THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

F

Friday 25 January 2013 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE
PHYSICS A

A182/01 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, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

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 two.
- The number of marks is given in brackets **[ ]** at the end of each 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.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful relationships

The Earth in the Universe

distance = wave speed × time

wave speed = frequency × wavelength

Sustainable energy

energy transferred = power × time

power = voltage × 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 × velocity

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

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

amount of energy transferred = work done

change in gravitational potential energy = weight × vertical height difference

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

Electric circuits

power = voltage × 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

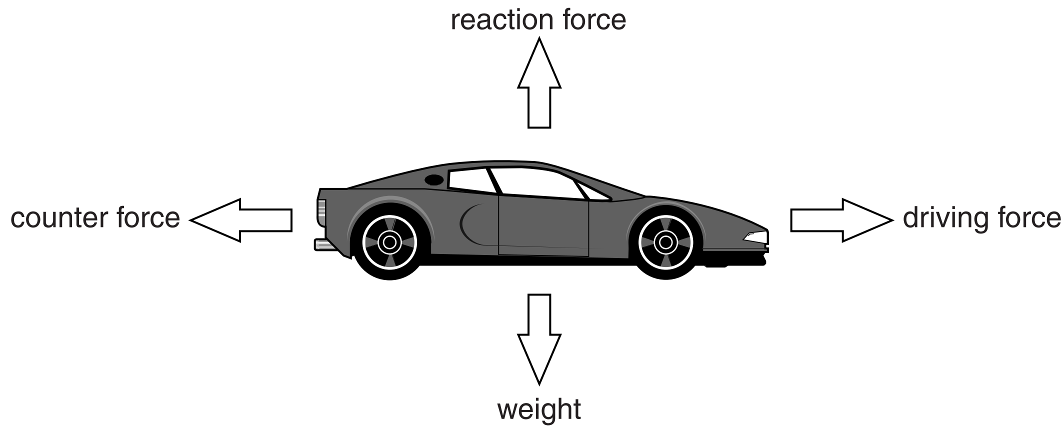
$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

Answer **all** the questions.

1 Racing car teams track the progress of cars to analyse their performance.

One team was testing how well a car accelerated at the start of a race.

(a) Some of the forces on the car are shown below.



(i) Draw a line from each **force** to the correct **description** of the force.

force	description
counter force	push of the engine
driving force	force due to friction and air resistance
reaction force	pull of gravity on the car
weight	force from the ground on the car

[2]

(ii) The team had force sensors on the car.

At one moment, the sensors measured the following forces:

counter force	**driving force**
11 500 N	18 000 N

Explain how this data shows that the car is speeding up.

....

....

.... **[2]**

(b) The car in part **(a)** accelerated from rest to 40 m/s in 4 seconds.

What was the average acceleration of the car?

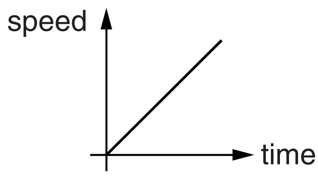
Put a (ring) around the correct answer.

0.1 m/s²   **10 m/s²**   **36 m/s²**   **44 m/s²** **[1]**

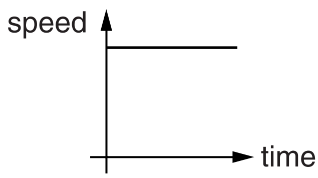
(c) The team use their measurements to plot a speed-time graph for the car.

Which speed-time graph, **A**, **B**, or **C**, shows the car accelerating?

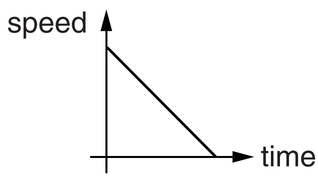
A



B



C



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

[Total: 6]

