Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 3 (Physics)
Higher Tier

GSS32

[GSS32]

FRIDAY 13 NOVEMBER 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 **8(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

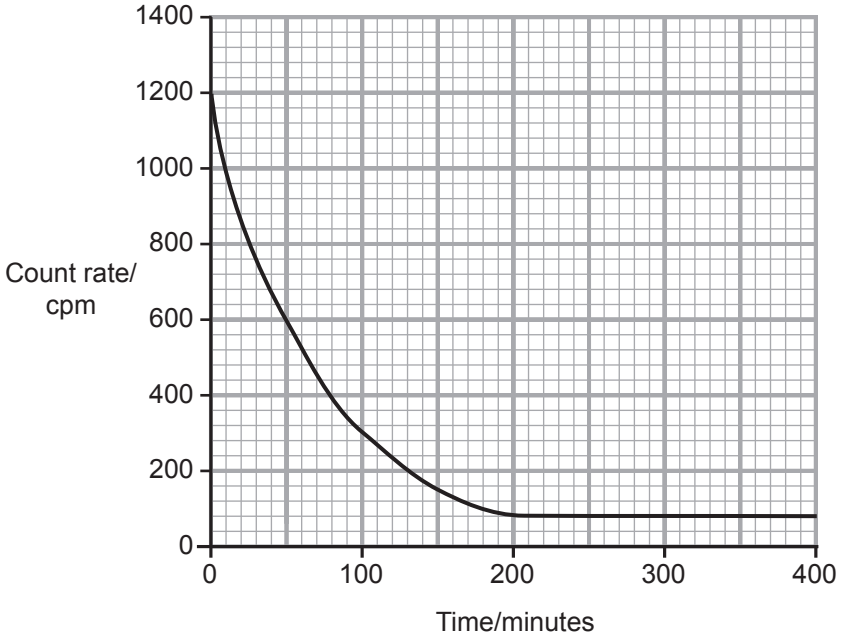
Examiner Only	
Marks	Remark

1 **(a)** The atoms of radioactive isotopes have unstable nuclei that disintegrate emitting radiation.

Name the **two** types of particle found in the nucleus of an atom.

_____ and _____ [2]

(b) The graph below shows how the count rate of a radioactive isotope changes with time.



(i) What is the count rate at 100 minutes?

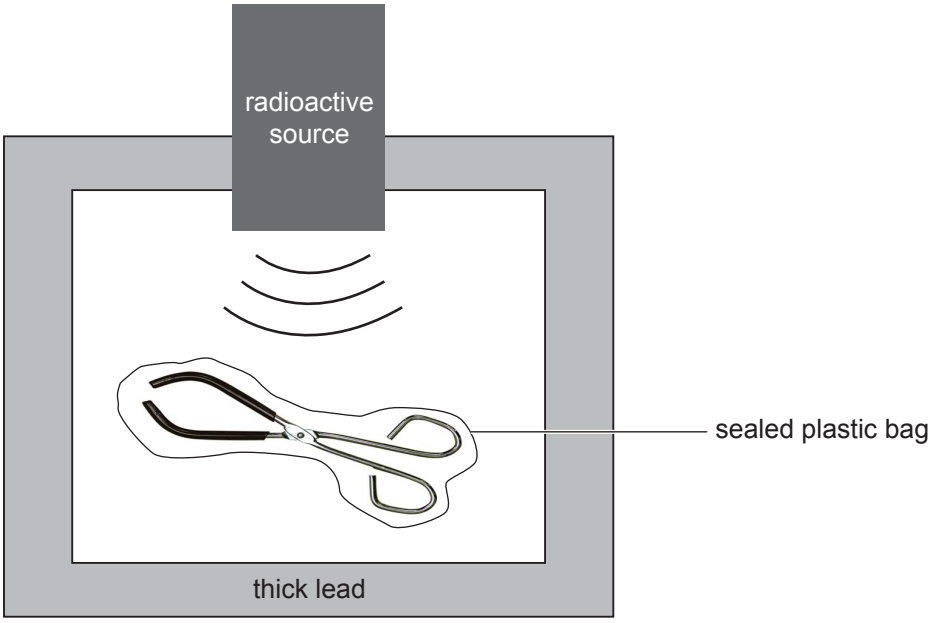
Answer _____ cpm [1]

(ii) Suggest the value of background radiation.

