Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

GCSE

B652/02

GATEWAY SCIENCE

PHYSICS B

Unit 2 Modules P4 P5 P6 (Higher Tier)

THURSDAY 2 FEBRUARY 2012: Morning
DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (NF/SW) 12MPE01175 57100/1

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. 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).**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **A list of physics equations is printed on pages four and five.**
- **The total number of marks for this paper is 60.**

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EQUATIONS

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

$$v = u + at$$

$$s = \frac{(u + v)}{2} t$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2} at^2$$

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

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{refractive index} = n = \frac{\sin i}{\sin r}$$

i = incident angle
r = refracted angle

$$\sin c = \frac{n_r}{n_i}$$

c = critical angle
n_r = refractive index of less dense material
n_i = refractive index of more dense material

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$V_{out} = V_{in} \times \frac{R_2}{(R_1 + R_2)}$$

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$V_p I_p = V_s I_s$$

Answer ALL the questions.

SECTION A – MODULE P4

1 Static electricity has many uses.

(a) One use of static electricity is in defibrillators.

The paddles of the defibrillator are charged.

(i) Describe how the doctor restarts the patient's heart.

In your answer write about

- **what the doctor does with the charged paddles**
- **how she makes sure charge reaches the heart.**

_____

_____

_____ **[2]**

(ii) What happens to the heart when the charge passes through it?

_____ **[1]**

(b) Static electricity can be DANGEROUS.

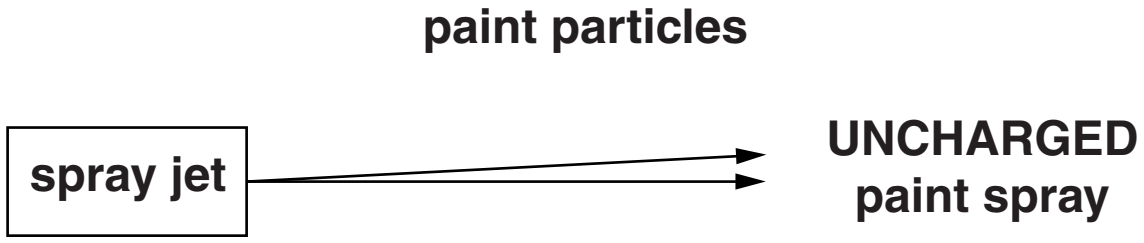
Describe ONE SITUATION where static electricity is dangerous.

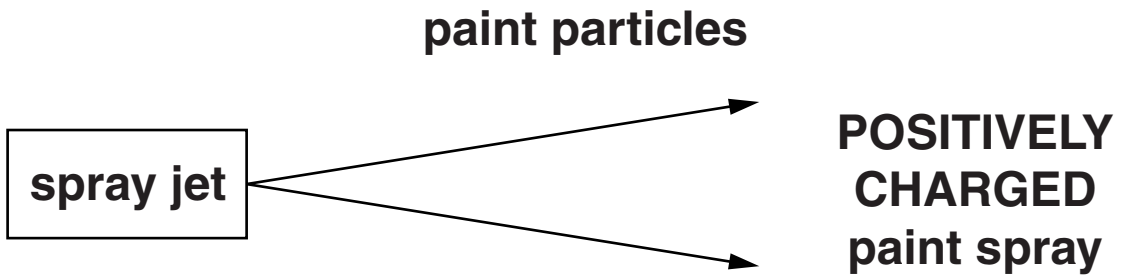
_____

_____ **[1]**

(c) Static electricity can be useful for paint spraying.

Look at the diagrams.





