Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

WEDNESDAY 27 FEBRUARY 2013, MORNING

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

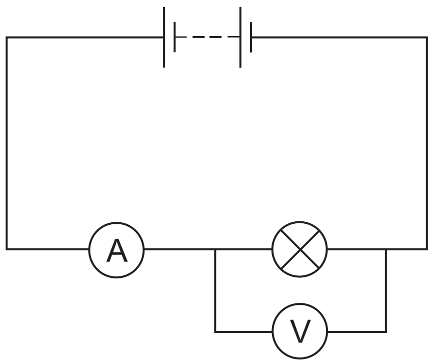
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all ten** questions.

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** and **9(c)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

1 Pupils set up the circuit below to investigate the effect of adding extra batteries.



The pupils' results are shown in the table below.

Number of batteries	Voltage/V	Current/A
1	1.5	0.10
2	3.0	0.19
3	4.5	0.30
4	6.0	0.41
5	7.5	0.50

(a) State **two** trends shown by these results.

1. ______________________________

____

2. ______________________________

______________________________ [2]

Examiner Only
Marks | Remark

(b) The pupils then used a light meter to measure how the brightness of a bulb was affected by the number of batteries.

The results are shown below.

Number of batteries	Bulb brightness/lux
1	14
2	22
3	35
4	35
5	35

(i) Explain the advantage of using only three batteries with this bulb.

____

____

____ [2]

(ii) Use the table opposite and the equation:

power = voltage × current

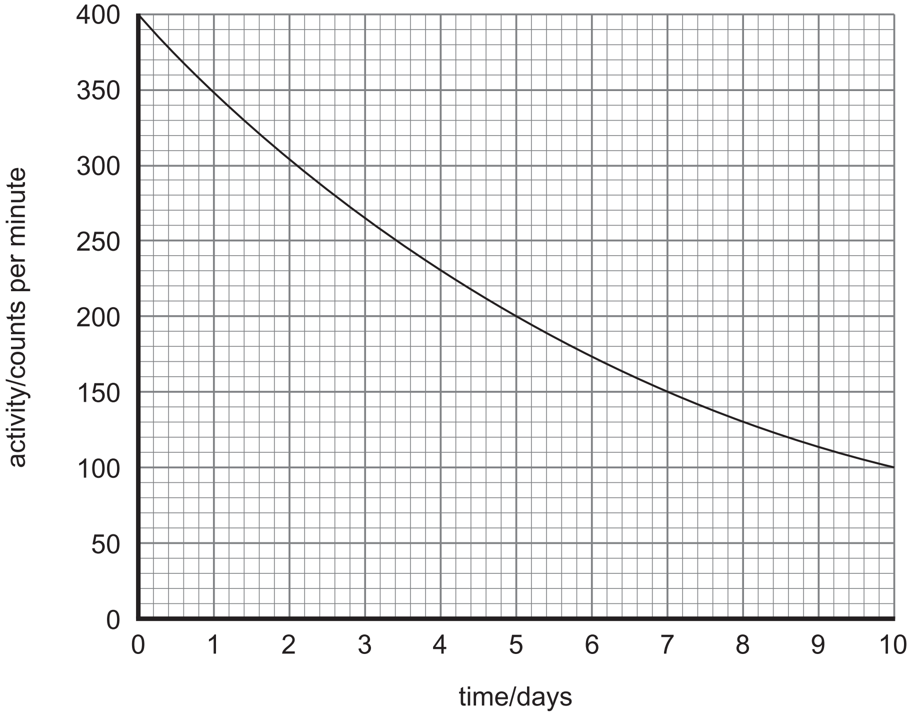
to calculate the power used when three batteries are connected to this bulb.

(Show your working out.)

Answer ____________________ W [2]

Examiner Only	
Marks	Remark

2 **(a)** The graph below shows how the activity of a radioactive isotope varies with time.



(i) What is the activity at 7 days?

_____________________ counts per minute [1]

(ii) Describe the trend shown by this graph.

