



General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

MONDAY 19 MAY 2014, AFTERNOON

Centre Number

71

Candidate Number

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.

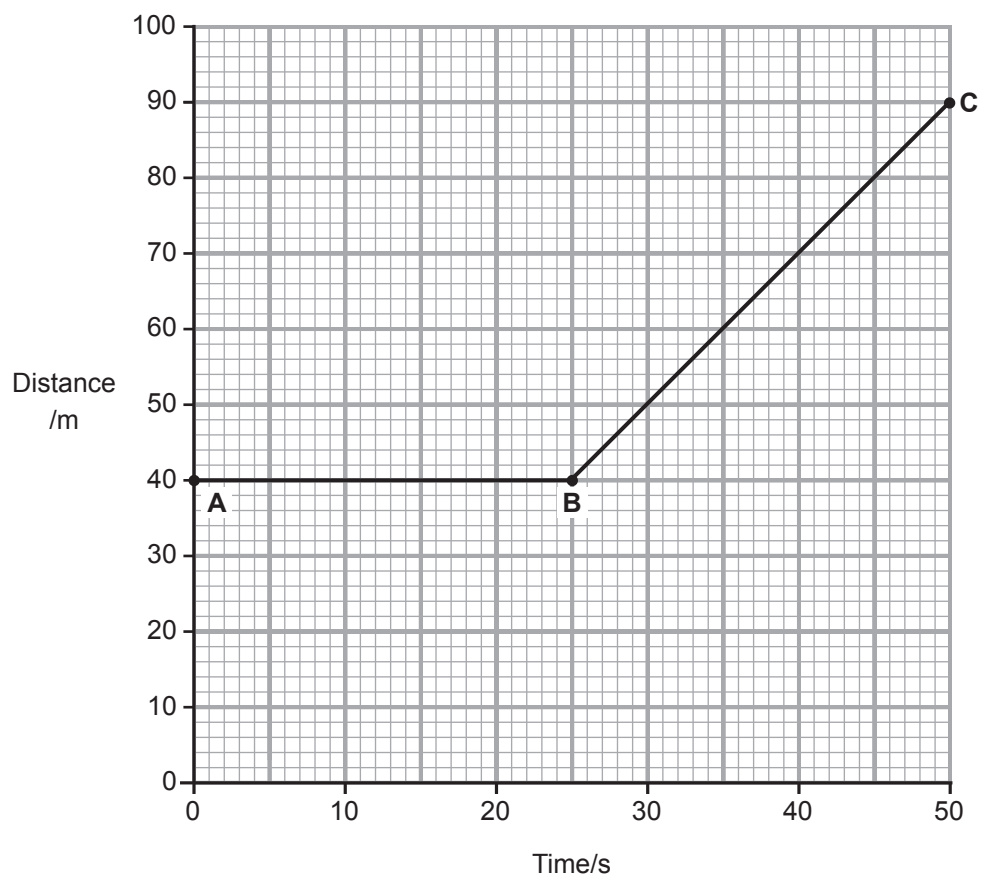
Quality of written communication will be assessed in Questions **4(b)** and **9(b)**.

For Examiner's use only

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

Total Marks

1 (a) The distance–time graph for part of a train journey is shown below.



(i) Describe the motion of the train from:

A to B _____

B to C _____ [2]

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Marks	Remark

(ii) Use the equation:

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

to calculate the average speed of the train between **A** and **C**.

(Show your working out.)

Answer _____ m/s [2]

(b) Patrick investigated the average speeds of five racing cars (**A**, **B**, **C**, **D** and **E**) over a two lap race.

The results are shown in the table below.

Car	1st lap time/s	2nd lap time/s
A	40	55
B	50	50
C	55	55
D	55	45
E	40	75

If all the cars start at the same time, which **two** will finish together?

