



Rewarding Learning

General Certificate of Secondary Education

Centre Number

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Candidate Number

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# 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.

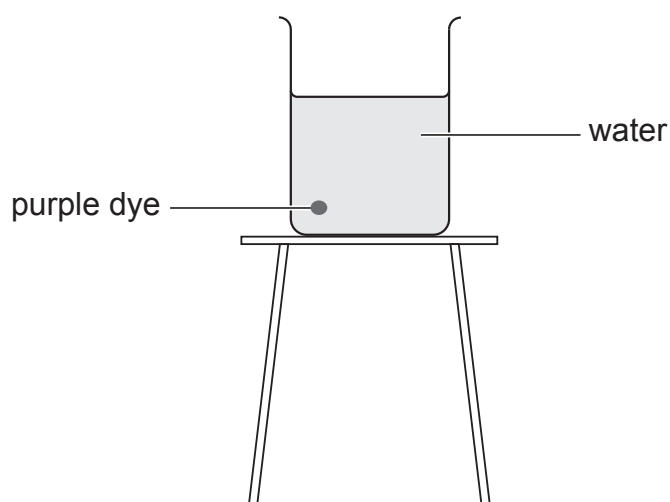
Quality of written communication will be assessed in Question **2(a)**.

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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.

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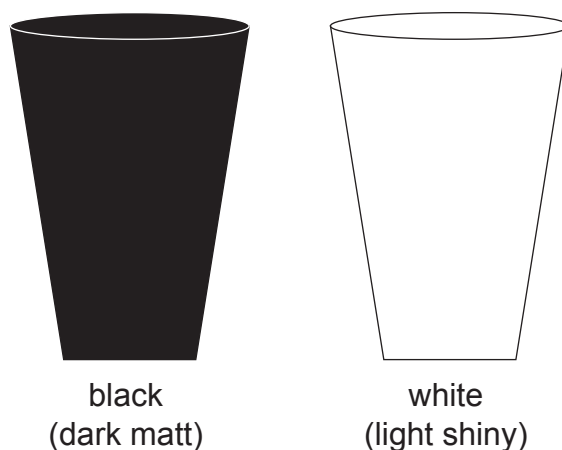
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[2]

- (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.



Source: Principal Examiner



- (i) Complete the following sentence.

After 5 minutes the temperature of water in the black cup

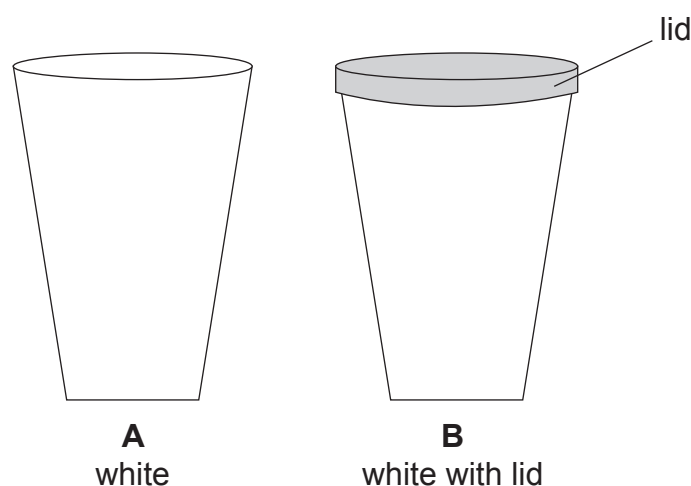
will be \_\_\_\_\_ than the temperature of the water in the white cup. [1]

- (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.



Source: Principal Examiner

- (c) Complete the following sentence.

