OCR
RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE **A182/01**

PHYSICS A

Unit A182: Modules P4, P5, P6 (Foundation Tier)

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:
None

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- A list of useful relationships is printed on page **2**.
- The number of marks for each question is given in brackets **[ ]** at the end of the question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

For Examiner's Use		
	Max	**Mark**
1	**7**	
2	**5**	
3	**6**	
4	**2**	
5	**3**	
6	**6**	
7	**6**	
8	**3**	
9	**2**	
10	**3**	
11	**2**	
12	**3**	
13	**6**	
14	**3**	
15	**3**	
TOTAL	**60**	

TWENTY FIRST CENTURY SCIENCE DATA SHEET

Useful Relationships

The Earth in the Universe

distance = wave speed x time

wave speed = frequency x wavelength

Sustainable Energy

energy transferred = power x time

power = voltage x current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

Explaining Motion

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

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

momentum = mass x velocity

change of momentum = resultant force x time for which it acts

work done by a force = force x distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight x vertical height difference

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric Circuits

power = voltage x current

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

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

Radioactive Materials

energy = mass x [speed of light in a vacuum]^2

Answer **all** the questions.

1 This question is about different journeys made in a lorry.

(a) The lorry is passing through a built up area where the speed limit is 14 m/s.

In 20 seconds, the lorry travels 250 metres.

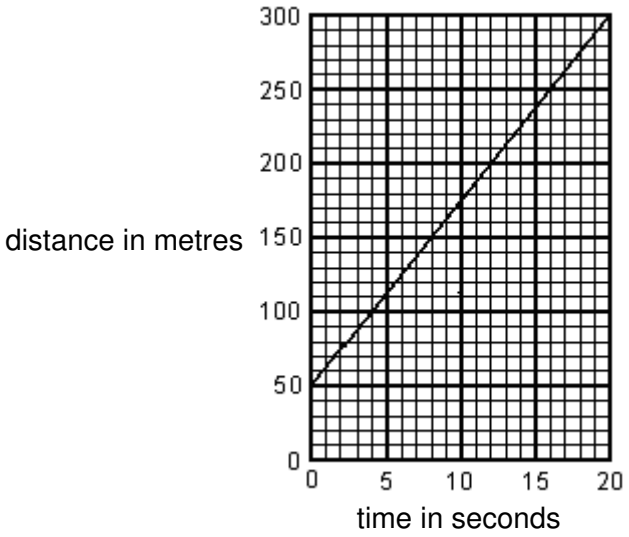
(i) Calculate the speed of the lorry, and decide whether the lorry is within the speed limit.

speed = ... m/s

.....

..... **[1]**

(ii) Here is the distance-time graph for the 250 metre part of the journey.



Explain how the graph increases your confidence in your decision about whether the lorry is within the speed limit.

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..... **[2]**

(b) The lorry is fitted with a speed limiter.

This sets its maximum speed to 25 m/s.

The lorry is driven down a test track at full speed to test the limiter.

Here are the results of four measurements.

trial number	measured speed
1	24.5 m/s
2	25.2 m/s
3	24.9 m/s
4	24.8 m/s

(i) Suggest why four measurements were taken instead of just one.

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..... **[1]**

(ii) Calculate the mean of the four measurements.

speed = ... m/s **[1]**

(iii) The speed measured in trial number five is 20.2 m/s.

What should be done with this result?

Give a reason in your answer.

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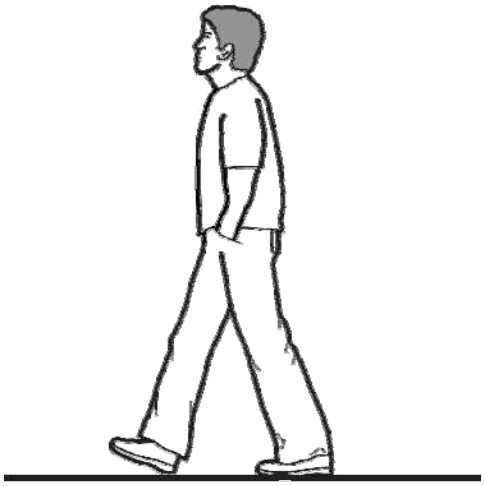
..... **[2]**

[Total: 7]

2 Tom goes for a walk in the park.



(a) There are two forces acting on Tom's feet from the ground.

Complete the table. Choose words from the list.

You may **not** use the same word twice.

friction **mass** **reaction** **weight**

direction of force from ground	name of force
vertical ↑	
horizontal →	

[2]

(b) Tom is moving forward at a steady speed.

