Centre Number

Candidate Number

![cea Rewarding Learning logo]

**General Certificate of Secondary Education
2014–2015**

Science: Single Award

Unit 3 (Physics)

Higher Tier

GSS32

[GSS32]

THURSDAY 26 FEBRUARY 2015, MORNING

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
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 Questions **3(a)** and **9(a)**.

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

9734.04**R**

1 **(a)** The graph below shows how the activity of a radioactive isotope changes with time.
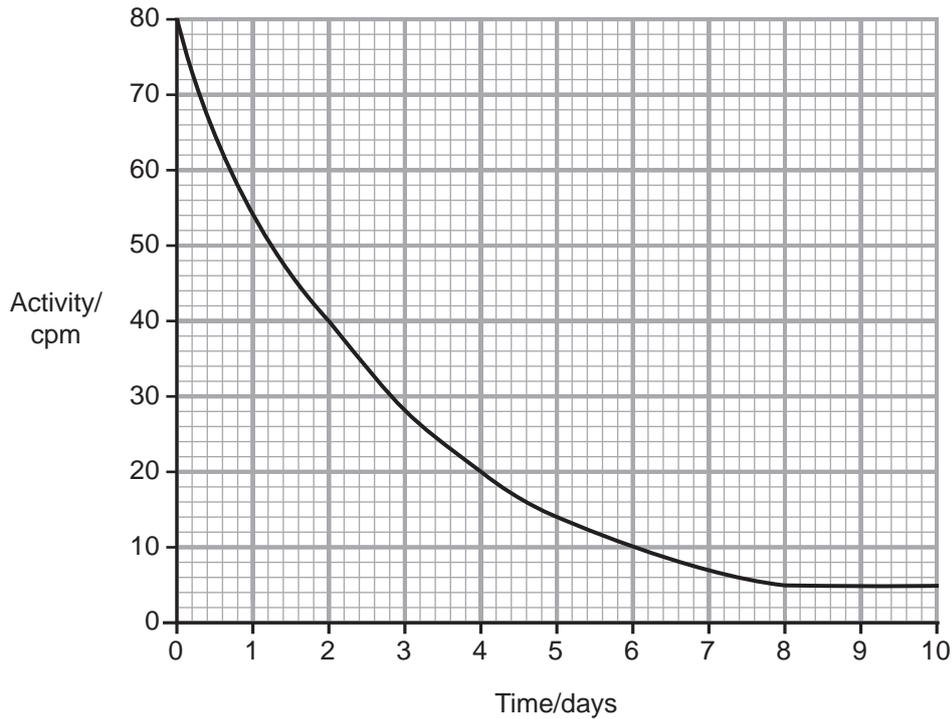
(i) What is the activity at 5 days?

Answer _____ cpm [1]

(ii) What is the half-life of this isotope?

Answer _____ days [1]

(iii) Use the graph to find the value of background radiation.

Answer _____ cpm [1]

(b) Explain fully why some atoms are described as radioactive.

_____

_____

_____ [2]

(c) The table below gives information about some radioactive materials.
Each of these materials costs the same amount of money.

Material	Half-life	Radiation emitted
A	6 hours	gamma
B	432 years	alpha
C	28 years	beta
D	11 years	gamma
E	138 days	alpha

Radiotherapy machines use radiation to destroy tumours deep inside the body.
Hospitals need radiotherapy machines to be cost effective and give value for money.

(i) Which material (**A**, **B**, **C**, **D** or **E**) would be best suited for radiotherapy? Explain fully your choice.

_____

_____

_____

_____ [3]

(ii) Apart from radiotherapy, give **one** other use for ionising radiation.