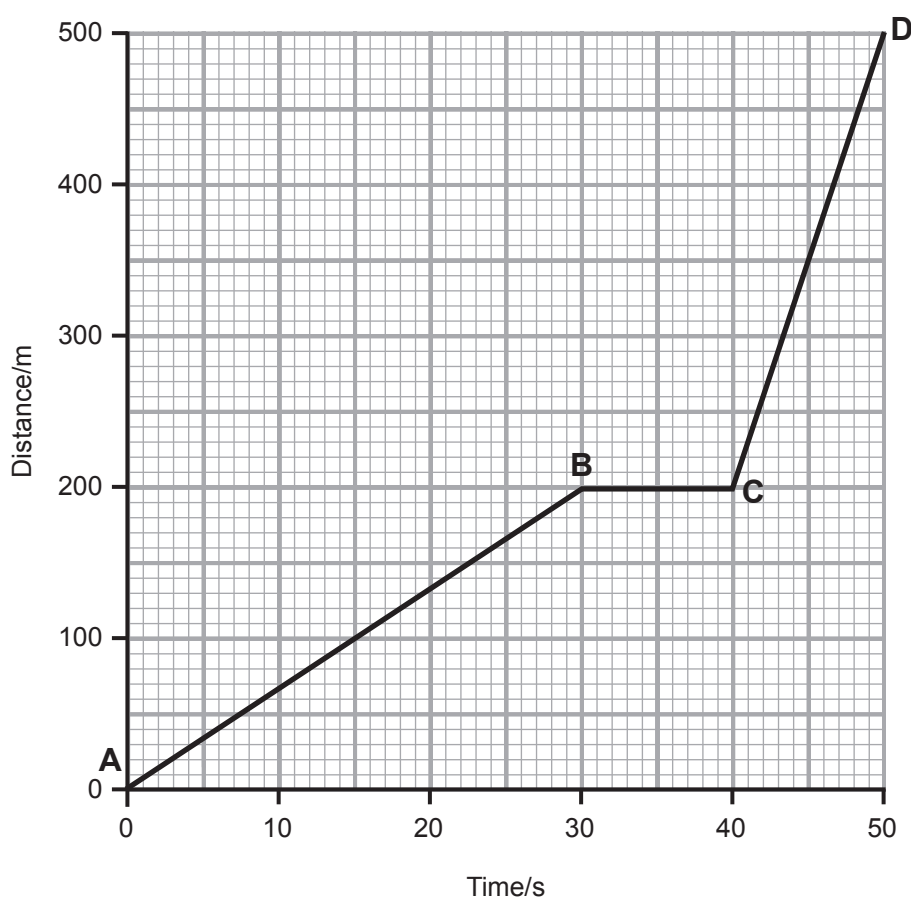
After 5 minutes the temperature of water in cup **A** will be

\_\_\_\_\_ 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]