Complete the sentences.

Choose words from this list.

You may **not** use the same word twice.

weight **friction** **upwards** **forwards** **backwards**

To move forwards, Tom's foot applies a force in the .....direction.

The foot does not slip because of ..... .

The horizontal force from the ground pushes Tom's foot in the .....direction.

[3]

[Total: 5]

3 Car manufacturers build safety features into their cars.

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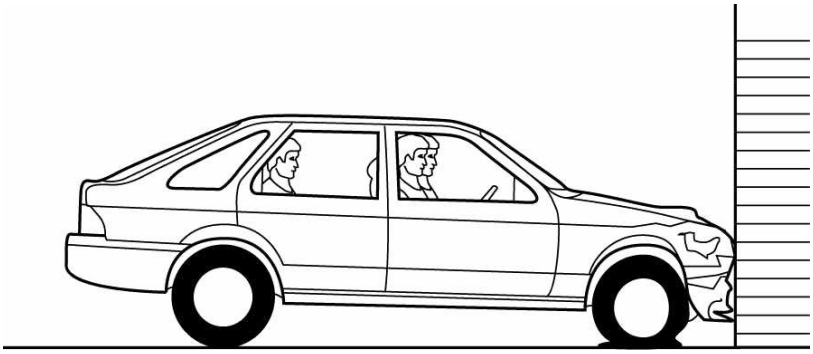

Describe safety features that are designed to protect people in the car when it has a crash.

Use ideas of momentum to explain how they protect people in a crash.

✎ *The quality of written communication will be assessed in your answer to this question.*

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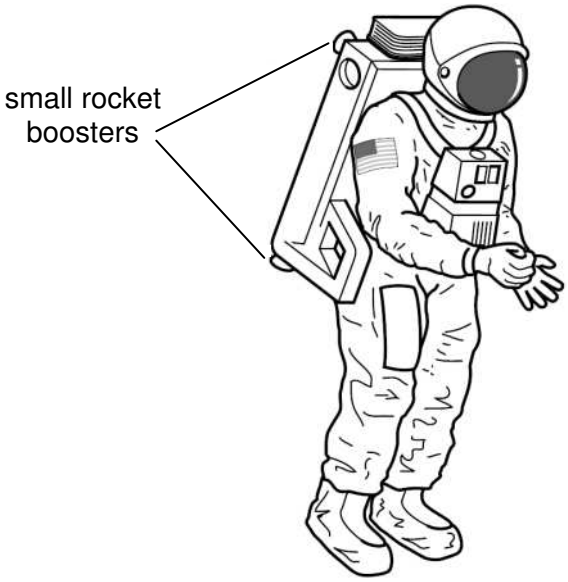
[Total: 6]

4 Buzz is an astronaut.

He is floating in space far away from the Sun or any planets.

He uses small rocket boosters on his space pack to move about.



Complete the sentences.

Choose words from this list.

charge **kinetic energy** **potential energy** **power** **work**

The rocket boosters exert a force on the astronaut.

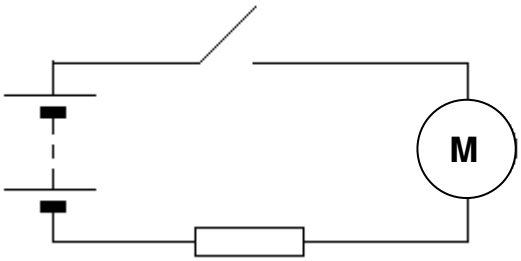
The astronaut speeds up, gaining .....

This happens because the rockets do ..... on the astronaut.

[2]

[Total: 2]

5 Bill assembles this circuit.



Explain why the motor spins when Bill presses the switch.