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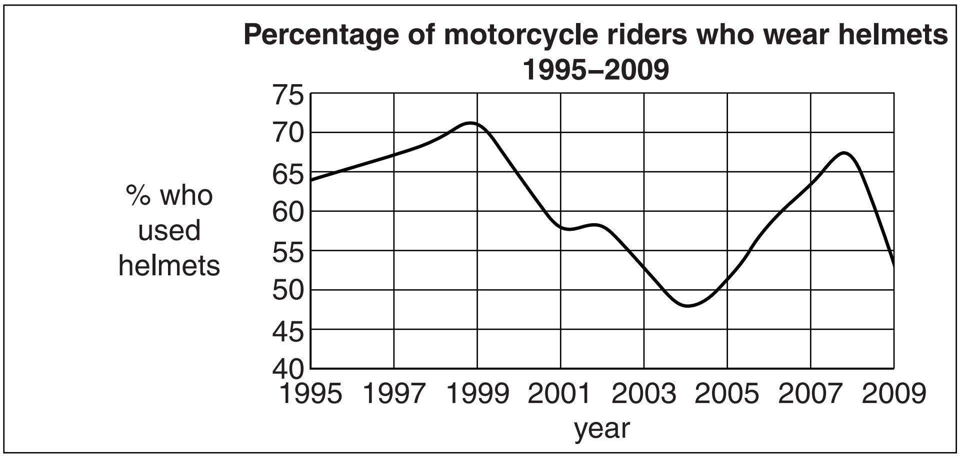
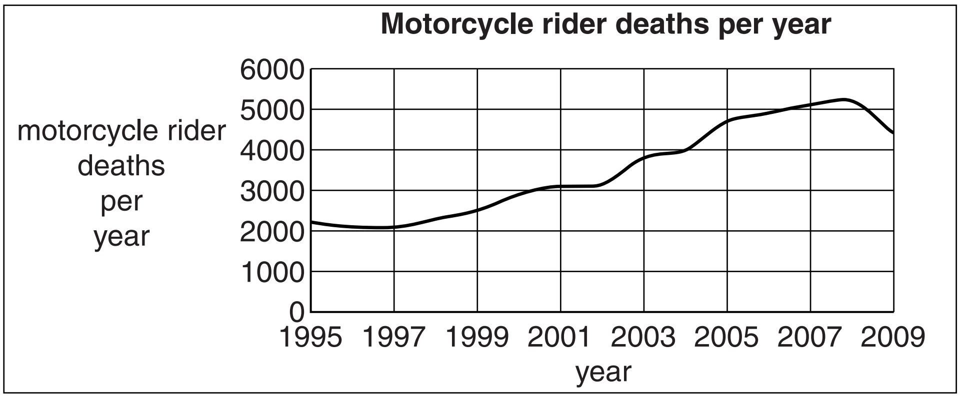
Question 2 begins on page 6

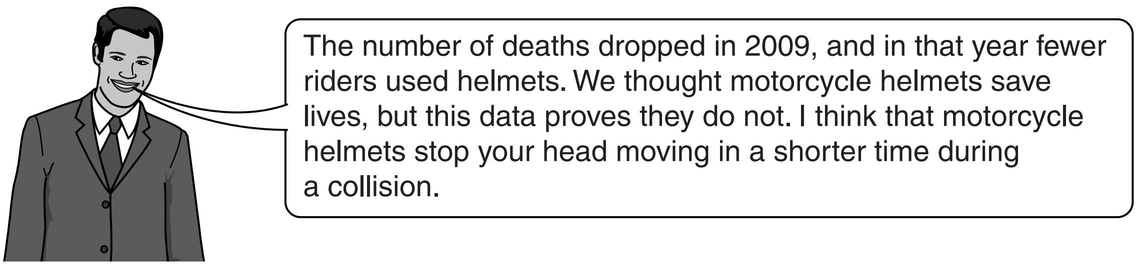
PLEASE DO NOT WRITE ON THIS PAGE

2 Look at the two graphs showing motorcycle rider deaths and helmet use.





A politician looks at the graphs.



The politician has misunderstood the ideas of correlation and cause, and does not understand how motorcycle helmets work.

Explain why he is **wrong**, using the data and your knowledge of physics.

The quality of written communication will be assessed in your answer.

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.... **[6]**

[Total: 6]

3 Hannah is doing an experiment with falling paper shapes.

(a) When Hannah lifts a paper circle, she does work on the paper.

(i) Calculate the work done on the paper when it is lifted up 2 m.

The paper has a weight of 0.1 N.

work done = ... J **[1]**

(ii) After the circle of paper is lifted up, what type of energy has increased?

Put a (ring) around the correct answer.

electrical **gravitational potential** **kinetic** **nuclear** **[1]**

(b) Hannah then drops the paper circle.

(i) What forces act on the paper circle as it falls?

....

.... **[2]**

(ii) When Hannah first drops the paper circle, it speeds up.

Which type of energy increases?

Put a (ring) around the correct answer.

electrical **gravitational potential** **kinetic** **nuclear** **[1]**

(c) Hannah then squashes the paper circle into a ball.

She then repeats her experiment dropping the paper ball from the same height.

She finds that the paper ball now drops **faster**.

Explain why.