_____ and _____ [1]

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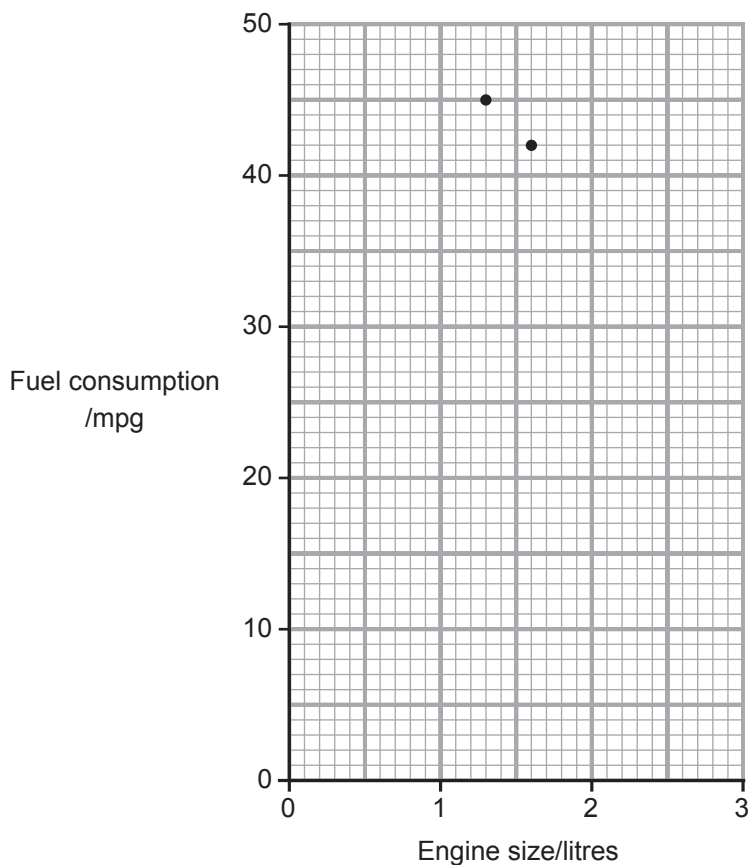
Marks Remark

2 (a) The table below gives information about five different makes of car.

Make	Engine size/ litres	Fuel consumption/ mpg
Aster	1.3	45
Lazio	1.6	42
Torino	1.8	39
Viva	2.0	37
Megro	2.5	32

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Marks	Remark

(i) Use this information to complete the graph below, including a line of best fit.



[2]

(ii) Use your graph to find the fuel consumption of a 1.0 litre engine.

Answer _____ mpg [1]

(b) Car manufacturers are trying to make cars more efficient.

(i) Suggest **one** way car manufacturers are making cars more efficient.

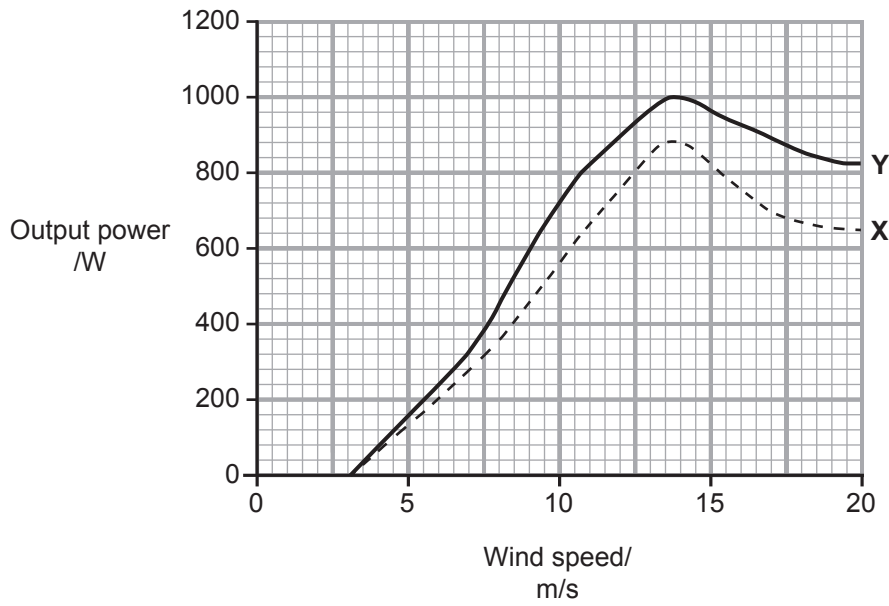
[1]

(ii) Petrol and diesel are made from oil, a finite fossil fuel. Explain the term 'finite' and why it is important to have more efficient cars.

[2]

Examiner Only	
Marks	Remark

3 (a) The graph below shows the performance of two types of wind turbine (X and Y).



(i) Calculate the difference between the maximum power produced by the two turbines.

(Show your working out.)

Answer _____ W [2]

(ii) Describe in detail how the output power of turbine X changes as the wind speed increases.