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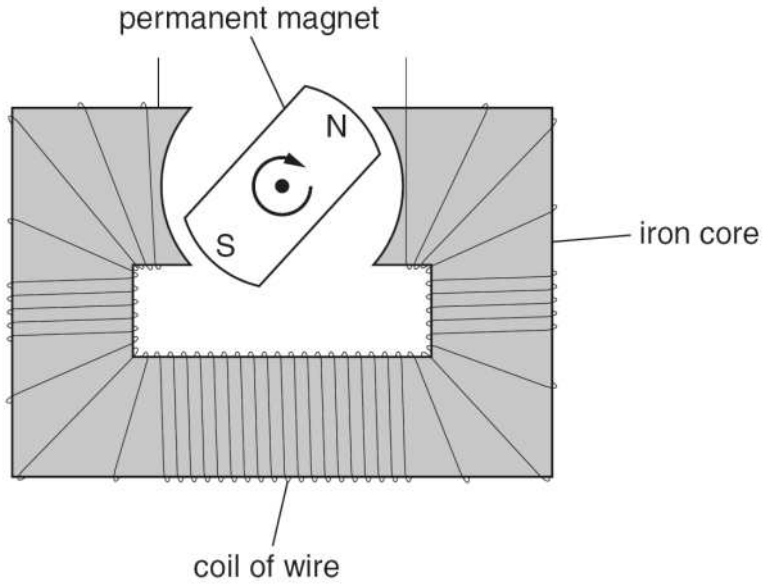
..... **[3]**

[Total: 3]

6 The diagram shows a simple generator.



Describe how a simple generator produces electricity.

✎ *The quality of written communication will be assessed in your answer to this question.*

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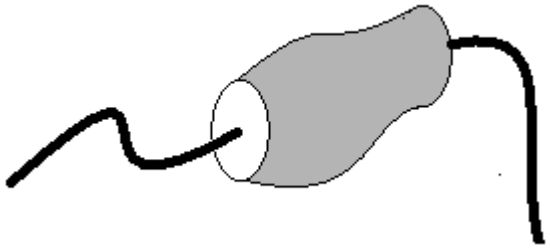
[Total: 6]

7 Jeff and Rita investigate a component.



They connect it to three different batteries, measuring the current and voltage each time.

Here are their results.

voltage in volts	current in amps	resistance in ohms
2.8	0.70	
5.9	1.2	4.9
12	1.8	

(a) Complete the table by filling in the two missing values for resistance.

[1]

(b) Jeff says that any changes in the resistance are caused by changes in the current.

Explain whether Jeff's explanation is supported by the results.

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..... **[2]**

(c) Rita knows that the resistance of many electrical components depends on their temperature. She thinks that this might explain the results.

Suggest what they could do to find out who is right.

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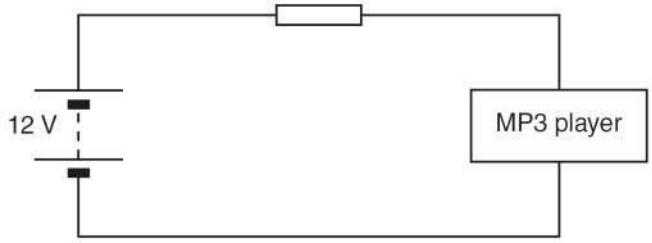
..... **[3]**

[Total: 6]

8 Jo likes to listen to her MP3 player.

She uses this circuit to connect her MP3 player to a 12 V battery.



(a) When the MP3 player is switched on, the potential difference across it is 3.0 V and the current in it is 0.15 A.

Calculate the power of her MP3 player.

Include the unit of power in your answer.

answer = ... **[2]**

(b) The battery supplies a potential difference of 12 V for the circuit.

The potential difference across the MP3 player is only 3 V.

What is the potential difference across the resistor?

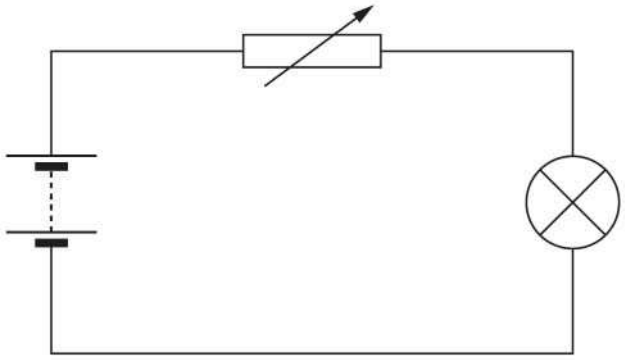
Put a (ring) around the correct answer.

3 V **9 V** **12 V** **15 V**

[1]

[Total: 3]

9 Sylvia sets up this circuit.



(a) Sylvia decides to measure the potential difference across the lamp.

Draw another component on the circuit diagram to show how she could do this.

[1]

(b) Sylvia finds that the potential difference across the lamp reads 4 V. Sylvia asks her friends what this means.

Alan

It tells you about the energy lost by the charge on its way through the lamp.

Bess

It's the rate at which charge passes through the lamp.

Carlo

It tells you how much energy there is in the battery.

Davina

It's the amount of charge in the lamp.