Answer _____ cpm [1]

Examiner Only	
Marks	Remark

(c) After operations in hospitals the surgical instruments need to be sterilised as shown in the diagram below.



(i) Name the type of radiation used to sterilise surgical instruments.

Answer _____ [1]

(ii) Explain fully why it is necessary to use the radioactive source inside thick lead.

_____

_____

_____ [2]

(iii) Fruit can also be treated with radiation before being transported long distances.

Explain fully why this is done and how it benefits shopkeepers.

_____

_____

_____

_____

_____ [3]

Examiner Only

Marks	Remark

2 **(a)** The table below shows the results of an investigation into the effect of the mass of a car on fuel consumption.

Car mass/kg	Fuel consumption/mpg
1000	70
1100	67
1200	64
1300	61
1400	58
1500	55

(i) State **two** things that the investigators must do to make this a fair test.

1. _____

_____

2. _____

_____ [2]

(ii) Explain how fuel consumption can be used as a measure of efficiency.

_____

_____ [1]

(iii) How can car manufacturers use the trend in these results to design more efficient cars?

_____

_____ [1]

(b) Petrol and diesel come from fossil fuels. Describe fully how fossil fuels are formed.

Examiner Only	
Marks	Remark

_____

_____

_____

_____ [3]

3 **(a)** Modern Christmas tree lights use a parallel circuit. Explain why parallel circuits are better than series circuits.

Your answer should include:

- how bulbs are connected in each circuit
- the amount of current flowing through bulbs in each circuit
- **one** disadvantage with parallel circuits.

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

[6]

Examiner Only	
Marks	Remark

(b) Power NI use meter readings to calculate household electricity bills.
A meter shows the number of units used.
Each unit costs 15p.

Use the meter readings below to calculate the electricity bill for a house.

5 3 1 0 5	5 3 8 2 7
Previous reading 3 months ago	Present reading

(Show your working out.)

Answer _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The table below gives the price and SAR rating for five mobile phones (**A**, **B**, **C**, **D** and **E**). The SAR rating is a measure of the amount of radiation absorbed by the body when using a mobile phone.

Model	Price/£	SAR rating
A	130	1.58
B	225	1.49
C	260	0.36
D	350	1.38
E	380	0.27

(i) Using the table Emma made the following statement:

"The higher the price of a phone, the safer it is."

Explain fully why her statement is **not** correct.

_____

_____

_____ [2]

(ii) Name the health risk associated with using mobile phones.

_____ [1]

(iii) Apart from buying a new phone, suggest **two** ways that users can reduce the amount of radiation absorbed from their mobile phones.

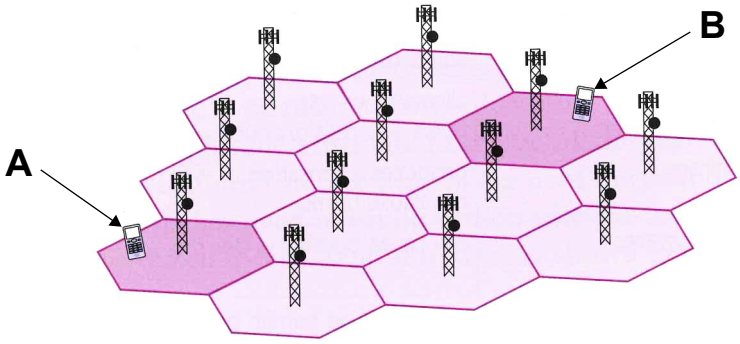
1. _____

_____

2. _____

_____ [2]

(b) The diagram below shows a mobile phone network.



Using the diagram explain fully how a signal goes between phone **A** and phone **B**.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 The whistle below is used to train dogs.

© thelefty / iStock / Thinkstock

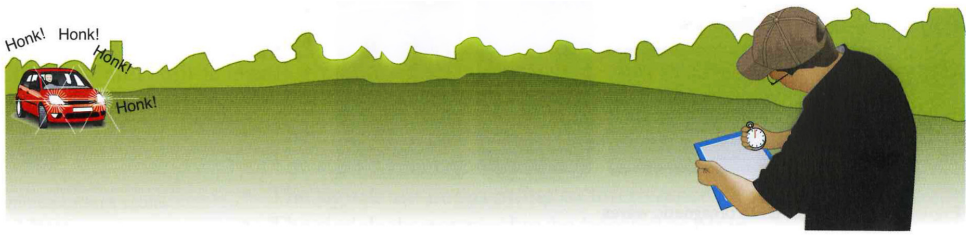
(a) Describe fully why humans cannot hear the sound produced by this whistle.