[3]

Examiner Only	
Marks	Remark

(b) (i) Wind energy is classed as renewable. What does the term 'renewable' mean?

_____ [1]

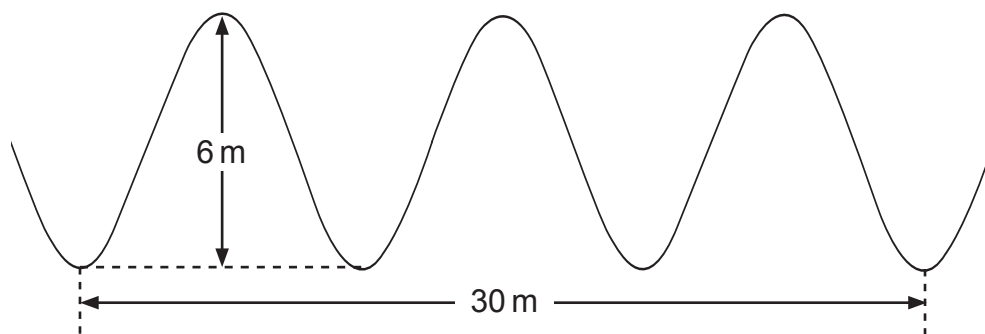
(ii) Give **one** environmental advantage and **one** disadvantage of using wind energy.

Advantage _____

Disadvantage _____
_____ [2]

Examiner Only	
Marks	Remark

4 (a) The diagram below shows some sea waves.



Use the information in the diagram to answer the following questions.

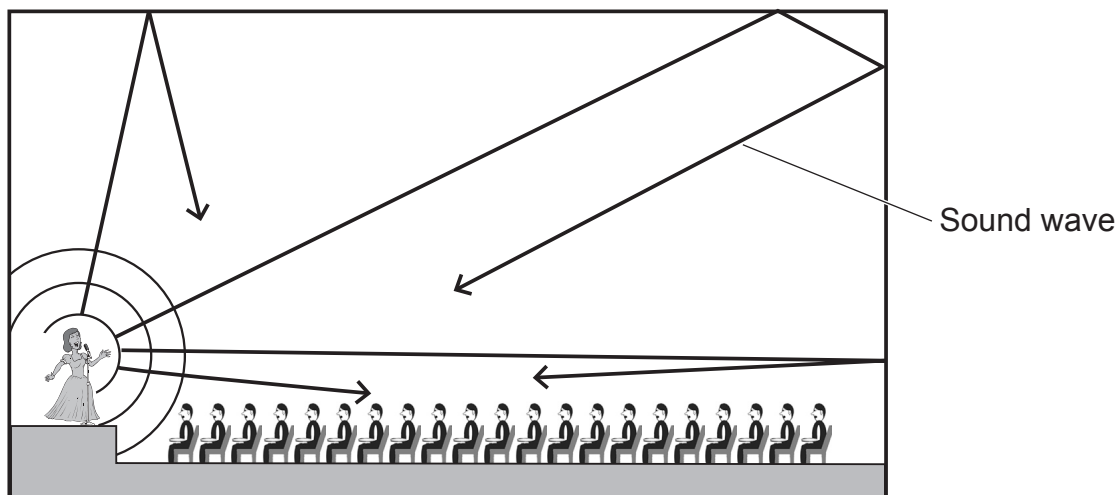
(i) What is the amplitude of these waves?

Answer _____ m [1]

(ii) What is the wavelength of these waves?

Answer _____ m [1]

(b) The diagram below shows the sound waves in a badly designed concert hall. Some of the audience complain that the sound they hear is not very clear.



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Marks	Remark

Explain fully why some people may not hear the sound clearly.

Your answer should include:

- the cause of the problem
- what the audience will hear and why
- what can be done to correct the problem

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

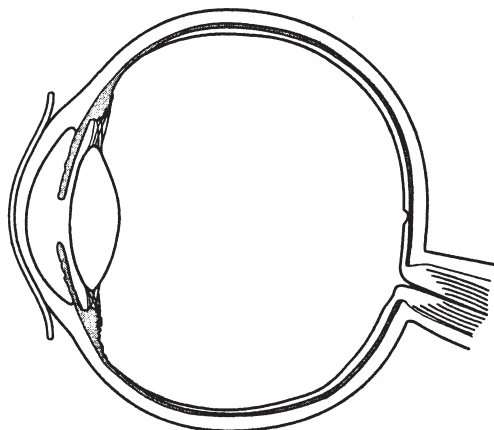
[6]

(c) Explain fully what ultrasound is.