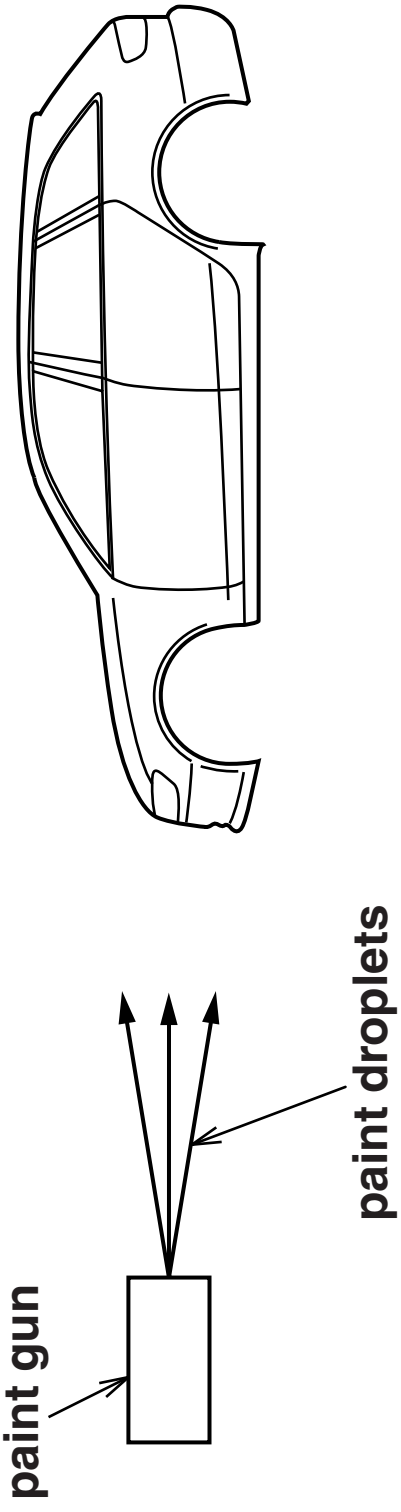
(i) Why does the positively charged paint spray spread out more?

_____

_____ **[1]**

(ii) Look at the diagram.

The car is spray painted using electrostatics.



Electrostatics helps to completely cover the car in paint.

Explain how.

_____

_____

_____ **[2]**

[Total: 7]

2 ULTRASOUND is used in hospitals.

Ultrasound has a very high frequency.

(a) What does FREQUENCY mean?

_____

_____ **[1]**

(b) Write down one USE for ultrasound in hospitals.

_____

_____ **[1]**

[Total: 2]

3 Nuclear power stations use uranium in a nuclear reaction.

(a) In the nuclear reaction, uranium nuclei split.

What is the name of this process?

_____ **[1]**

(b) There are many stages in the generation of electricity in a nuclear power station.

Look at this list.

TURNING A TURBINE

TURNING A GENERATOR

PRODUCING STEAM

PRODUCING HEAT

NUCLEAR REACTION

Complete the table by putting the five stages in the correct order.

Two stages have been done for you.

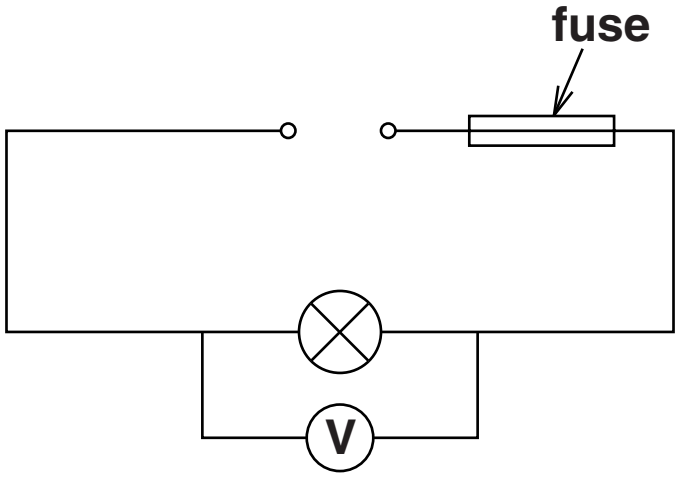
ORDER	STAGE
1	nuclear reaction
2	
3	
4	
5	turning a generator

[1]

[Total: 2]

4 Amrit has three fuses she could put into a circuit.

Look at the diagram.



The voltage across the lamp is 230V.

The resistance of the lamp is 69 Ω.

Amrit has a 3 A, a 5 A and a 13 A fuse.

Calculate the CURRENT in the lamp and explain why the 5 A fuse is the best choice.

The equations on pages 4 and 5 may help you.

