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Friday 12 June 2015 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE
PHYSICS A/ADDITIONAL SCIENCE 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

- The 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 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.

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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

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

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Question 1 begins on page 4

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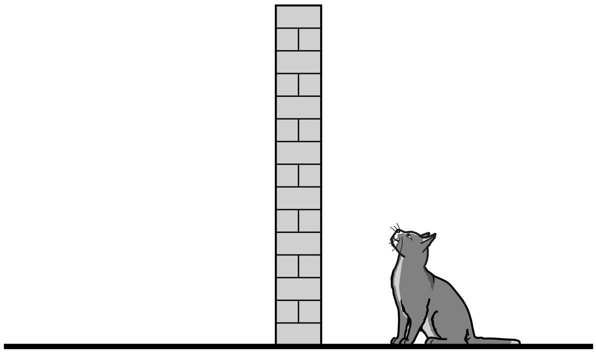
Answer **all** the questions.

1 Iggy the cat is sitting next to the bottom of a wall.



He jumps from the ground onto the wall.
Iggy has mass 5 kg and weighs 50 N. The wall is 1.2 m high.

(a) What is the correct way to calculate the gravitational potential energy gained by Iggy?

Put a ring around the correct answer.

$\frac{\mathbf{5\,kg}}{\mathbf{1.2\,m}}$ **5 kg × 1.2 m** $\frac{\mathbf{50\,N}}{\mathbf{1.2\,m}}$ **50 N × 1.2 m** **[1]**

(b) As Iggy walks along the wall he knocks a plant pot off the wall.
The pot falls to the ground.

(i) What force pulls the pot to the ground?

.... **[1]**

(ii) What type of energy does the pot gain as it falls?

.... **[1]**

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(c) The pot hits the ground and breaks.

Complete the sentence, using **one** of the phrases below:

less than **more than** **the same as**

The total energy of the broken pot and its surroundings when it is on the ground is

.... the total energy of the pot and its surroundings when it is on the wall. **[1]**

(d) George and Kate are doing an experiment with falling objects.

They use two balls of the same shape and size, but **different masses**.
They release the balls from the same height above the floor.

The balls take the same time to drop to the floor.

Explain why the balls have the **same speed** but **different kinetic energy**.

....

....

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.... **[2]**

[Total: 6]

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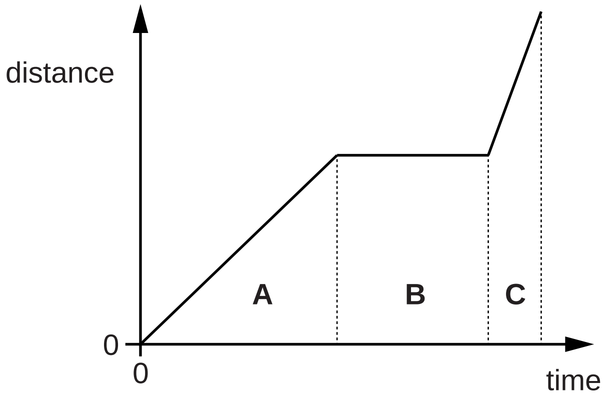
2 Alex goes for a ride on his bike.

The graph shows how his distance from the start of his ride changes with time.



(a) The graph has been divided into three regions **A**, **B** and **C**.

Which region or regions show each type of motion?

Put ticks (✓) in the correct box or boxes for each row.

You may tick more than one box in a row.

Type of motion	**Region**		
	A	**B**	**C**
Stationary			
Moving with constant speed			
Fastest speed			

[3]

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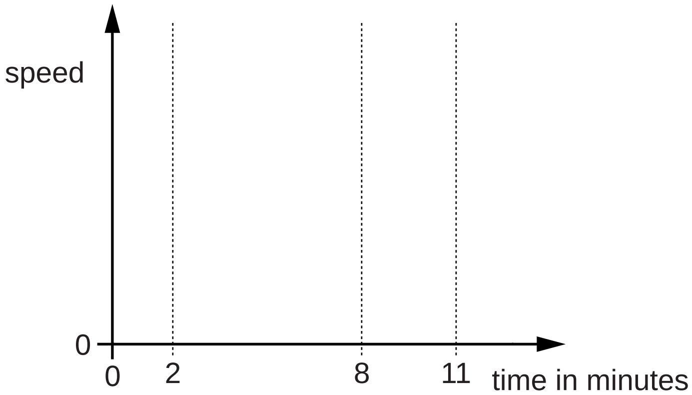
(b) On his return ride, Alex:

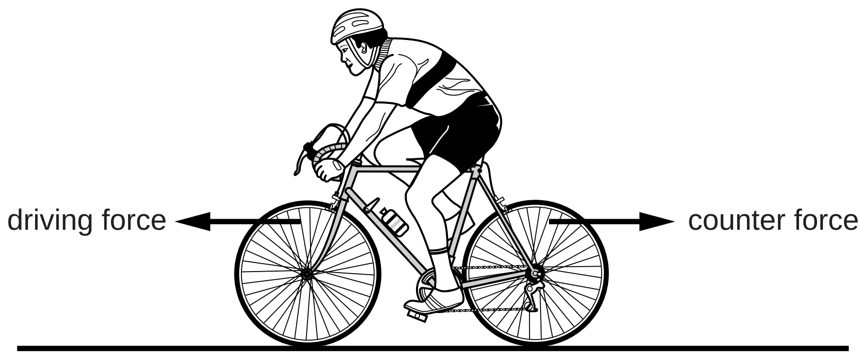
- accelerates from rest from 0 to 2 minutes
- then rides at constant speed from 2 to 8 minutes
- and finally slows down and comes to rest at 11 minutes.

On the sketch graph below show how Alex's **speed** changes with time during his return ride.



[3]

(c) Alex rides along a straight horizontal road.
There are two horizontal forces acting on him and his bike, as shown in the diagram.



(i) What is the counter force due to?

.... **[1]**

(ii) How does the driving force compare with the counter force when he is travelling at **constant speed**?

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

The driving force is **slightly bigger** than the counter force.	☐
The driving force is **much bigger** than the counter force.	☐
The driving force is **smaller** than the counter force.	☐
The driving force is **the same as** the counter force.	☐

[1]

[Total: 8]

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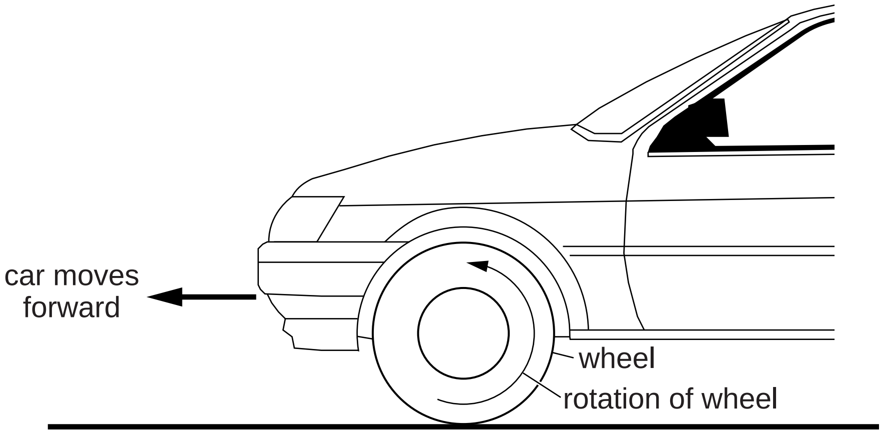
3 This question is about the forces that make a car move forwards.

The rotation of a wheel causes the car to move forward.



When the road is icy, it is more difficult to get the car moving.

Use ideas about forces to explain how the rotation of a wheel makes the car move forward and why it is more difficult to get the car moving when the road is icy.

You may draw **labelled** arrows on the diagram to help you answer the question.

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

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.... **[6]**

[Total: 6]

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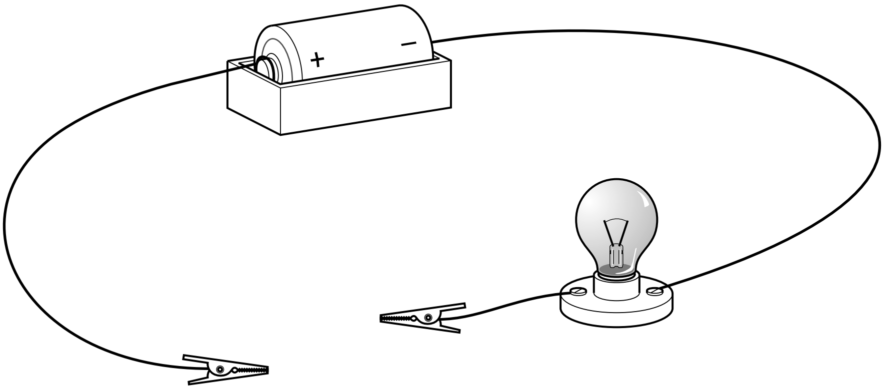
4 Anna sets up an electrical circuit to test different materials.