____

____ [1]

(iii) Use the graph to give the half-life of this isotope.

_____________________ days [1]

(b) Explain fully why some nuclei are radioactive.

____

____

____ [2]

Examiner Only	
Marks	Remark

This isotope produces gamma radiation.

Examiner Only	
Marks	Remark

(c) Explain fully why gamma radiation can be used to treat cancer within the body.

____

____

____ [2]

Examiner Only	
Marks	Remark

3 The Northern Ireland government has recently announced that there will be an increase in the amount of electricity generated from sources other than fossil fuels.

Explain fully what fossil fuels are, how they are formed, and why the emphasis on developing alternative sources has increased in recent years.

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

____ [6]

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(Questions continue overleaf)

4 The table below gives information on the different types of wave in the electromagnetic spectrum.

Type	Wavelength/m	Energy/ arbitrary units
Gamma	0.00000000001	300 000
X-rays	0.0000000001	3000
	0.00000001	30
Visible light	0.0000005	6
	0.00001	0.3
Microwaves	0.03	0.001
Radio waves	1000	0.00003

(a) State the relationship between wavelength and energy in the table above.

____

____ [1]

(b) Complete the table by correctly naming the other **two** types of electromagnetic radiation. [2]

(c) All these waves travel at the same speed (300 000 000 m/s).

(i) Use the equation:

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

to calculate the frequency of radio waves.

(Show your working out.)

Answer ________________ Hz [2]

Examiner Only

Marks	Remark

Examiner Only

Marks	Remark

(ii) Use the equation to suggest how frequency will change when wavelength increases.

____

____ [1]

(d) (i) Microwaves are used in mobile phone communications. Suggest **one** other use of microwaves.

____ [1]

(ii) Using the information provided and your knowledge, explain fully why microwaves are more likely than X-rays to affect the health of young people.

____

____

____

____ [2]

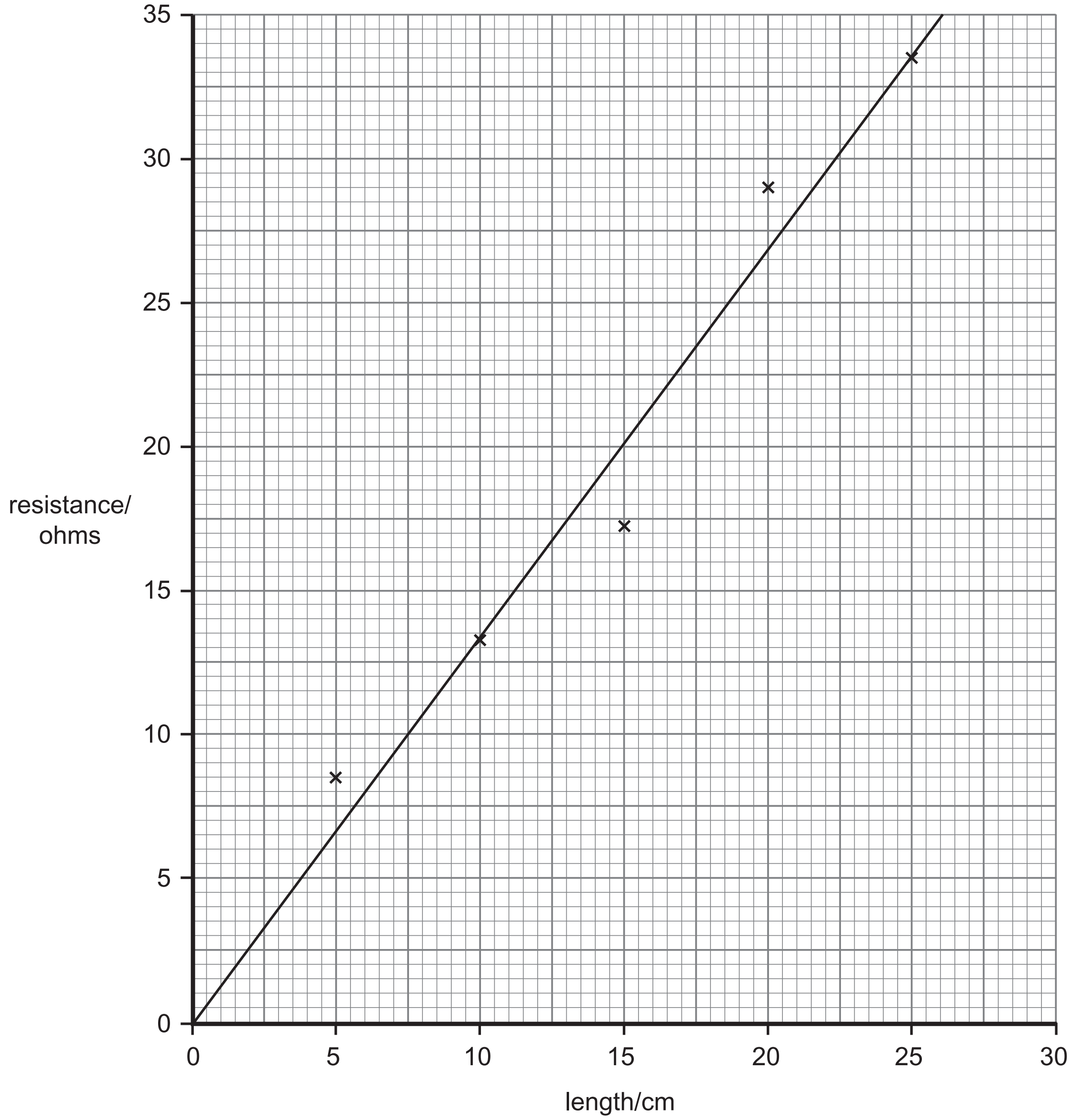
(iii) Name the medical condition associated with exposure to electromagnetic radiation.

