

$$v^2 = \frac{2E_k}{m}$$

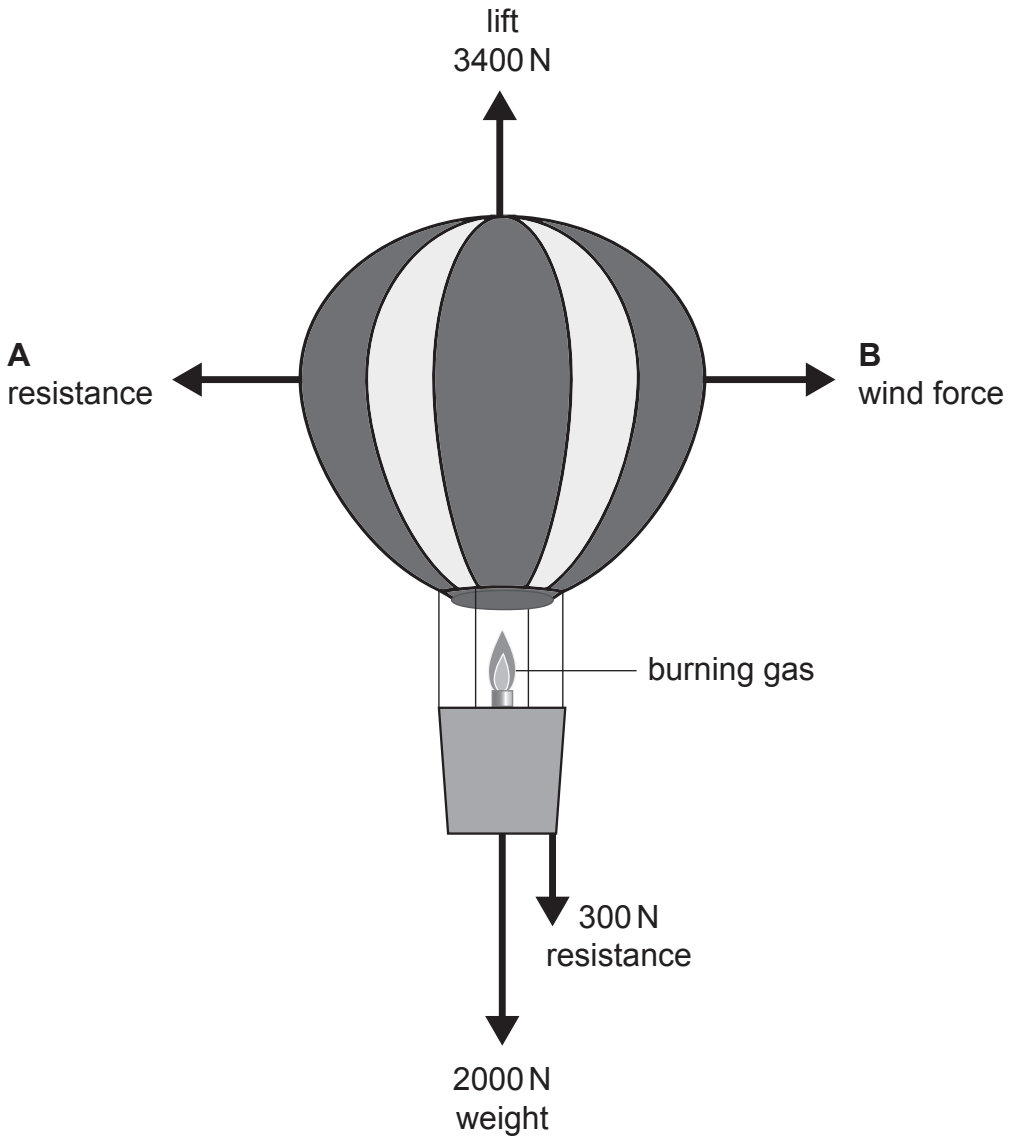
to calculate the velocity (v) of the diver when entering the water.

(Show your working out.)

_____ m/s [2]

[Turn over

6 The diagram below shows the forces acting on a hot air balloon.



Source: Principal Examiner

(a) There is **no** resultant force on the balloon in the horizontal direction.

Use this information to complete the following sentence.

The size of force **A** _____ the size of force **B**. [1]

(b) There is a resultant force on the balloon in the vertical direction.