_____

_____

answer _____ A

The 5 A fuse is the best choice because _____

_____

_____ **. [3]**

[Total: 3]

5 Alpha and beta radiations are emitted from unstable nuclei.

(a) An alpha (α) particle is a helium nucleus:

$$^{4}_{2}\alpha$$

A uranium (U) nucleus decays to form thorium (Th) and an alpha particle.

Complete the nuclear equation for uranium decay.

Put an answer in each box.

$$^{238}_{92}U \rightarrow \boxed{} \; Th + {}^{4}_{2}\alpha$$

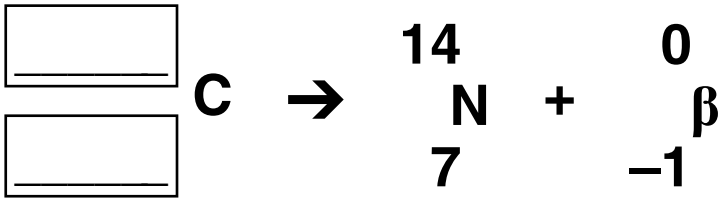
[1]

(b) A beta (β) particle is a fast moving electron from the nucleus:

$$^{0}_{-1}\beta$$

A radioactive carbon (C) nucleus decays to form nitrogen (N) and a beta particle.

Complete the nuclear equation for carbon decay. Put an answer in each box.



[1]

(c) Radioactive radium has a half life of 1600 years.

The count rate from a radium source is 1200 counts per minute.

How long will it take for the count rate to become 75 counts per minute?

Put a (ring) around the correct answer.