[2]

Examiner Only	
Marks	Remark

5 The diagram below shows the human eye.



© CCEA

(a) Explain the term refraction and describe fully the passage of light through the eye for normal vision.

[3]

Examiner Only	
Marks	Remark

(b) On a visit to the opticians a lady was heard to say:

When I read a page at normal reading distance the words are very blurry but as I move the page further away the words become clearer.



(i) Name the sight defect this lady has and describe fully what causes the defect.

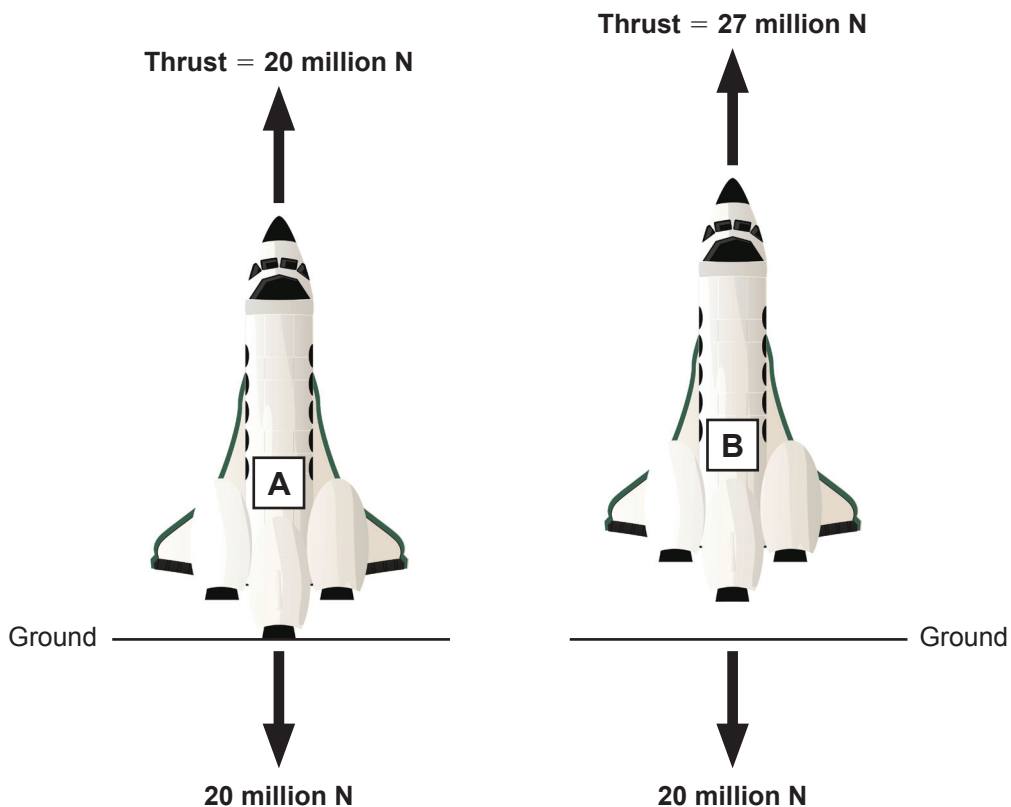
_____ [3]

(ii) Name the type of lens used to correct this sight defect.

_____ [1]

Examiner Only	
Marks	Remark

- 6 The diagrams below show the space shuttle on the ground one second before take off (**A**) and then one second after take off (**B**).



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- (a) (i) Name the 20 million N downward force in diagram **A**.

_____ [1]

- (ii) Explain fully in terms of forces the movement, if any, of the space shuttle in diagram **A**.

 _____ [2]

- (iii) Calculate the size of the resultant force in diagram **B**. Describe the effect this resultant force has on the space shuttle.

 _____ [2]

Examiner Only	
Marks	Remark

(b) A short time after take off the space shuttle (mass 2×10^6 kg) reaches a velocity of 4.5×10^2 m/s.

(i) Use the equation:

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

to calculate the momentum of the space shuttle.

(Show your working out.)

Answer _____ [2]

(ii) State the unit of momentum.