_____ [1]
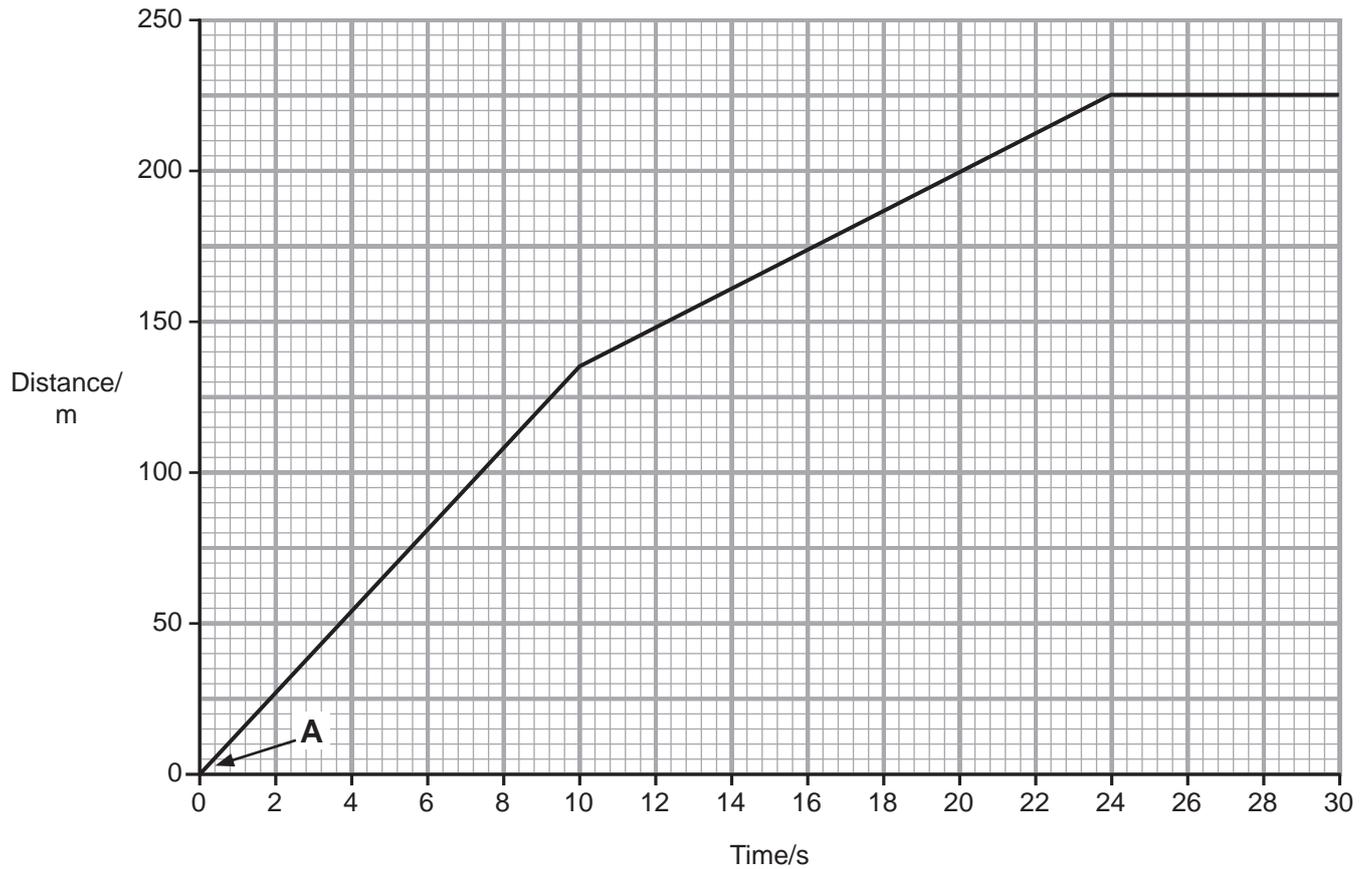
2 **(a)** Shown below is a distance-time graph for a car moving on a straight, level road.

The driver sees traffic lights changing to red at point **A** (0,0) but drives another 135 m before braking.

(i) At what time does the driver start to brake?