(a) The lamp glows when she puts a piece of copper into the circuit between the clips.

(i) Why is there a current in the circuit?

....

....

....

.... [2]

(ii) Suggest a change Anna could make to the circuit so that this lamp is brighter.

....

.... [1]

(b) Anna replaces the copper in the circuit with plastic. The lamp does not light.

Explain why the plastic is not a conductor.

....

.... [1]

[Total: 4]

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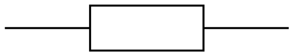
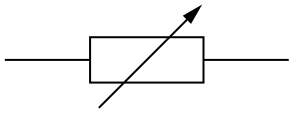
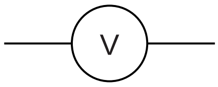
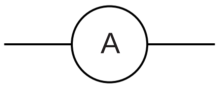
5 Draw one straight line from each symbol to its correct name.

Symbol	**Name**
	Ammeter
	Fixed resistor
	Variable resistor
	Voltmeter

[3]

[Total: 3]

Turn over for the next question

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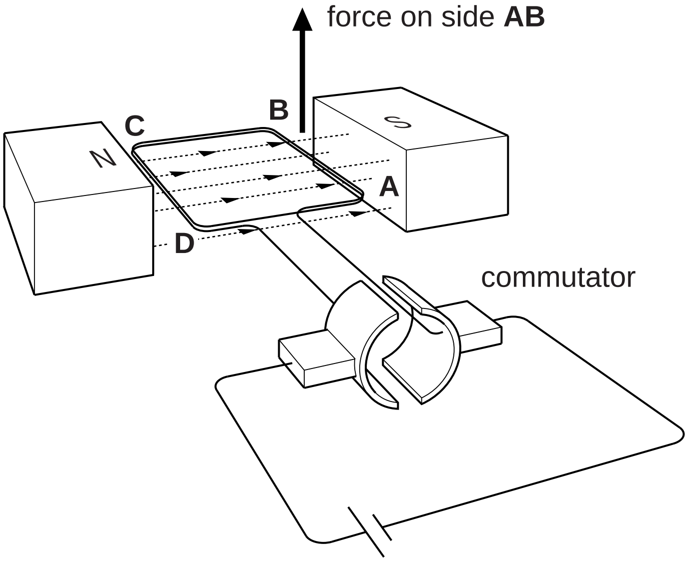
6 Lots of devices use an electric motor.

The diagram shows the main features of a motor.



(a) The arrow on the diagram shows the force acting on side **AB** when a current flows in the coil.

(i) Draw another arrow **on the diagram** showing the force on side **CD**. **[1]**

(ii) Why are there forces on sides **AB** and **CD**?

....

....

....

.... **[2]**

(b) Explain the function of the commutator in this motor.

....

....

....

.... **[3]**

[Total: 6]

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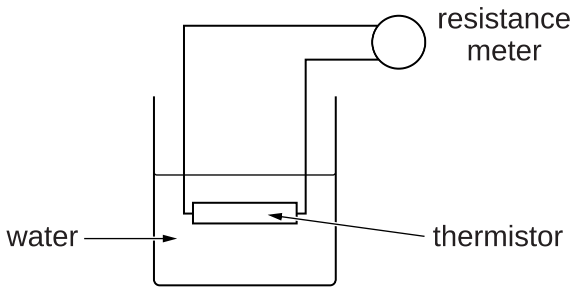
7 Sarah is doing an experiment with a thermistor.

She connects a meter to the thermistor to measure its resistance.

She puts the thermistor in a beaker of cold water and then warm water and records its resistance each time.

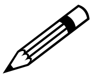


Here are Sarah's results.

Temperature of water	Resistance of thermistor in kΩ
cold	33.0
warm	28.5

Sarah thinks that there is a correlation between the temperature of the water and the resistance of the thermistor.

Is Sarah right about a correlation and what should she do to confirm her conclusion?



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

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.... **[6]**

[Total: 6]

8 A teacher does an experiment to measure the half-life of a radioactive source.

She begins by measuring the background radiation.

(a) State a source of background radiation.

.... **[1]**

(b) She places the source in front of a Geiger counter, which measures the amount of ionising radiation.