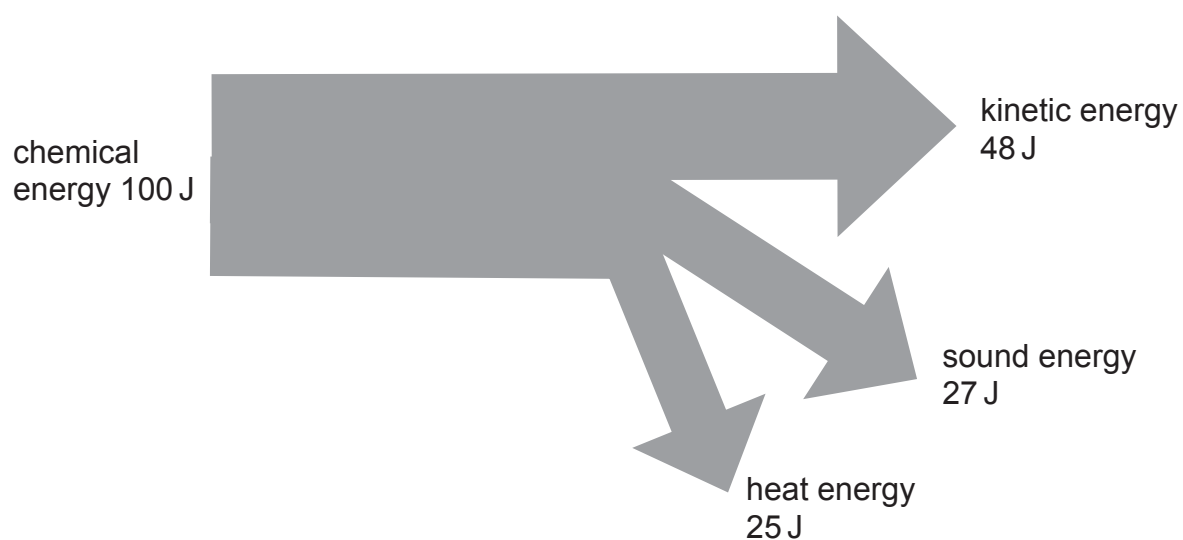
[Turn over

12797



\*24GSA3205\*

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



Source: Principal Examiner

(i) Use the equation:

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

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)**

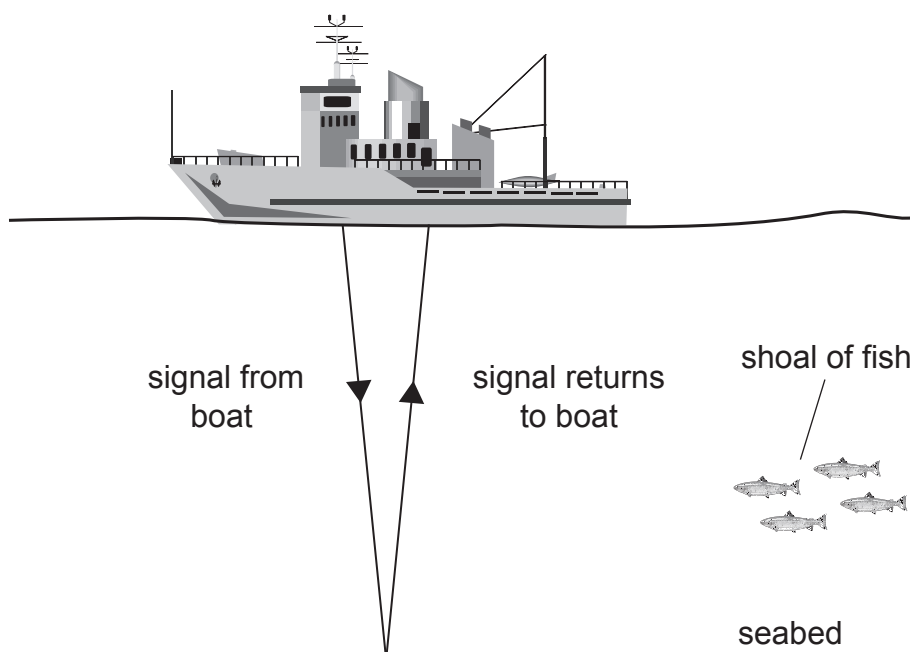
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**[Turn over**



**\*24GSA3207\***

- 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**?

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[2]

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

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[1]





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

| Material | Temperature/<br>°C | Speed of Sound/<br>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 \_\_\_\_\_