1 920 000 YEARS

6400 YEARS

3200 YEARS

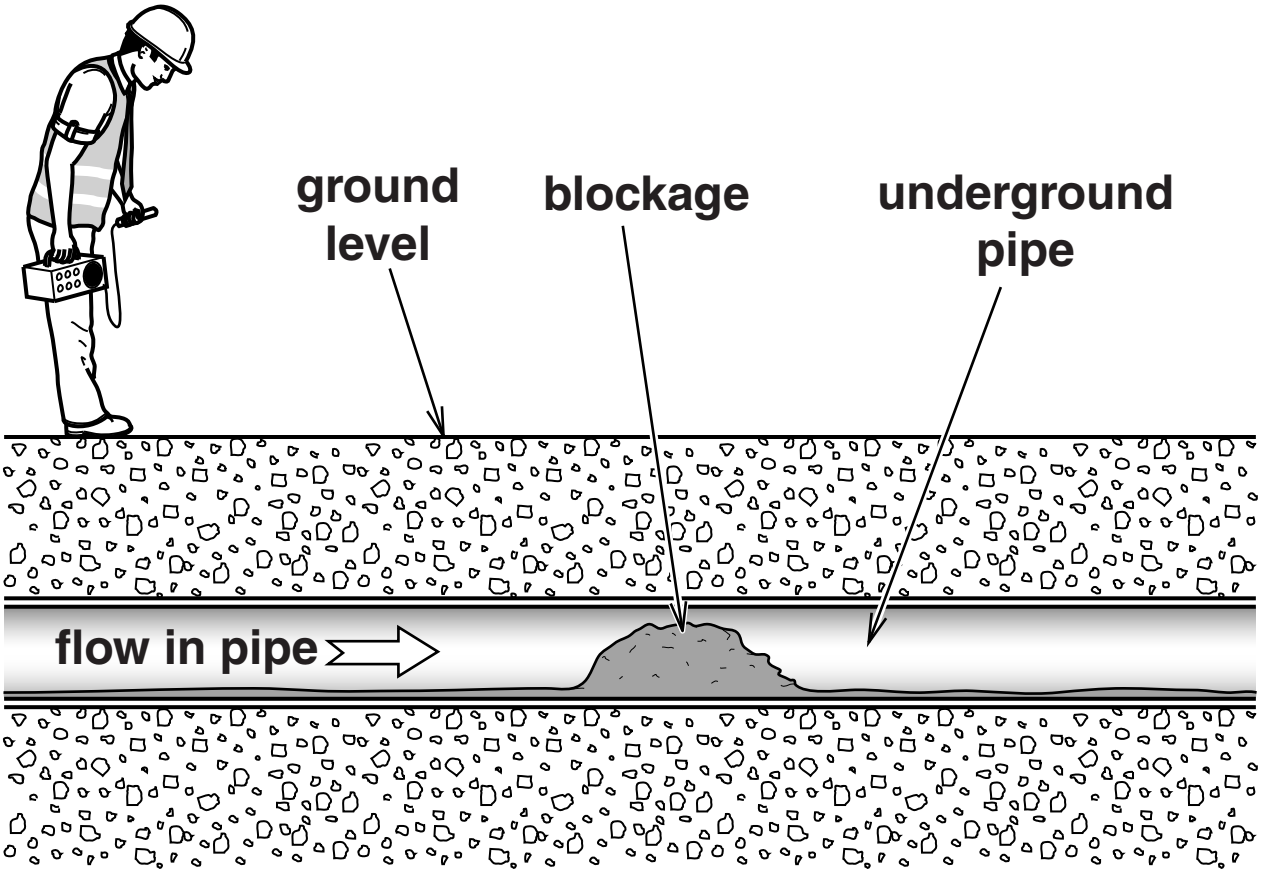
400 YEARS

100 YEARS

[1]

(d) Radioactive tracers can be used to detect blockages in pipes underground.

Look at the diagram.



Explain in detail how a radioactive tracer can be used to detect the blockage.

In your answer write about

- **the type of tracer used**
- **where the tracer is placed**
- **where the radiation is detected**
- **how the blockage is found.**

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

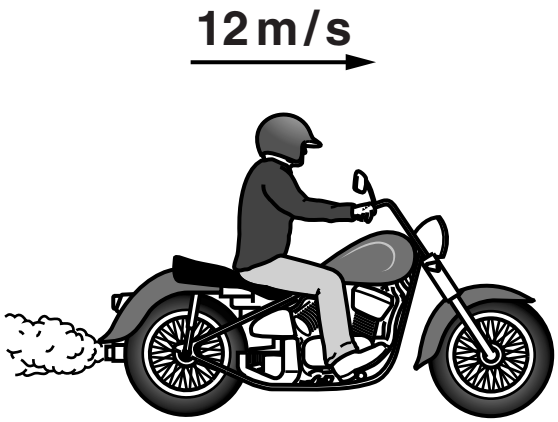
_____

_____ **[3]**

[Total: 6]

6 Simon and Dave are riding bikes.

(a) Look at the diagram of Dave riding his bike.



Dave has a mass of 80 kg and his bike has a mass of 220 kg.

His speed is 12 m/s.

Calculate the MOMENTUM of Dave and his bike.

The equations on pages 4 and 5 may help you.

_____

_____

answer _____ kg m/s [2]

(b) Dave's initial speed is 12 m/s.

He accelerates at 0.5 m/s^2 for 5 s.

Calculate Dave's FINAL speed.

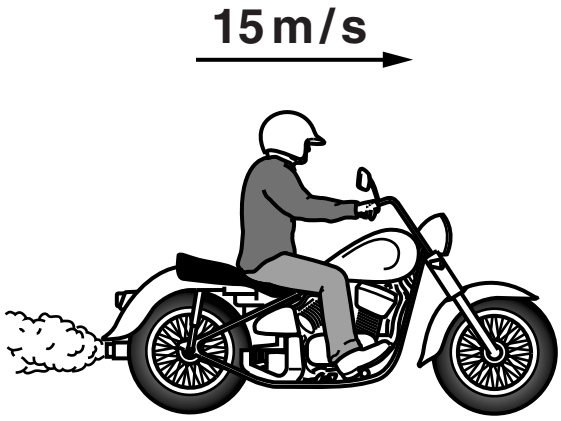
The equations on pages 4 and 5 may help you.

_____

_____

answer _____ m/s [2]

(c) Look at the diagram of Simon riding his bike.



Simon ACCELERATES from 15 m/s to 33 m/s.

This takes 12 s.

Calculate the DISTANCE travelled during this acceleration.

The equations on pages 4 and 5 may help you.