Answer _____ s [1]

(ii) At what time does the car stop?

Answer _____ s [1]

(iii) Calculate the braking distance of the car.

(Show your working out.)

Answer _____ m [2]

(b) This braking distance was for a car on a dry road.

Explain fully, in terms of forces, the effect a **wet** road will have on braking distance.

_____

_____

_____ [2]

9734.04**R**   **5**   **[Turn over**

3 **(a)** Describe fully how mobile phones work and the risks of using them.

Your answer should include:

- the type of electromagnetic wave used
- how the signal is transmitted across the country
- the possible health risks of mobile phone use
- how the risks can be reduced.

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

_____

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_____

_____ [6]

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(Questions continue overleaf)

(b) The diagram below shows a boat using ultrasound to measure the depth of the sea.
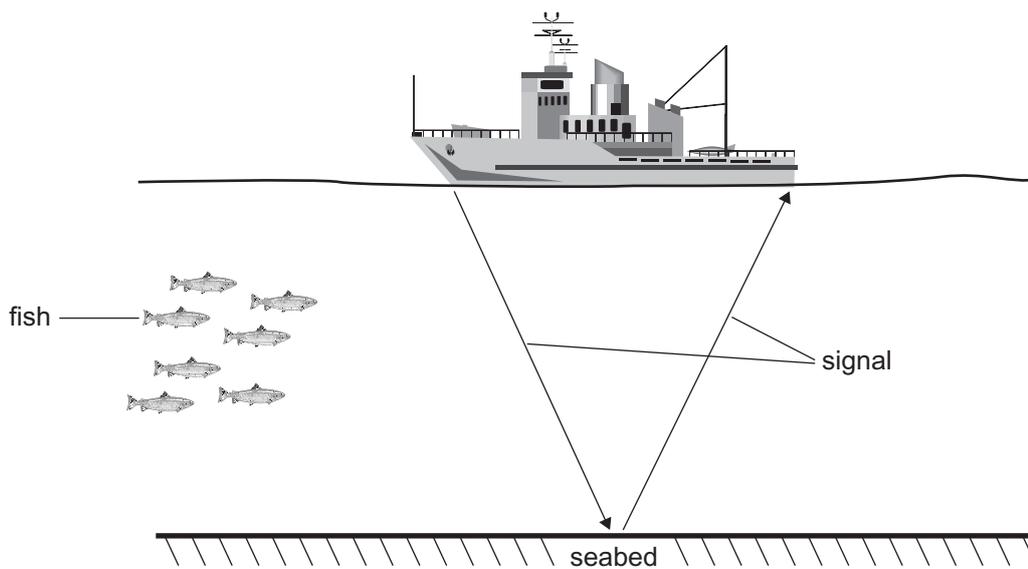
The table below shows the results from different areas.

Signal return time/s	Distance signal travels/m	Depth of sea/m
0.04	60	30
0.12	180	90
0.20	300	150
0.28	420	
0.36	540	270

(i) Complete the table by calculating the missing value for depth. [1]

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(ii) Using information from the table and the equation below:

$$\textbf{speed} = \frac{\textbf{distance signal travels}}{\textbf{signal return time}}$$

calculate the speed of sound in water.
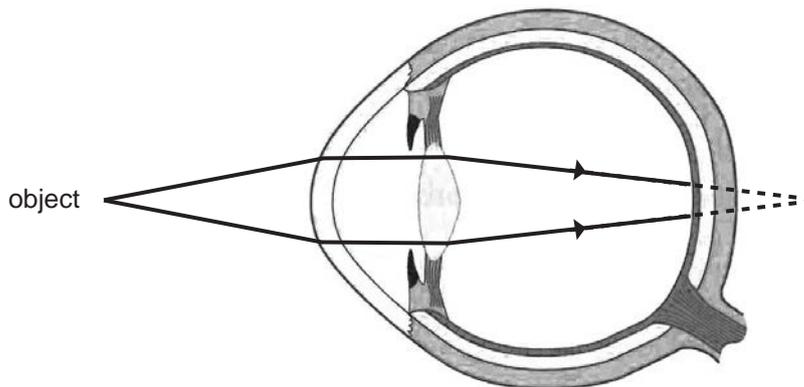
(Show your working out.)