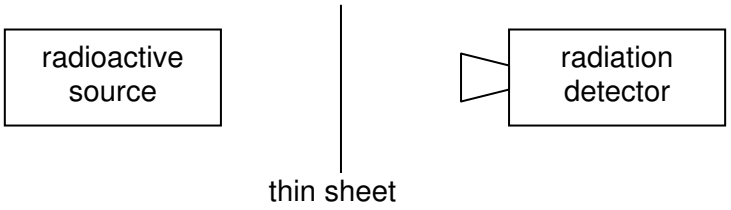
Who gives the correct explanation?

answer ..... **[1]**

[Total: 2]

10 Gordon wants to know whether a thin sheet is made of paper or gold foil.

He places a radioactive source on one side of the sheet. On the other side of the sheet a detector measures the amount of radiation that is received.



Which would be the best type of radiation to use?

Justify your answer.

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..... **[3]**

[Total: 3]

11 The annual dose **limit** for a worker in a nuclear power station is higher than for a member of the public.

(a) Why might it be acceptable for workers in the power station to receive a higher dose than members of the public?

Put a tick (✓) in the box next to the correct answer.

Members of the public are not exposed to as much radiation. ☐

Nuclear power provides us with energy. This is worth the small risk to the workers. ☐

Workers in a nuclear power station are used to a higher dose. ☐

[1]

(b) What precautions could be taken to sensibly reduce the risk to the workers in a nuclear power station?

Put a tick (✓) in the box next the correct answer.

Not allow the workers to bring any visitors to the power station. ☐

Reduce the number of workers. ☐

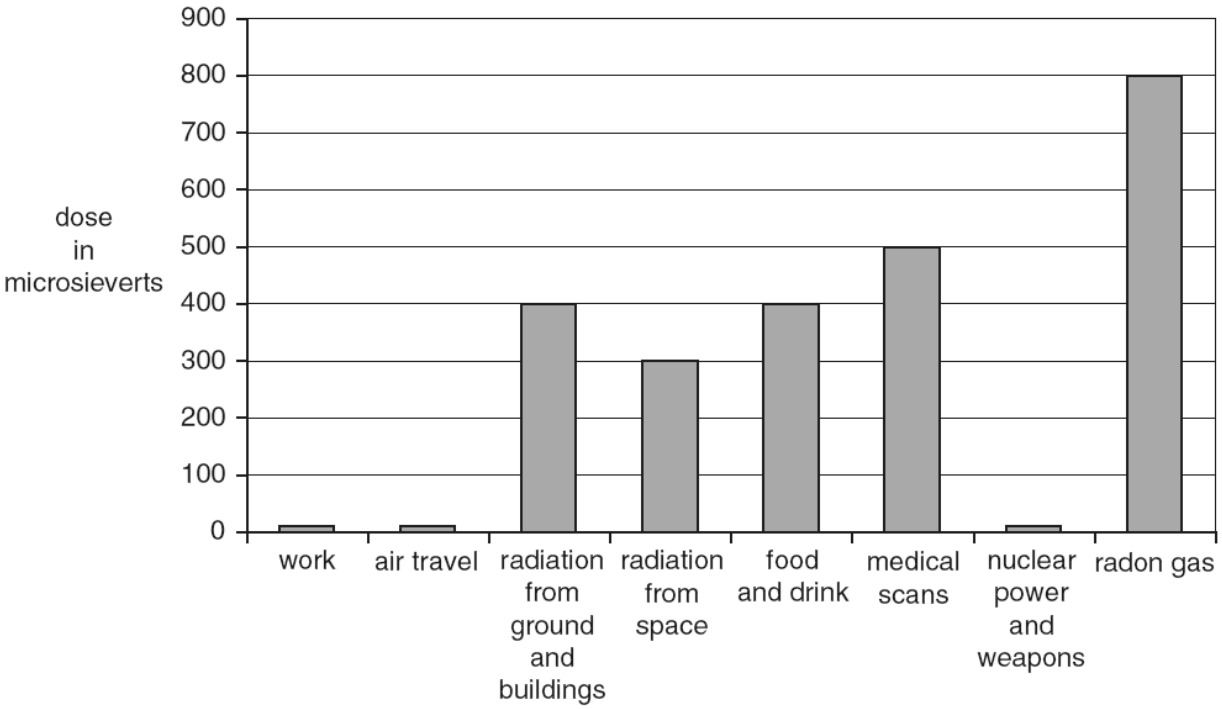
Provide food for the workers that has been sterilised by irradiation. ☐

Use shielding to reduce the level of radiation. ☐

[1]

[Total: 2]

12 The bar chart shows the typical yearly radiation dose for a person in Britain from different sources.



(a) What would be the total radiation dose a typical person in Britain would get from the ground and buildings, and medical scans in a year?