Answer _____ [1]

Examiner Only	
Marks	Remark

- 7 The picture below shows a wind-up torch. The torch makes electricity in the same way as the generator in a power station.



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- (a) Explain fully how this torch makes electricity and state how the brightness could be increased.

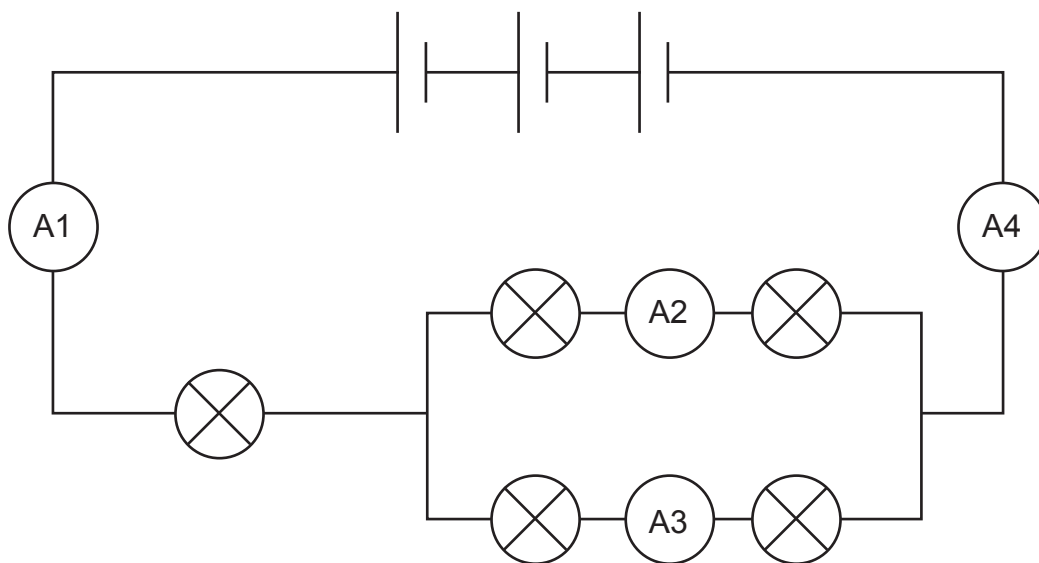
[3]

- (b) In a fossil fuel power station the chemical energy in the fuel is changed into heat in the burner. Describe the **three** other energy changes, stating where they occur in the power station.

[3]

Examiner Only	
Marks	Remark

(c) The circuit below was used to investigate current flow. All the bulbs are identical.



(i) If ammeter A1 reads 0.6 A, what will be the readings on ammeters A2, A3 and A4?

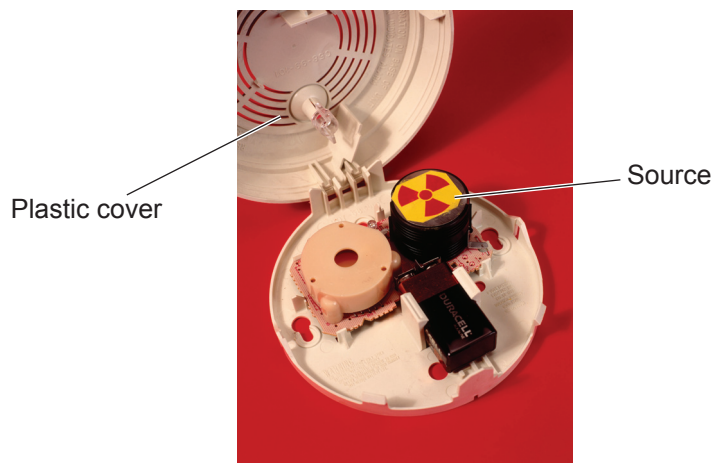
A2 _____ A
 A3 _____ A
 A4 _____ A [2]

(ii) Describe and explain fully how current actually flows around a circuit.

 _____ [3]

Examiner Only	
Marks	Remark

- 8 The picture below shows a radioactive source inside a common type of smoke alarm.



© Andrew Lambert Photography/Science Photo Library

The most common radioactive source used in smoke alarms is americium-241 which emits alpha radiation.

- (a) Explain fully why some atoms are radioactive.

[2]

- (b) The smoke alarm works by having a constant flow of radiation from the source. When this flow is interrupted by smoke the alarm sounds.

- (i) Explain fully why an alpha source is best to use in smoke alarms.