Answer _____ m/s [2]

(iii) If the fish swim under the boat what effect, if any, will this have on the time it takes for the signal to return?

_____ [1]

[Turn over

4 **(a)** The diagram below shows a common eyesight problem which causes blurred vision.

object

© *GCSE Science Single Award for CCEA Foundation and Higher Tier by James Napier, Alyn McFarland, Roy White, Colin Murphy. Published by Hodder Education in 2013. ISBN: 9781444195729. Reproduced by permission of Hodder Education.*

(i) Name the eyesight problem represented by this diagram and explain fully what causes this problem.

_____

_____

_____

_____ [3]

(ii) Describe when this person will experience blurred vision.

_____

_____ [1]

(b) Explain the term refraction, naming and comparing the two parts of the eye involved.

_____

_____

_____

_____

_____ [3]

5 **(a)** The Big Bang theory is used to explain the formation of the Universe.

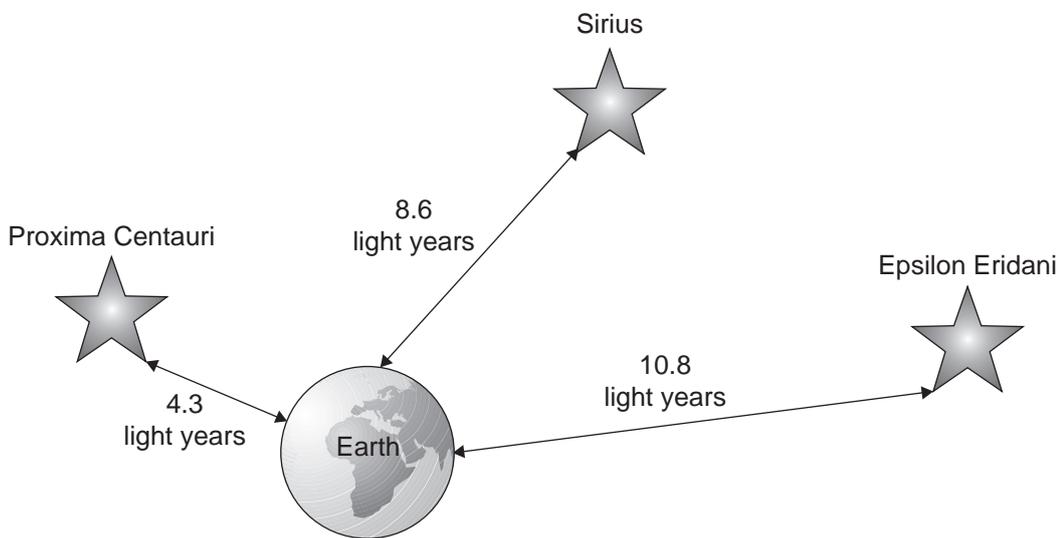 **(i)** According to the Big Bang theory how old is the Universe?

Answer _____ [1]

  (ii) One piece of evidence used to support the Big Bang theory is the movement of galaxies. Describe fully the movement of the galaxies.

_____

_____

_____ [2]

  (iii) Give **one** other piece of evidence that supports the Big Bang theory.