Radioactive materials give out ionising radiation.

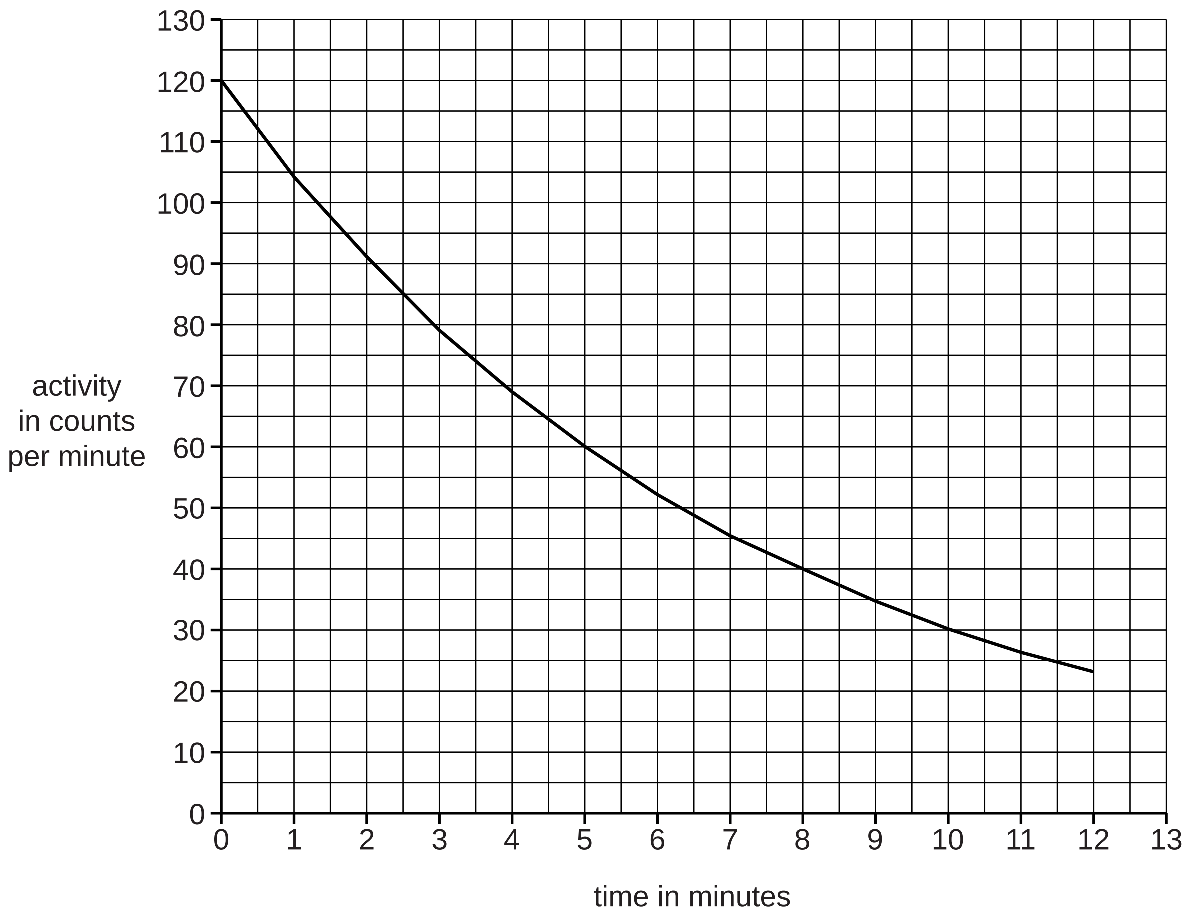
Which of the following types of radiation are given out by radioactive materials?

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

beta	☐
gamma	☐
red light	☐
ultraviolet	☐
X-rays	☐

[2]

(c) This graph shows how the activity of the radioactive source changes with time.



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(i) Jo says the half-life is 5 minutes.

Use the graph to decide if she is correct.

Justify your answer.

....

....

....

.... **[2]**

(ii) A source is considered safe when its activity becomes the same as background radiation.

The background radiation is 30 counts per minute.

Use the graph to estimate when this source is considered safe.

time = ... minutes **[1]**

(d) The teacher handles the radioactive source very carefully to avoid the risk of **irradiation** and **contamination**.

What is meant by **irradiation** and **contamination**?

irradiation ....

....

contamination ....