[3]

- (ii) Americium-241 has a half-life of 432 years. Suggest **one** reason why a long half-life is important in a smoke alarm.

[1]

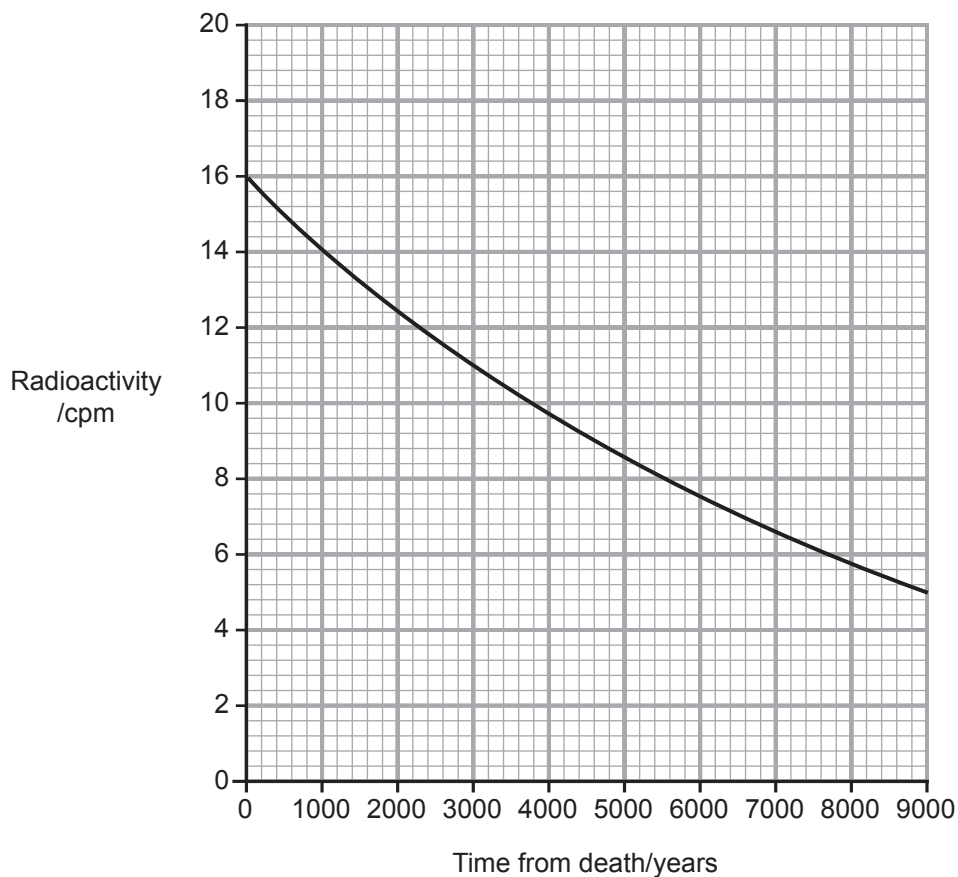
Examiner Only

Marks Remark

(iii) Radioactivity is the emission of ionising radiation. What is meant by the term ionising radiation?

_____ [1]

(c) The graph below shows how the radioactivity of carbon-14 decreases in the remains of a once living organism.



(i) Use the graph to find the half-life of carbon-14.

Answer _____ years [1]

(ii) In 1985 a human body was found in an English peat bog and the radioactivity of the carbon-14 found in the body was 10 cpm. Use the graph to find how many years ago this person died.

Answer _____ years [1]

Examiner Only	
Marks	Remark

- 9 The table gives information about seven galaxies (A to G) in the Universe.

Galaxy	Amount of red shift /arbitrary units	Time for light to reach Earth/years
A	0.0043	59 million
B	0.01	140 million
C	0.1	1.3 billion
D	0.5	5 billion
E	1.0	7.7 billion
F	2.0	10.3 billion
G	3.0	11.5 billion

- (a) Which galaxy is furthest away? Explain your answer.

[2]

- (b) Use the information in the table and your knowledge to explain the Big Bang theory and how red shift provides evidence for this theory. Your answer should describe star formation.

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

[6]

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Marks	Remark

(c) How many years ago did the Big Bang take place?

Answer _____ [1]

(d) Name an alternative scientific theory to the Big Bang theory.

_____ [1]

(e) What is meant by the term light year?

_____ [1]

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Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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