_____

_____ [1]

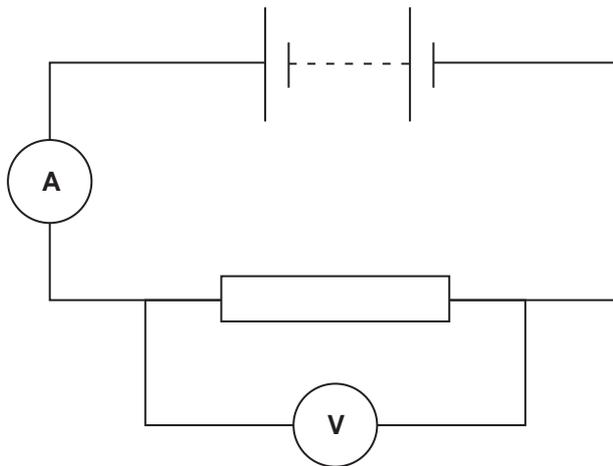**(b)** The diagram below shows the distance of three stars from Earth.

Define the term 'light year' and explain why a person observing these stars is 'looking back in time'.

_____

_____

_____

_____ [2]

6 **(a)** The circuit below was used to investigate the relationship between the resistance of a wire and its cross-sectional area.

The results are shown below.

Cross-sectional area/mm²	Voltage/V	Current/A	Resistance
10	6	0.4	15.0
20	6	0.7	8.6
30	6	1.0	6.0
40	6	1.3	4.6
50	6	1.6	

(i) Name the unit of resistance.

Answer _____ [1]

(ii) Use the equation:

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

to calculate the resistance of the wire with a cross-sectional area of 50 mm^2.
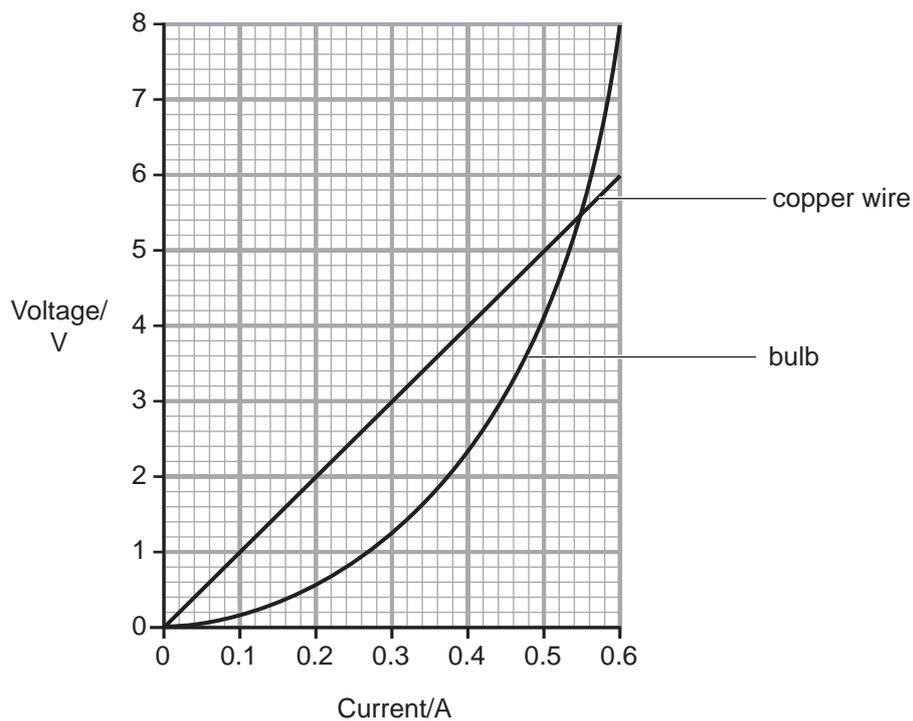
(Show your working out.)

Answer _____ [2]

(iii) Describe the conclusion that can be drawn from this investigation.

_____

_____ [1]

Examiner Only	
Marks	Remark

(b) The graph below shows the relationships between voltage and current for copper wire and a bulb.

(i) Describe **one** similarity and **one** difference between these relationships.