.... **[2]**

[Total: 8]

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9 **(a)** The diagram below is a way of showing the particles that make up an atom.

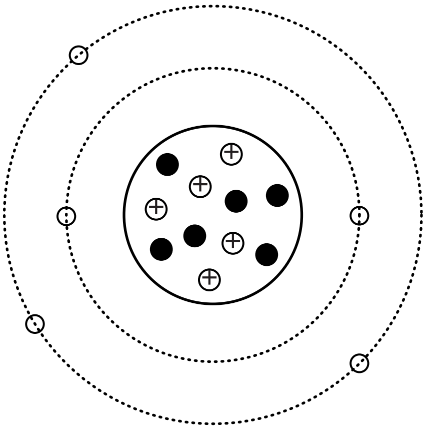
Draw a straight line from each box to show where the particles are in the atom. **[2]**

particle

electron

neutron

proton



(b) A nuclear reaction takes place in the Sun releasing a lot of energy.

Hydrogen nuclei join together to produce helium.

What is the name of this process?

Put a ring around the correct answer.

fission **fusion** **half-life** **radioactivity** **[1]**

(c) Nuclear power stations produce radioactive waste.

The waste is categorised as high level, intermediate level and low level.

Draw a straight line from each **level of waste** to its **method of disposal**.

Level of waste	Method of disposal
High	Mix with concrete; put in steel drums; keep in purpose-built stores.
Intermediate	Store under water for many years; put in drums in an underground store.
Low	Put in drums; surround by concrete; keep in landfill sites.

[2]

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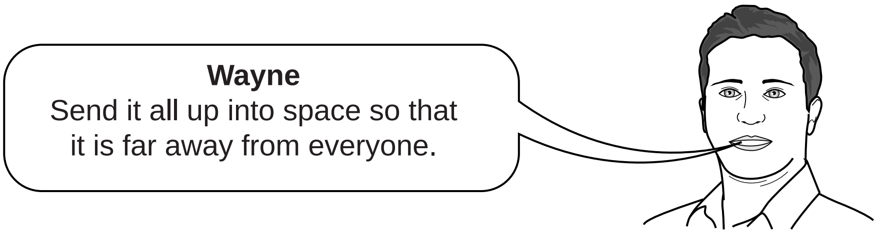
(d) Wayne has been thinking about the risk to humans from radioactive nuclear waste.



Do you think this is a good idea?

Justify your answer.

....

....

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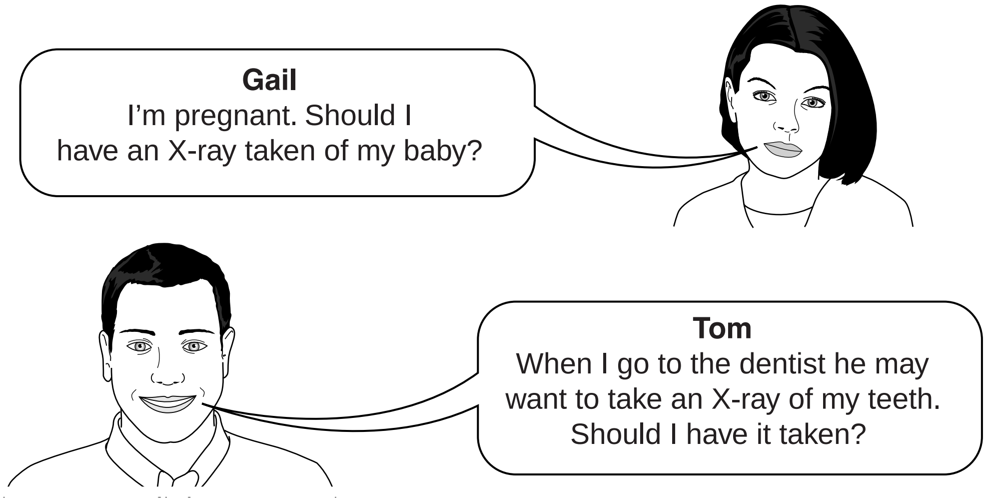
.... **[2]**

[Total: 7]

Turn over for the next question

10 Gail and Tom are discussing whether to have an X-ray taken.



Here are some data about radiation doses.

Source of radiation	Dose in mSv
Background radiation per year	2.600
X-ray of body	0.700
X-ray of teeth	0.005

Use the data and your own knowledge to advise Gail and Tom about the benefits and risks of having an X-ray taken.

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

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.... **[6]**

[Total: 6]

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