_____

_____

answer _____ m [2]

[Total: 6]

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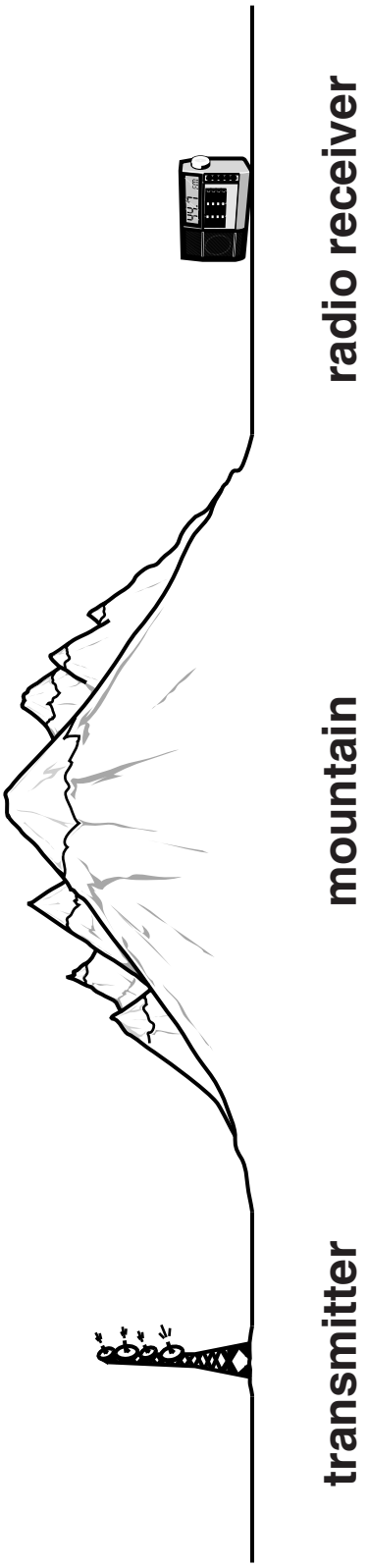
7 Radio waves carry signals.

Look at the diagram.



(a) The mountain is between the transmitter and the radio receiver.

(i) The radio signal is transmitted at 20 MHz (20 000 000 Hz).

Signals transmitted at this frequency reach the receiver.

Suggest TWO ways the signal could reach the receiver.

_____

_____

_____

_____ **[2]**

(ii) The transmitter also emits waves of frequency 35 GHz.

These waves are much weaker when they reach the receiver.

Suggest why.

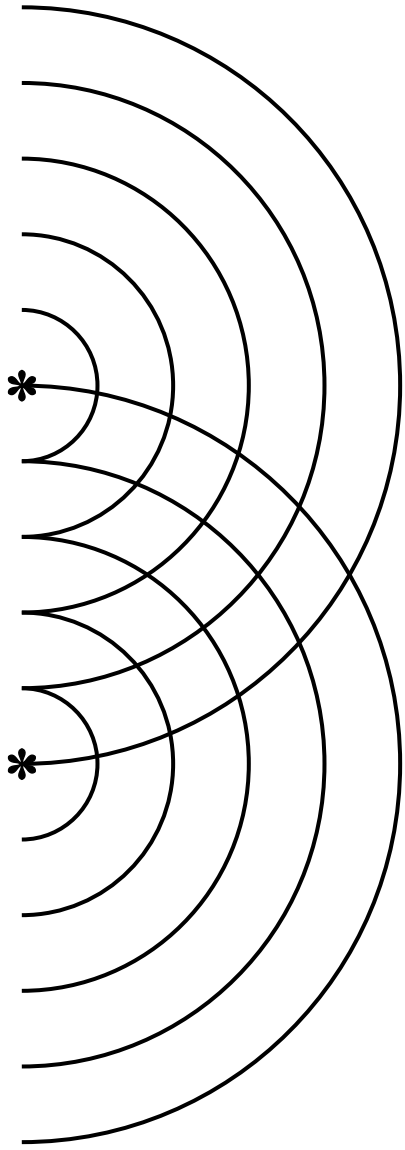
_____

_____

_____ **[2]**

(b) Two transmitters labelled ✻ emit circular waves of the same frequency.

Look at the diagram showing the crests of the waves.