____ [1]

5 (a) Two pupils were investigating the effect of length on resistance.

To do this they rolled conducting putty into different lengths keeping the thickness the same.

The results are shown in the graph below.



(i) What is the effect of length on resistance?

____

____ [1]

(ii) What evidence in the graph suggests that some of these results could be improved?

____

____ [1]

Examiner Only	
Marks	Remark

(iii) In a second experiment, thicker pieces of putty were used for each length. Draw a line on the graph to show the results you would expect. [2]

(b) The teacher suggests repeating the experiment using wire instead of putty. The table below gives information about some available spools of wire.

Spool	Material	Cross-section area/mm^2	Length of spool/m	Resistance per metre/ohms
A	Constantan	0.27	228	7.8
B	Constantan	0.31	180	6.3
C	Constantan	0.91	22	2.6
D	Copper	0.27	1120	0.43
E	Copper	0.40	450	0.14
F	Copper	0.91	100	0.04
G	Nichrome	0.27	244	17
H	Nichrome	0.46	94	10
I	Nichrome	0.60	23	3.5

(i) The teacher suggests using spool **G** to investigate the effect of length on resistance. Explain why.

____ [1]

(ii) The teacher wants to find the effect of different materials on resistance. Select three spools that would be suitable for this investigation. Explain your answer fully.