\_\_\_\_\_

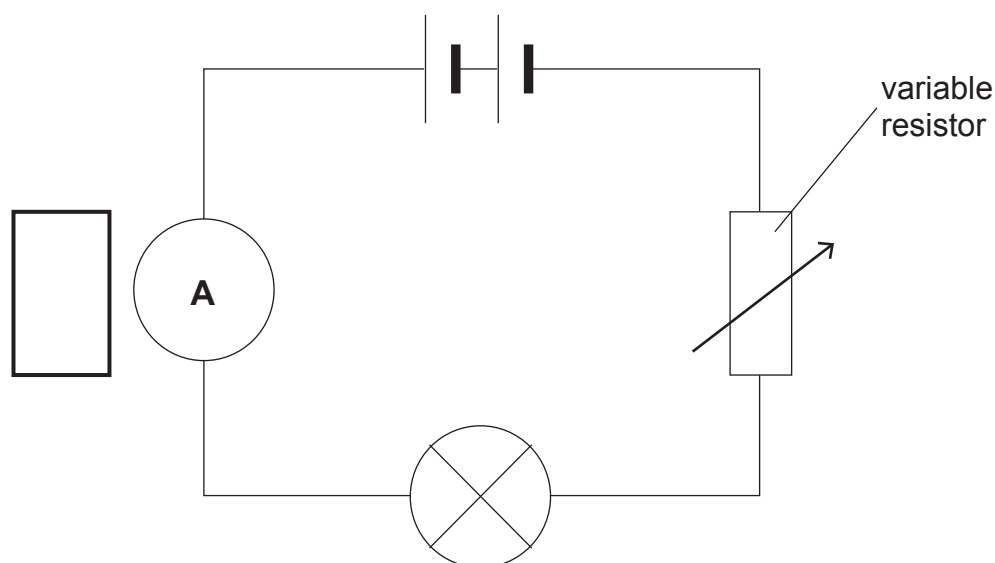
2 \_\_\_\_\_

\_\_\_\_\_ [2]

[Turn over



- 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.

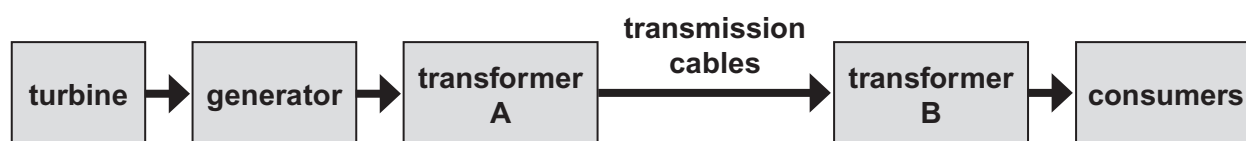
When the variable resistor is used to increase the resistance in the circuit, the reading on the ammeter will \_\_\_\_\_ and the brightness of the bulb will \_\_\_\_\_ . [1]

- (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.

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[2]

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

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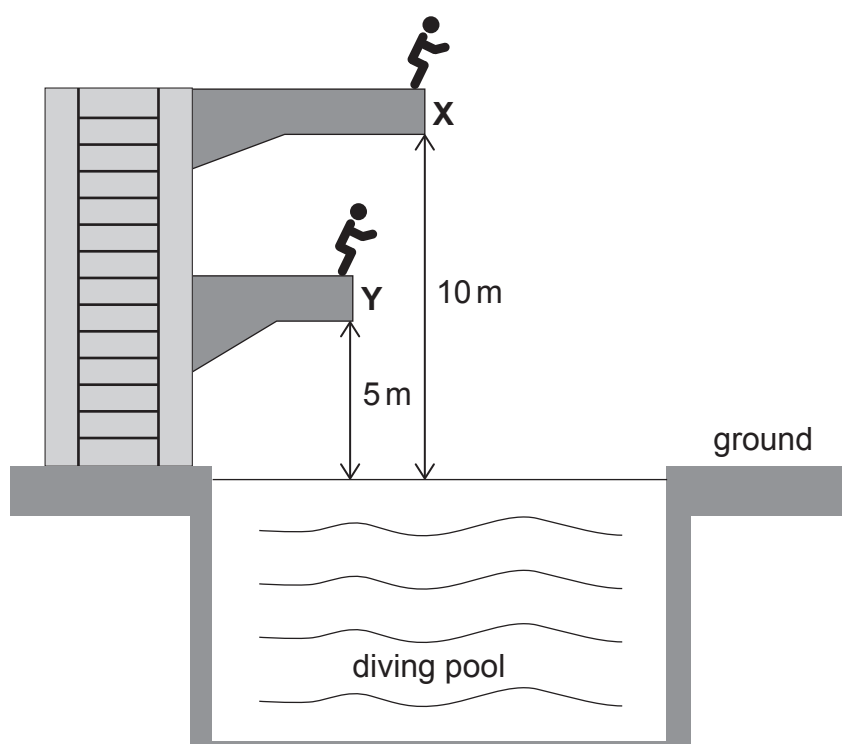
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[2]



- 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.