(i) Calculate the size of the resultant force in the vertical direction.

_____ N [1]

(ii) Describe fully the movement of the balloon caused by this resultant force.

_____

_____ [2]

(c) The gas that is burned in the hot air balloon is a non-renewable fossil fuel.

(i) What is meant by the term **non-renewable**?

_____

_____ [1]

(ii) Name **one** non-renewable source of energy that is **not** a fossil fuel.

_____ [1]

7 **(a)** Describe fully the formation of a star.

_____

_____

_____

_____

_____ [3]

(b) The Universe is made up of many galaxies.

(i) What is a **galaxy**?

_____ [1]

(ii) What is the name of our galaxy?

_____ [1]

(c) The diagram below shows part of the spectrum of light from the Sun containing a pattern of dark lines.

When astronomers look at the spectra from other galaxies they also contain this pattern of dark lines but they show red shift.

Source: Principal Examiner

(i) Give **two** conclusions that the astronomers can make from these spectra.

1. _____

_____

2. _____

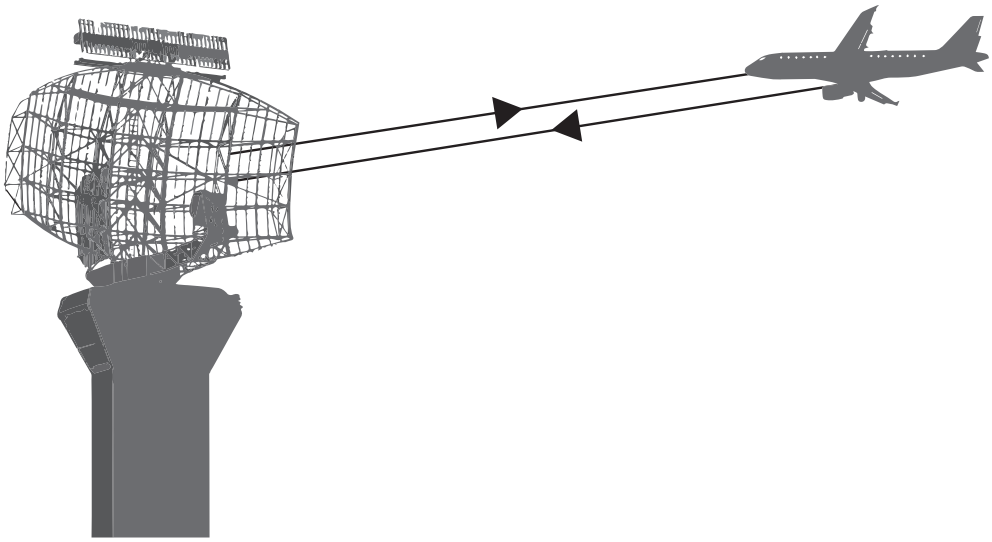
_____ [2]

(ii) Red shift evidence supports the theory that the Universe began 14 billion years ago. Name this theory.

_____ [1]

[Turn over

8 **(a)** Airports use radar to keep track of where an aircraft is in the sky.
The airport antenna sends a signal out and detects the returning signal that has reflected off the aircraft.



Source: Principal Examiner

It takes a time of 1×10^{-4} s for a signal to travel from the antenna to the aircraft and return again.
The signal travels at a speed of 3×10^{8} m/s.

Use the equation:

$$\textbf{speed} = \frac{\textbf{distance travelled}}{\textbf{time taken}}$$

to calculate the distance the aircraft is from the antenna.

(Show your working out.)

_____ m [3]

(b) The table below gives some information about the colours of visible light in the electromagnetic spectrum.

Colour of light	Wavelength/m × 10^{-9}	Energy/eV
red	625 – 740	1.68 – 2.00
orange	590 – 625	2.00 – 2.11
yellow	565 – 590	2.11 – 2.20
green	500 – 565	2.20 – 2.49
blue	445 – 500	2.49 – 2.80
indigo	425 – 445	2.80 – 2.92
violet	380 – 425	2.92 – 3.27

(i) State the trend shown by this information.

_____

_____ [1]

The human eye is most sensitive to light with a wavelength of 550 × 10^{-9} m.

(ii) What colour of light is the eye most sensitive to?