_____

_____

_____ [2]

(b) Shown below are two pupils experimenting to find the speed of sound using the flash-bang method.



(i) Describe fully **two** measurements these pupils will need to make during this experiment.

1. _____

_____

2. _____

_____ [2]

(ii) The experiment was repeated on a different day.

Suggest **one** reason, apart from human error, why their value for the speed of sound may be different.

_____

_____ [1]

(c) The table below gives information about how the features of a wave change with the depth of water.

Depth of water/ m	Wavelength/ m ($\times 10^3$)	Amplitude/ m	Wave speed/ m/s
7000	282	0.05	3395
4000	213	0.08	2567
2000	151	0.15	1814
200	48	1.50	572
50	23	6.00	284
10	11	30.00	130

(i) Describe fully how **one** wave feature changes with depth of water.

_____

_____ [1]

(ii) With reference to waves, explain fully what is meant by the term 'amplitude'.

_____

_____ [2]

(iii) Use the equation:

$$\textbf{frequency} = \frac{\textbf{wave speed}}{\textbf{wavelength}}$$

to calculate the frequency of the wave when the water is 50 m deep.

(Show your working out.)

Answer _____ Hz [2]

Examiner Only

Marks	Remark

Examiner Only

Marks	Remark

6 **(a)** The table below gives information about six planets in the Solar System.

Planet	Average distance from Sun/km ($\times 10^8$)	Average surface temperature/ °C	Orbit time/ years	Orbital speed/ km/year ($\times 10^8$)
Venus	1.10	480		11.10
Earth	1.50	22	1.00	9.60
Mars	2.25	–23	1.88	8.10
Jupiter	7.80	–150	11.86	4.10
Saturn	14.00		29.46	3.00
Uranus	29.00	–210	84.01	2.20

Use this information to answer the following questions.

(i) An asteroid called Herculina has an orbital speed of 6.1×10^8 km/year.
Suggest its average distance from the Sun.

Answer _____ km [1]

(ii) Suggest the average surface temperature of Saturn.

Answer _____ °C [1]

(iii) Suggest what is meant by the term 'orbit time'.

_____

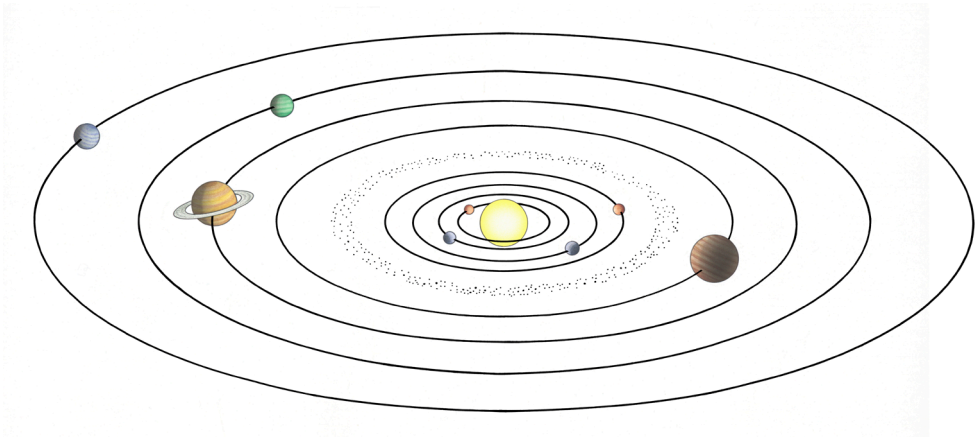
_____ [1]

(iv) Suggest the orbit time of Venus.

Answer _____ years [1]

(b) The diagram below shows the planets orbiting the Sun.

Examiner Only	
Marks	Remark



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(i) Use the diagram above to explain why distances from the Sun are usually given as an average.

_____

_____ [1]

(ii) Name the model of the Solar System shown in the diagram.