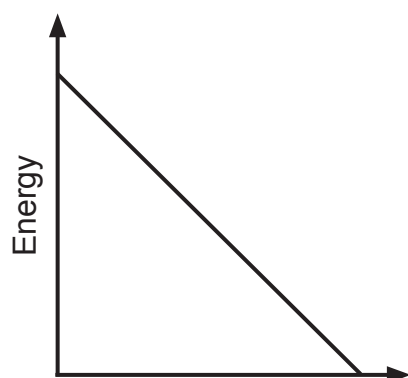
Platform \_\_\_\_\_

[1]



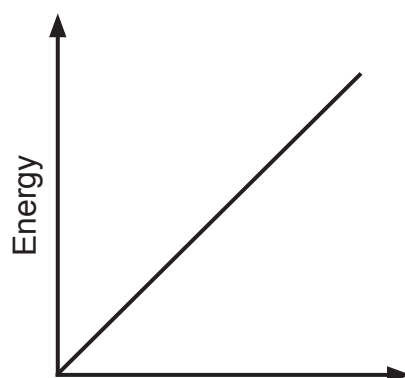
When a diver falls from platform **X** his potential energy is converted to kinetic energy.

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



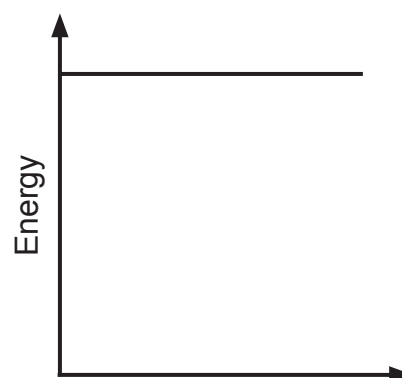
Time

**A**



Time

**B**



Time

**C**

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:

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

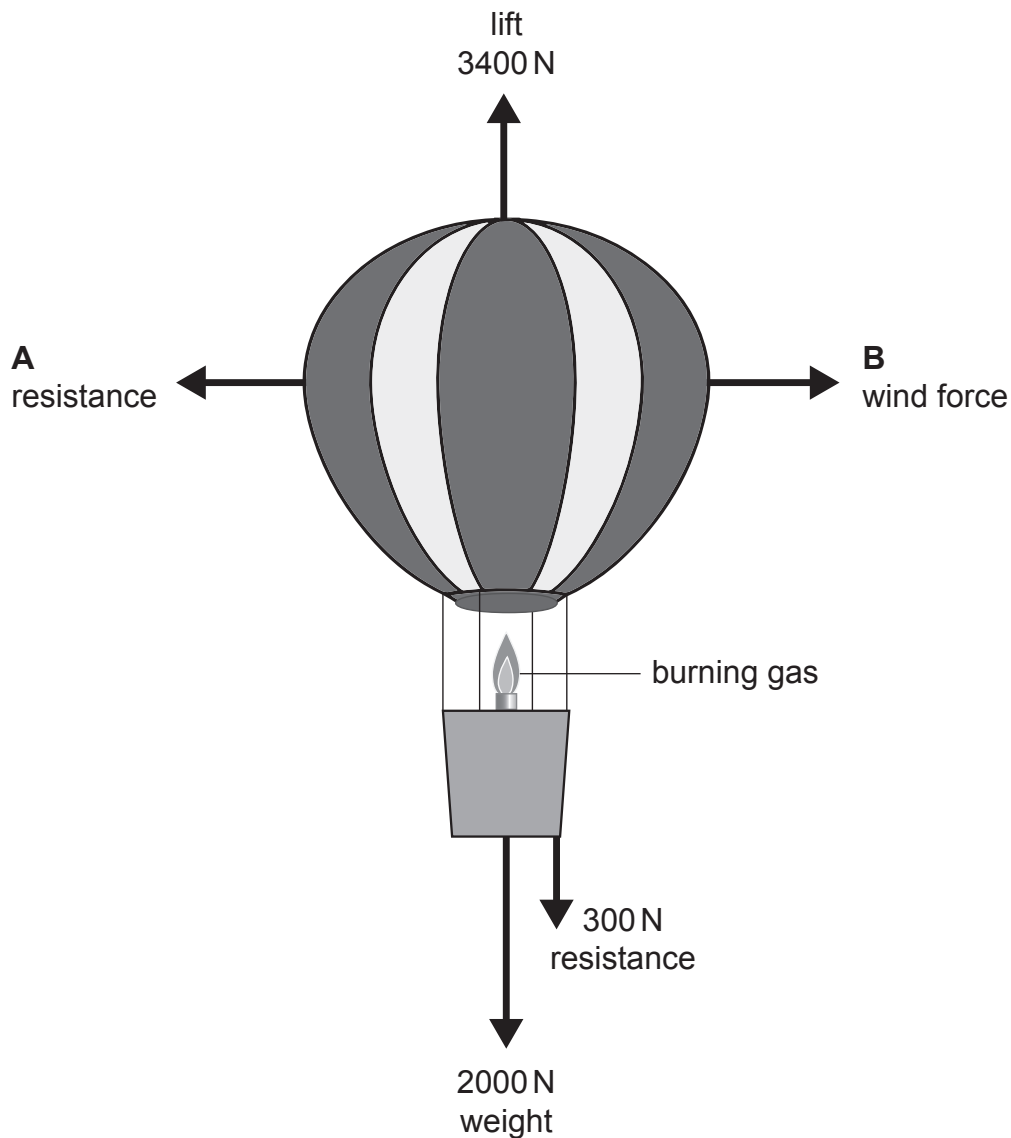
to calculate the velocity ( $v$ ) of the diver when entering the water.

(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]

[Turn over



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

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[3]

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

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

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[1]

(ii) What is the name of our galaxy?

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[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]

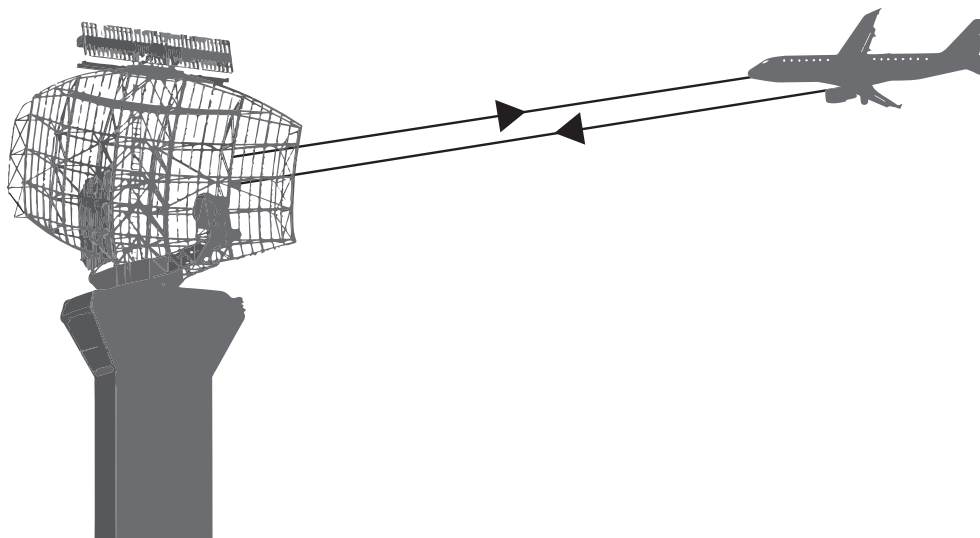
- (ii) Red shift evidence supports the theory that the Universe began 14 billion years ago. Name this theory.