____

____

____

____ [3]

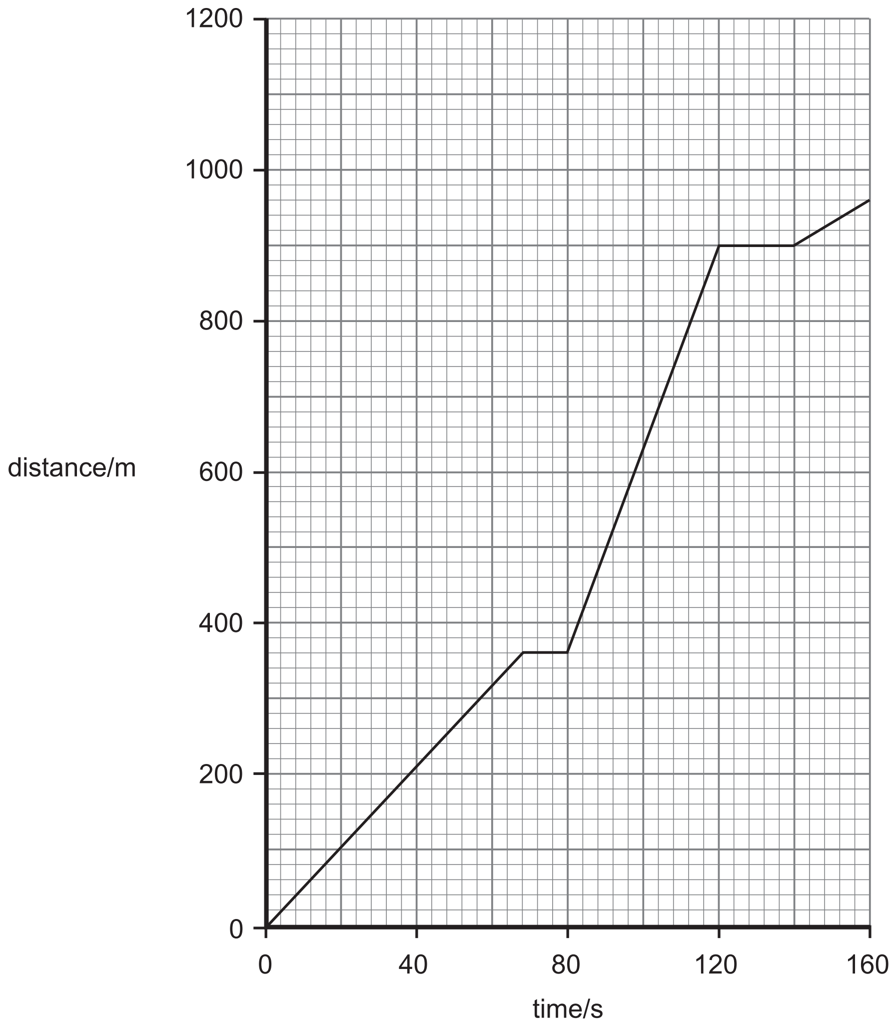
(iii) Using the graph and the table, state what length of conducting putty has the same resistance as 1 metre of the wire in spool **H**.

______________ cm [1]

Examiner Only
Marks | Remark

Examiner Only	
Marks	Remark

6 (a) Shown below is the distance-time graph for a car journey.



(i) Between which times of the journey is the car moving the fastest?

______________________ and ______________________ s [1]

(ii) Use the equation:

$$\textbf{average speed} = \frac{\textbf{total distance}}{\textbf{total time}}$$

to calculate the average speed of the car for the whole journey.

(Show your working out.)

Answer ____________ m/s [2]

(iii) For how long was the car stopped?

_____________ s [1]

The photograph below shows safety features on a car being tested.

© TRL Ltd / Science Photo Library

(b) State **two** safety features of a car that are designed to absorb energy in a collision.