Similarity _____

_____

Difference _____

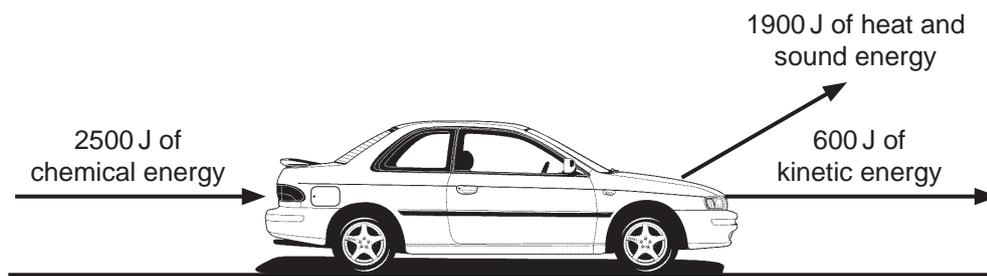_____ [2]

(ii) Use the graph and your knowledge to describe how the **resistance** of the copper wire changes as the current increases.

_____

_____ [1]

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(Questions continue overleaf)

7 **(a)** The diagram below shows the energy input and output for a car engine.

2500 J of chemical energy

1900 J of heat and sound energy

600 J of kinetic energy

(i) Use the equation:

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

to calculate the efficiency of the car's engine.

(Show your working out.)

Answer _____ [2]

(ii) Why can efficiency never be greater than 1 (100%)?

_____

_____ [1]

(iii) State the energy type that all energy eventually becomes and explain the effect this will have on the environment.

_____

_____

_____ [2]

(b) Car manufacturers are increasingly using fuel extenders and substitutes.

    (i) Name **one** extender and **one** substitute.

        extender ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

        substitute ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯ [2]

    (ii) Explain the difference between extenders and substitutes.

        ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

        ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

        ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯ [2]

    (iii) Give **one** advantage of using extenders and substitutes.

        ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯ [1]

8 The pictures below show a parachutist, of mass 80 kg, at four different points (**A**, **B**, **C** and **D**) during his descent.

The forces acting on the parachutist and speed at each point are also given.

Time →

Air resistance	200 N	400 N	600 N	800 N
	A	**B**	**C**	**D**
Weight	800 N	800 N	800 N	800 N
Speed	5 m/s	15 m/s	30 m/s	50 m/s
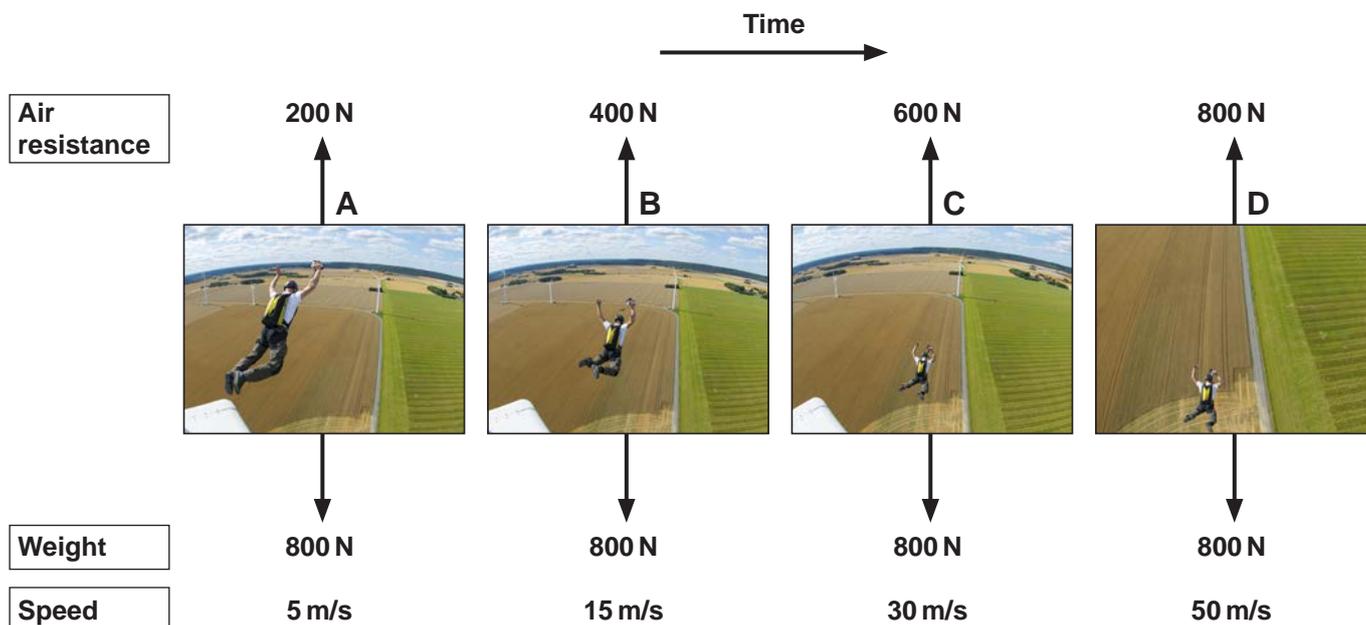
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Examiner Only	
Marks	Remark