\_\_\_\_\_ [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  $1 \times 10^{-4}$  s for a signal to travel from the antenna to the aircraft and return again.  
The signal travels at a speed of  $3 \times 10^8$  m/s.

Use the equation:

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

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 $\times 10^{-9}$ | 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  $550 \times 10^{-9}$  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.



Source: Principal Examiner

- (i) Explain fully why an element is radioactive.

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[2]

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

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[1]



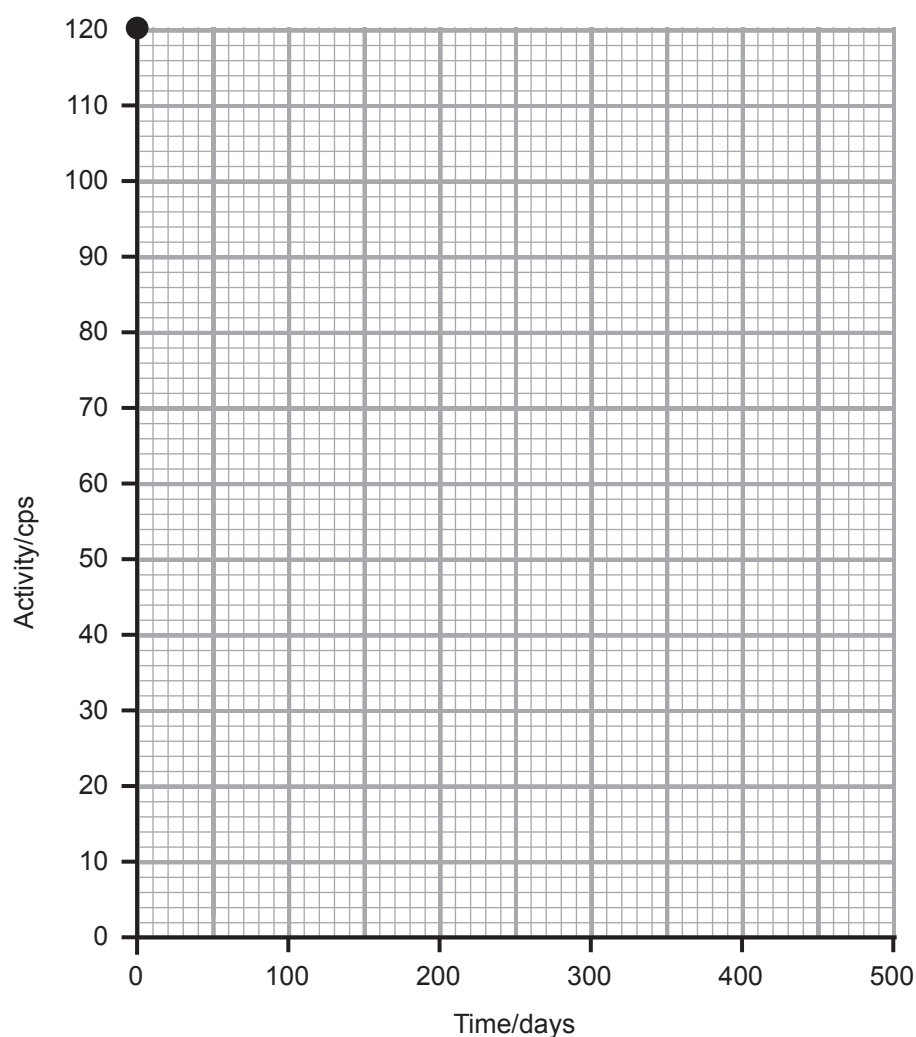
(b) Polonium-210 has a half-life of 140 days.

- (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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| Question Number         | Marks |
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| 2                       |       |
| 3                       |       |
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Examiner Number

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