_____ [1]

(iii) Give **two** differences between this model and the earlier model of the Solar System.

1. _____

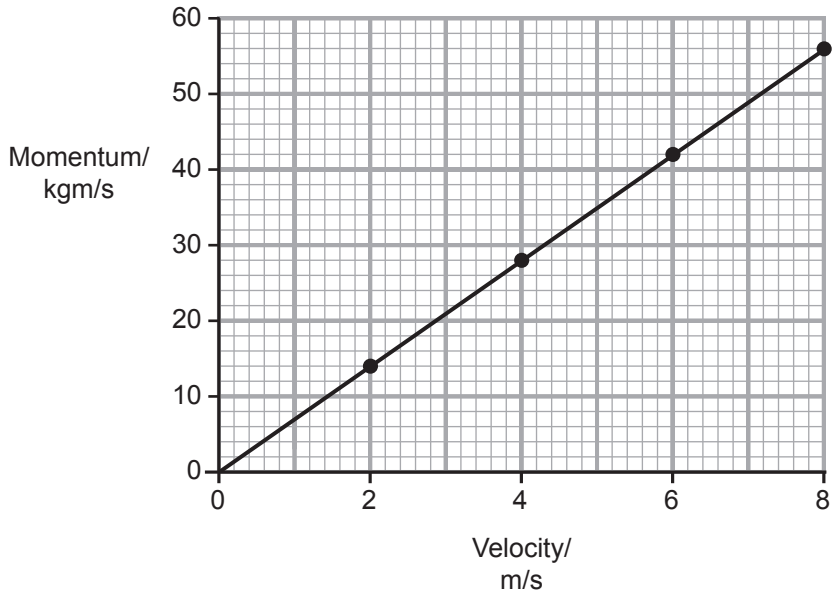
_____

2. _____

_____ [2]

Examiner Only	
Marks	Remark

7 The graph below shows how the momentum of an object changes with velocity.



(a) Using the graph and the equation:

momentum = mass × velocity

calculate the mass of this object.

(Show your working out.)

Answer _____ kg [2]

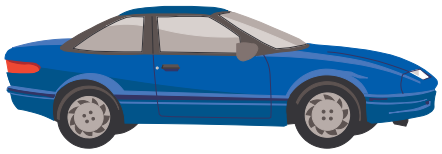
(b) On the graph above, draw the line you would expect for this object if its mass was reduced. [2]

(c) The diagram below shows two vehicles immediately before car **A** collides with car **B**.

Examiner Only

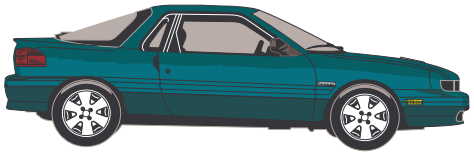
Marks	Remark

Mass = 1500 kg
Velocity = 5 m/s
Momentum = 7500 kgm/s



A

Mass = 1500 kg
Velocity = 0 m/s
Momentum = 0 kgm/s



B

(i) Explain fully, in terms of momentum, what will happen to car **B** during the collision.

_____

_____

_____

_____

_____ [3]

(ii) Crumple zones are designed to reduce injury to passengers. Explain how a crumple zone protects passengers in a collision.

_____

_____ [1]

8 The photograph below shows a gas-fuelled power station.

(a) Explain fully how electricity is generated in this power station. You must name the component parts and describe the energy changes.

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

[6]

Examiner Only	
Marks	Remark

(b) Electricity leaving the power station is passed through a transformer. Name the type of transformer used and explain fully why it is used.

Name _____

Explanation _____

_____

_____ [3]

Examiner Only	
Marks	Remark

9 The photograph below shows a bus moving at constant speed.

The table below shows four other sets of forces that could act on the bus.

Set	Forward force/ N	Friction/ N	Effect on speed
A	1000	1000	constant speed
B	1000	1500	
C	750	750	
D	1500	750	

(a) Complete the table to show the effect on speed of each set of forces. The first one has been done for you. [2]

Examiner Only

Marks	Remark

(b) This bus is a **hybrid** vehicle with a '**regenerative braking**' system. Describe how these new technologies work and explain how they reduce our reliance on fossil fuels.

[3]

(c) Describe fully the role friction plays when the brakes are used to stop a vehicle.

[2]

Examiner Only

Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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