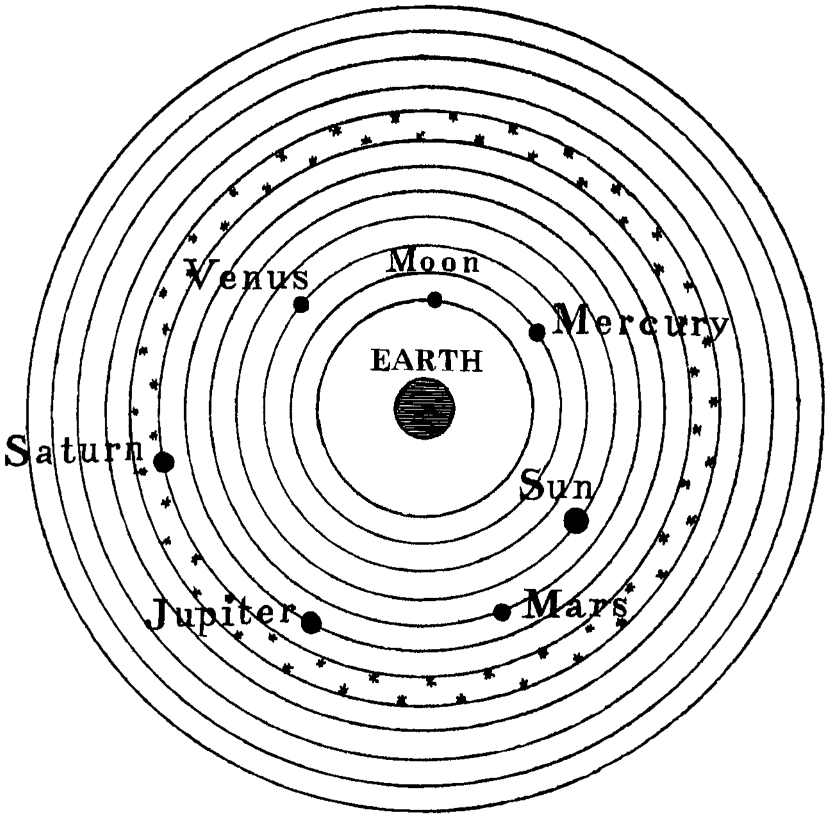
____

____ [2]

Examiner Only	
Marks	Remark

7 **(a)** The diagram below shows the model of the Solar System used by the ancient Greeks.

Examiner Only	
Marks	Remark



© Sheila Terry / Science Photo Library

Name this model of the Solar System and give **two** differences between this model and the current model.

____

____

____

____ [3]

(b) The table below gives the speeds of galaxies in our Universe at different distances from Earth.

Galaxy	Distance from Earth/ tens of millions of light years	Speed away from Earth/ thousands of km/s
A	5	1
B	65	15
C	95	22
D	170	39
E	260	61

(i) Explain fully how the information in the table provides evidence for the Big Bang theory.

____

____

____

____ [3]

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

____ [1]

(iii) How many years ago did the Big Bang occur?

____ [1]

(iv) Explain the meaning of the term 'light year'.

____

____ [2]

Examiner Only

Marks	Remark

8 **(a)** The table below gives information about four types of electric lights.

Light	**Power input/watts**	**Light power output/watts**	**Average lifetime/ hrs**	**Cost to buy/£**	**Efficiency/ %**
Filament bulb	100	30	1000	0.5	
Halogen lamp	40	30	10 000	4	75
LED spotlight	10	7	30 000	6	70
Fluorescent tube	15	10	5000	5	67

(i) Use the equation:

$$\textbf{efficiency} = \frac{\textbf{useful power output}}{\textbf{total power input}}$$

to calculate the efficiency of the filament bulb.

(Show your working out.)

Answer ________________ % [2]

(ii) The total cost of lighting includes the cost to buy and the cost of electricity used.

You need to provide 30 000 hours of lighting for the lowest overall cost.

Explain fully why you might choose the LED spotlight rather than the halogen lamp.

____

____

____ [2]

Examiner Only

Marks	Remark

(b) State the law of conservation of energy.

____

____

____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** During a cycle race a cyclist of mass 60 kg travelled at a velocity of 15 m/s on a bicycle of mass 10 kg.

(i) Use the equation:

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

to calculate the momentum at this velocity.

(Show your working out.)

Answer _______________ [2]

(ii) State the units of momentum.

_______________ [1]

(b) Explain the terms average and instantaneous speed.

____

____

____ [2]

(c) Explain fully, in terms of forces and their effects, the differences between cyclists **A** and **B** below.

Examiner Only	
Marks	Remark

A

B

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

____ [6]

10 **(a)** Describe fully the cause and effect of short sight.

Examiner Only	
Marks	Remark

____

____

____

____ [3]

(b) State how short sight is corrected.

____ [1]

THIS IS THE END OF THE QUESTION PAPER