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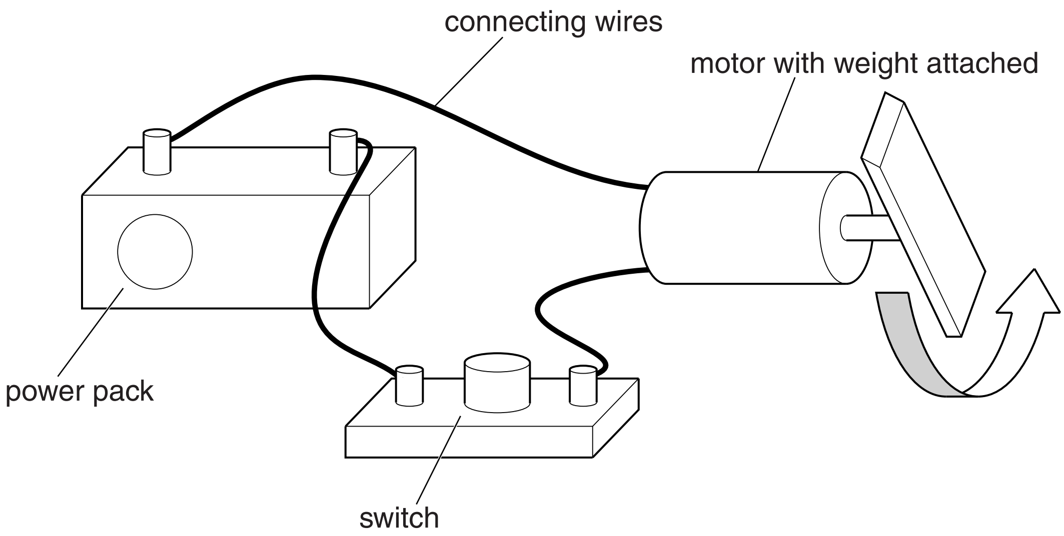
.... **[3]**

[Total: 8]

4 Luke sets up an experiment with a motor.



When Luke turns on the circuit, the motor rotates.

He finds out how many times the motor rotates each second.

He measures the power supplied to the motor.

He then repeats the experiment with different values of power.

Here are his results.

Power (W)	4	6	8	10	12
Number of rotations per second	0.50	0.75	1.0	1.2	1.3

Luke says, "The power cannot be related to the number of rotations per second. There is no reason for a correlation".

Is Luke correct? Explain your answer.

The quality of written communication will be assessed in your answer.

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.... **[6]**

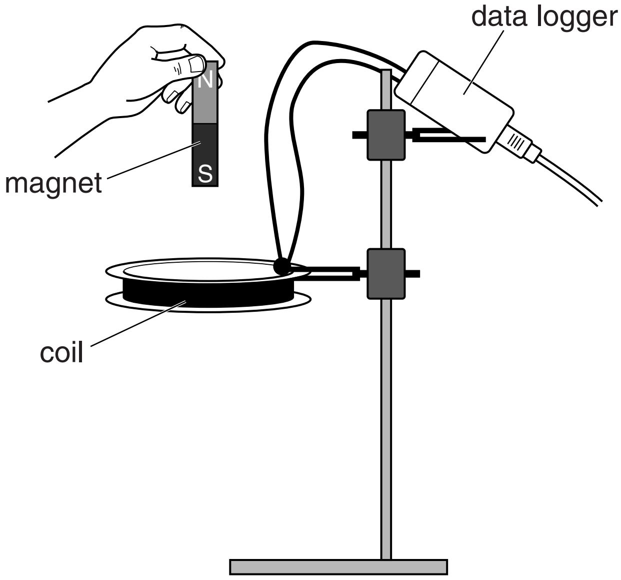
[Total: 6]

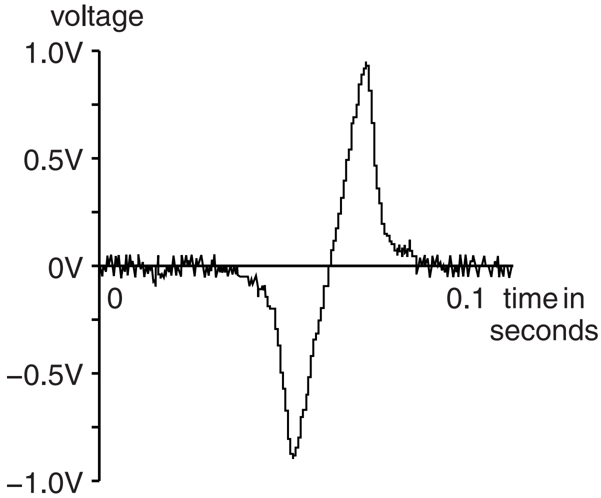
5 Ali does an experiment using a coil of wire and a magnet.

He connects the coil of wire to a data logger.