Put a ring around the correct answer. All values are in microsieverts.

100 **400** **500** **900**

[1]

(b) The total for all sources is 2430 microsieverts.

Which of the following statements are correct conclusions **from the bar chart**?

Put ticks (✓) in the boxes next to the **two** correct statements.

Not everyone will have medical scans. ☐

Radon gas provides more than half the total dose. ☐

The fraction of dose received from nuclear power stations is very small. ☐

The dose from radon gas will be different in different parts of Britain. ☐

The dose from food and drink is less than a quarter of the total dose. ☐

[2]

[Total: 3]

13 A nuclear reactor produces radioactive materials for use in hospitals. The radioactive materials are used to treat patients.

Identify the different types of radioactive waste generated by the production and use of these radioactive materials and describe how the waste should be dealt with.

✎ *The quality of written communication will be assessed in your answer to this question.*

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..... **[6]**

[Total: 6]

14 Hospitals use a generator containing a radioactive substance called Mo – 99 to make an isotope called Tc – 99 m.

Mo – 99 has a half life of 66 hours.

Tc – 99 m has a half life of 6 hours.

The technician tests a sample from the generator to find out what it contains.

He measures its activity at four different times.

Here are the results.

time of measurement	activity of sample in Bq
06:00h	5200
12:00h	2600
18:00h	1300
24:00h	650

What does the sample contain? Use data from the table to justify your answer.

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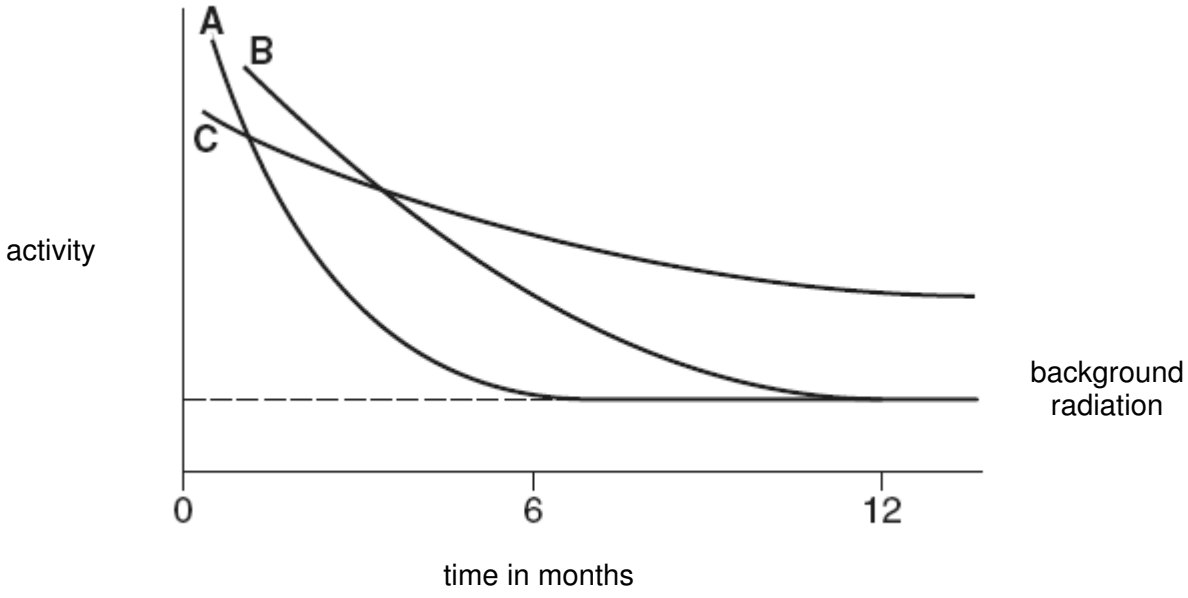
..... **[3]**

[Total: 3]

15 Different radioactive sources are used in hospitals for different purposes.

The graph shows activity over time of three different radioactive sources.



(a) Which radioactive source has the shortest half-life **A**, **B** or **C**? .....

[1]

(b) Which has the most activity after 12 months **A**, **B** or **C**? .....

[1]

(c) Which source is likely to be a long term storage problem **A**, **B** or **C**? .....

[1]

[Total : 3]

[Paper Total: 60]

END OF QUESTION PAPER