_____ [1]

(c) Infrared radiation is another part of the electromagnetic spectrum. It has a longer wavelength than red light.

(i) Suggest a value for the wavelength of infrared radiation.

_____ m [1]

(ii) Violet light has a shorter wavelength than red light. Name **one** region of the electromagnetic spectrum that has a shorter wavelength than violet light.

_____ [1]

[Turn over

9 **(a)** Polonium-210 is an example of a radioactive element which emits ionising radiation.

Danger Radioactive Material

Source: Principal Examiner

(i) Explain fully why an element is radioactive.

_____

_____

_____ [2]

(ii) What is meant by the term **ionisation**?

_____

_____ [1]

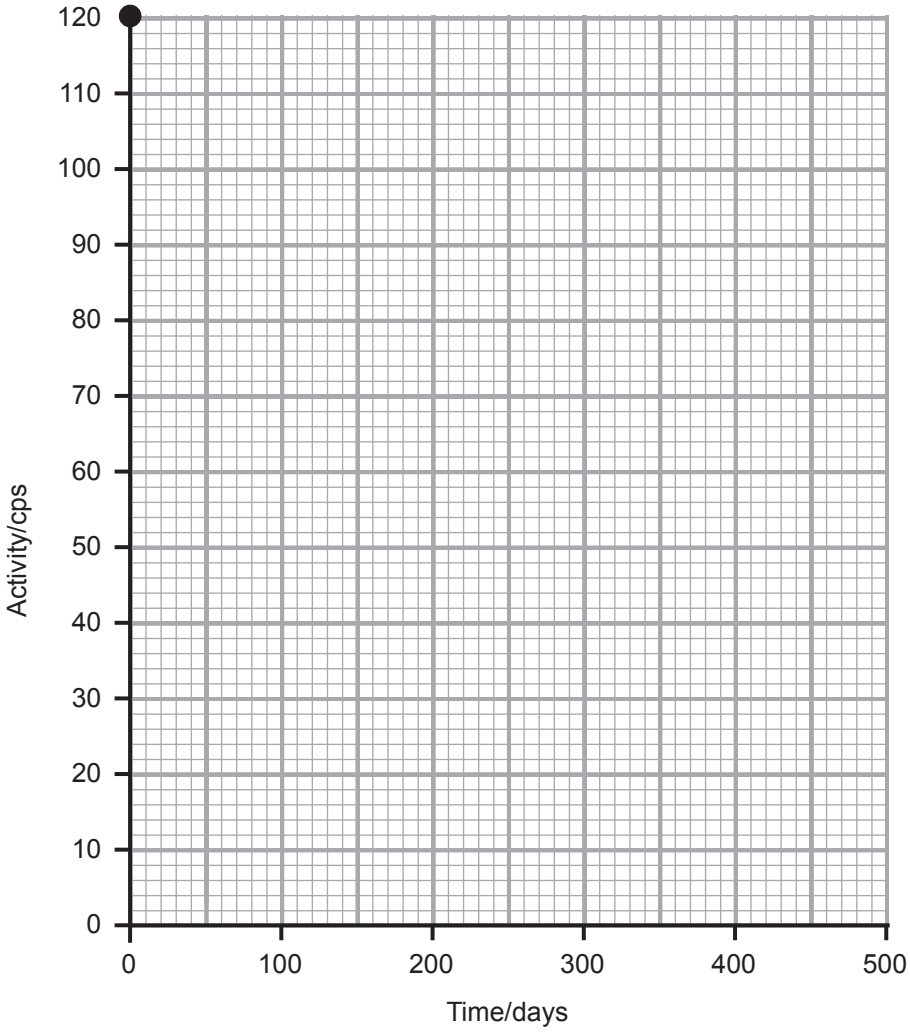
(b) Polonium-210 has a half-life of 140 days.

(i) Use this information to calculate the activity at 140, 280 and 420 days for a sample that has an initial activity of 120 cps.

Time/days	0	140	280	420
Activity/cps	120			

[1]

(ii) Use your answers from (i) to draw a line graph on the grid below.
The first point is plotted for you.



[2]

Polonium-210 emits alpha radiation.

(c) Complete the following sentence.

Alpha radiation travels a distance of a few _____ in air. [1]

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For Examiner's use only	
Question Number	Marks
1	
2	
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Total Marks	

Examiner Number

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