He then drops the magnet through the coil.

Ali displays the data as a graph showing how the voltage across the coil changes with time.





(a) **(i)** Complete the sentences about this experiment.

Put a (ring) around each correct answer.

As the magnet drops into the coil, it **induces / magnetises / resists** a voltage across the coil.

induces	
magnetises	
resists	

The voltage becomes negative when the magnet **goes into / comes out of / spins in** the coil.

goes into	
comes out of	
spins in	

This process is called **electromagnetic induction. / potential energy. / the motor effect.**

electromagnetic induction.	
potential energy.	
the motor effect.	

[3]

(ii) State **two** ways that Ali could increase the voltage across the ends of the coil of wire.

1 ....

2 ....
[2]

(b) The effect described in part **(a)** is used in power stations to produce electricity.

(i) What is the name of the device that uses this effect in a power station?

Draw a (ring) around the correct answer.

generator **motor** **pylon** **[1]**

(ii) Compare the electricity produced by a power station with the electricity produced in this experiment.

Use information from the graph.

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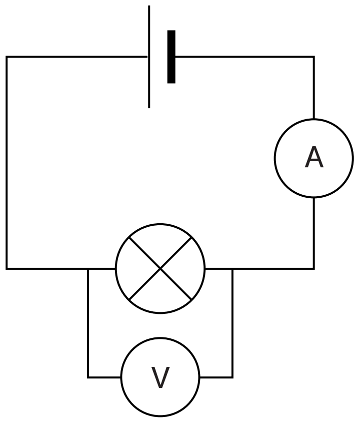
.... **[2]**

[Total: 8]

6 Jason sets up the following circuit.



(a) He measures the current and voltage.

Draw a line from each **quantity** to its correct **description**.

quantity	description
	the flow of charge in a circuit
current	the number of lamps in the circuit
voltage	the length of the wires in the circuit
	the push of the battery on the charges in the circuit

[2]

(b) The voltage is 1.5V and the current is 0.5A.

Jason then calculates the power and resistance of the lamp.

Draw a line from each **quantity** to the correct **calculation** for it.

quantity	calculation
	$1.5\,V \times 0.5\,A$
power (W)	$1.5\,V + 0.5\,A$
	$1.5\,V - 0.5\,A$
resistance (Ω)	$\frac{1.5\,V}{0.5\,A}$
	$\frac{0.5\,A}{1.5\,V}$

[2]

(c) Jason doubles the length of the **connecting** wires in his circuit, but keeps all other components the same.

He finds that the power of the lamp does not change.

Explain why.

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.... **[2]**

[Total: 6]

7 There are many arguments for and against nuclear power.

Some people are worried about the materials left over as waste from nuclear power stations.

(a) Three of the materials left over are caesium-134, technetium-99 and zirconium-93.

They have very different half-lives.

(i) What is half-life?

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

The time taken for the radioactive material to completely change into another material.	☐
The time taken for a radioactive material to become safe.	☐
The time taken for half of the radioactive material to decay.	☐

[1]

(ii) Caesium-134 has a half-life of about 2 years.

Technetium-99 has a half-life of about 200 000 years.

Zirconium-93 has a half-life of about 1.5 million years.

Samples of each material start with the same activity.

Which material will take the **longest** time for its activity to halve?

....

Which material will take the **shortest** time for its activity to halve?

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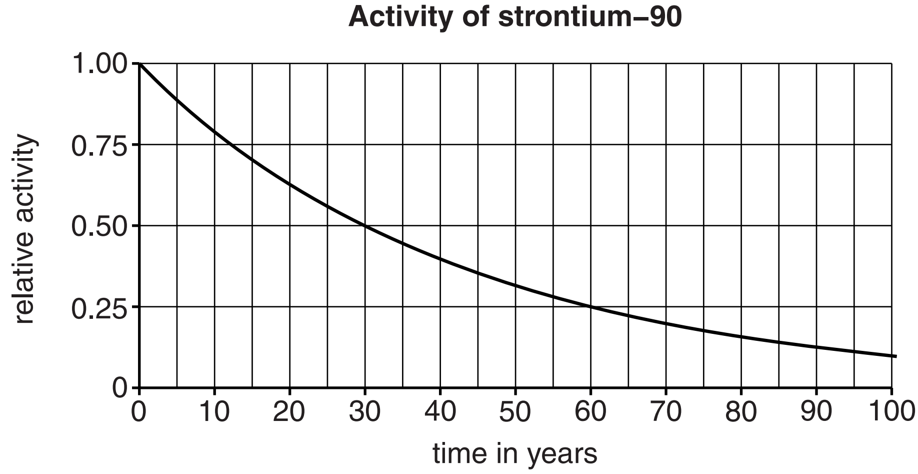
[2]

(iii) Another material often left over from nuclear power stations is strontium-90.