(a) What effect, if any, does speed have on the forces acting on this parachutist?

_____

_____

_____

_____ [2]

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18

(b) (i) Explain fully, in terms of forces, the acceleration (if any) of the parachutist at point **B**.

_____

_____

_____

_____ [3]

(ii) Explain fully, in terms of forces, the movement of the parachutist at point **D**.

_____

_____

_____ [2]

(c) (i) The parachutist hits the ground with a momentum of 120 kg m/s.

Use the equation:

momentum = mass × velocity
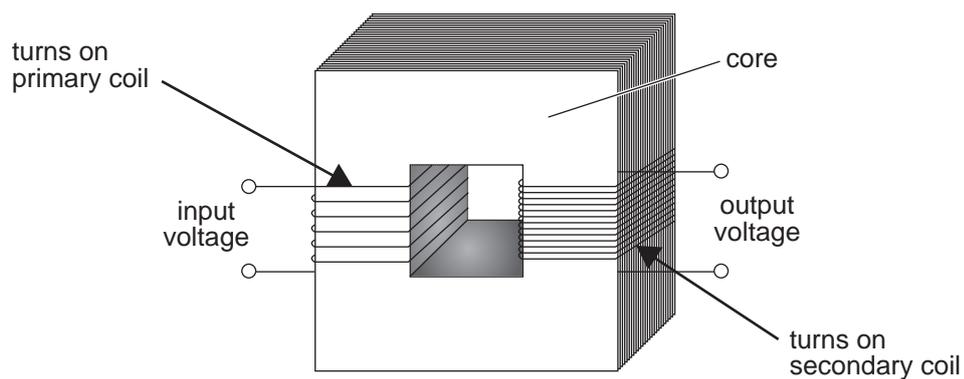
to calculate his velocity as he lands.

(Show your working out.)

Answer _____ m/s [2]

(ii) What is the momentum of the parachutist sitting on the ground after landing? Explain your answer.

_____

_____

_____ [2]

[Turn over

9 **(a)** The diagram below shows how electricity made in a power station generator is distributed across the grid.

generator   transformer   grid

Describe fully how electricity is made in a generator and then distributed across the grid. Your answer should include the energy and electrical changes with reasons (where appropriate).

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

(b) The diagram below shows how an electrical transformer works.

The table below gives information about five transformers.

Transformer type	Primary turns	Secondary turns
step-up	40	400
step-down	500	50
step-down	500	400
step-up	60	600
step-down	400	100

Use the information provided to answer the following questions.

(i) Describe fully how a step-down transformer differs from a step-up transformer.

_____

_____ [1]

(ii) State which type of transformer is shown in the diagram above. Explain your answer.

_____

_____ [1]

(c) Electricity companies charge customers 21 pence per unit for electricity used. Name the unit of electrical consumption.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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