The graph below shows how strontium-90 decays.



How long does it take strontium-90 to decay to a quarter of its starting activity?

Use the graph.

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

(b) **(i)** The left over material from nuclear power stations is categorised as high, intermediate or low level waste.

Draw a line to link each **type of waste** to its correct **method of storage**.

type of waste	**method of storage**
high level waste	stored in concrete
intermediate level waste	encased in glass and then stored under water until cool
low level waste	put in landfill sites

[2]

(ii) Nuclear waste produces three types of ionising radiation.

One of the types of ionising radiation is gamma.

What are the names of the other types of ionising radiation?

....

.... **[1]**

(iii) Some nuclear waste emits all three types of radiation and is usually held in lead containers.

John suggests that an aluminium container should be used to contain the waste, as it is lighter.

Explain why using the aluminium container would **not** be a good idea.

....

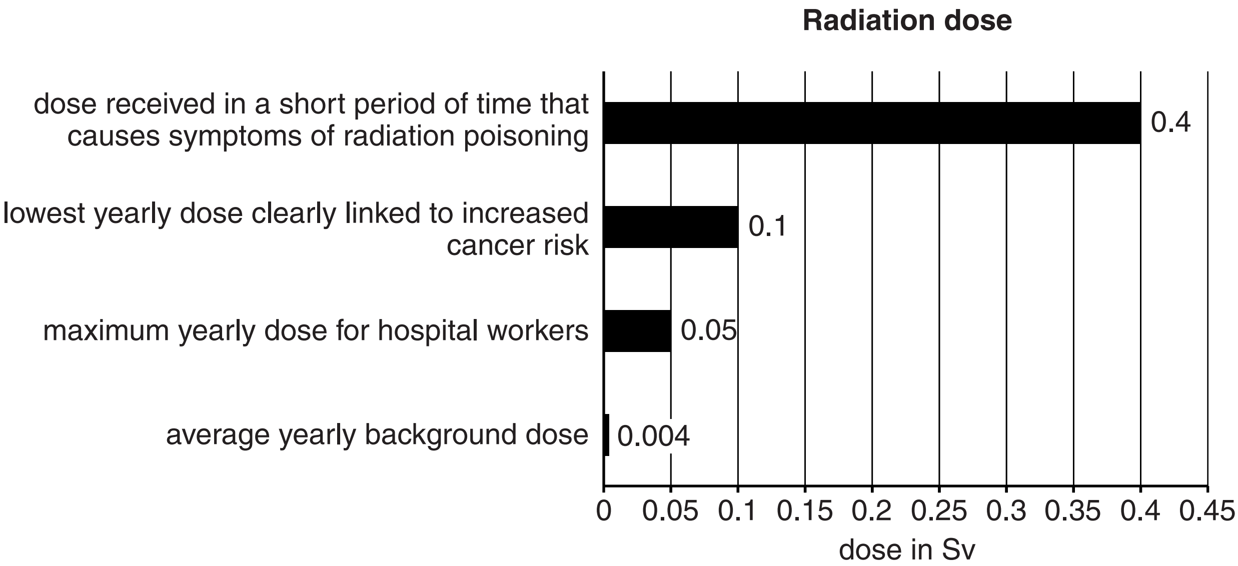
.... **[2]**

[Total: 9]

8 Zoe is trying to decide what job she wants to do.

She likes the idea of working in the radiology department of a hospital, but is worried about the increased risk from the radiation.

She finds the following chart.



Zoe says she does not understand what the chart is showing.

Explain what the chart shows and how it can help her to compare the risks and benefits of working in a radiology department.

The quality of written communication will be assessed in your answer.

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.... **[6]**

[Total: 6]

9 Radon gas comes from the ground and emits alpha radiation.

The government has regulations about how buildings must be built.

Some of these regulations are about including protection against radon gas when a house is built.

(a) Why would radon gas in houses be dangerous to humans?

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.... **[2]**

(b) The following chart shows the risk of cancer from exposure to different levels of radon gas.

Indoor radon level	Lifetime risk of cancer
low	less than 1 in 200
medium	1 in 190
high	1 in 100

The building regulations insist that houses in high level radon areas have radon protection measures installed.

A politician proposes that people in areas with medium levels of indoor radon should also install the protection measures and that the government should pay for the change.

How would different groups of people be affected by this change?

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.... **[3]**

[Total: 5]

END OF QUESTION PAPER