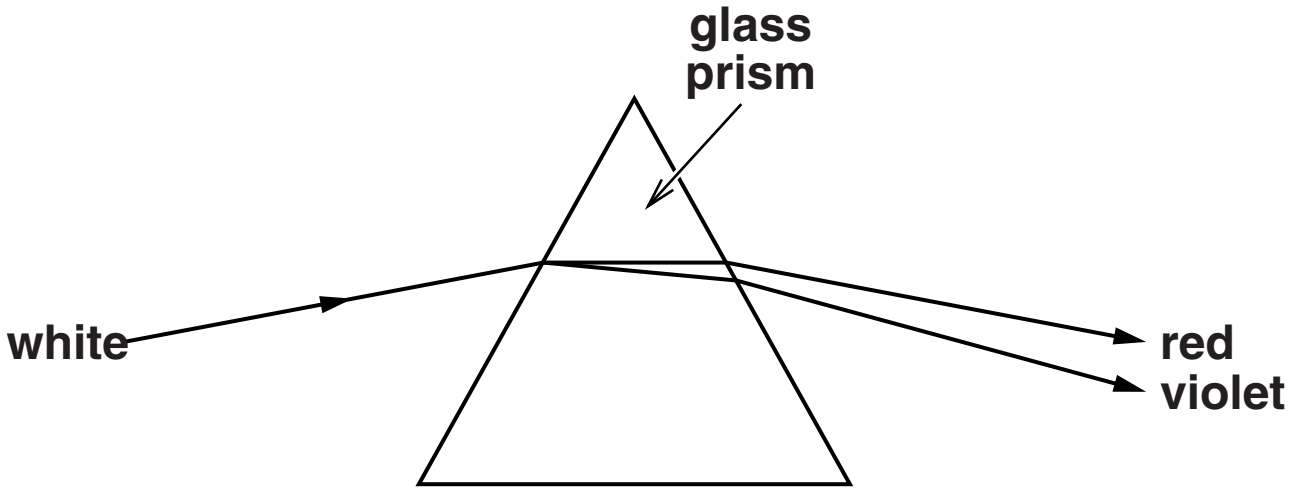
Clearly mark a point on the diagram to show where CONSTRUCTIVE interference occurs. Label this point C.

Clearly mark a point on the diagram to show where DESTRUCTIVE interference occurs. Label this point D.

[2]

[Total: 6]

8 Look at the diagram of white light as it passes through a glass prism.



The white light disperses into a spectrum from red to violet.

Explain why red and violet light are deviated differently.

In your answer write about

- **speed**
- **refractive index.**

_____

_____

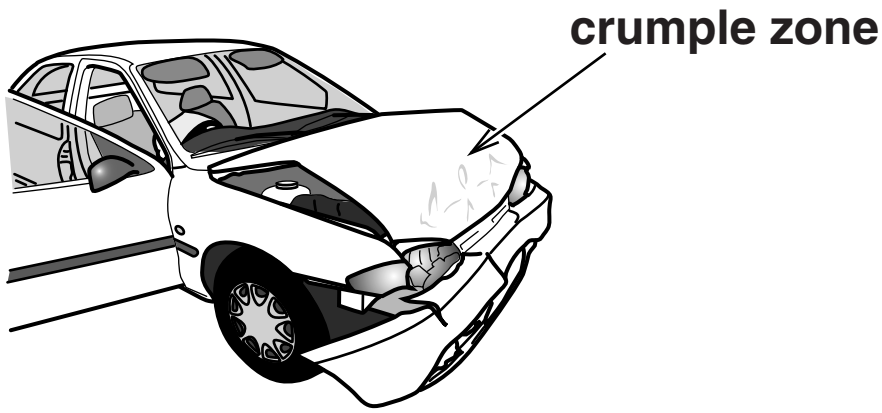
_____

_____ **[3]**

[Total: 3]

9 A data logger records the forces on a crash dummy used for testing car safety.

The test car crashes into a barrier at 64 km/hr (40 miles per hour).



(a) The car and the barrier experience FORCES.

Describe the forces on the car and the barrier in terms of their size and direction.

size _____

_____

direction _____

_____ **[2]**

(b) An identical car is fitted with an IMPROVED crumple zone.

This car also crashes into the barrier at 64 km/hr (40 mph).

The improved crumple zone REDUCES the forces on the crash dummy.

Explain how.

The equations on pages 4 and 5 may help you.

In your answer, use ideas about

- **time**
- **momentum.**

_____

_____

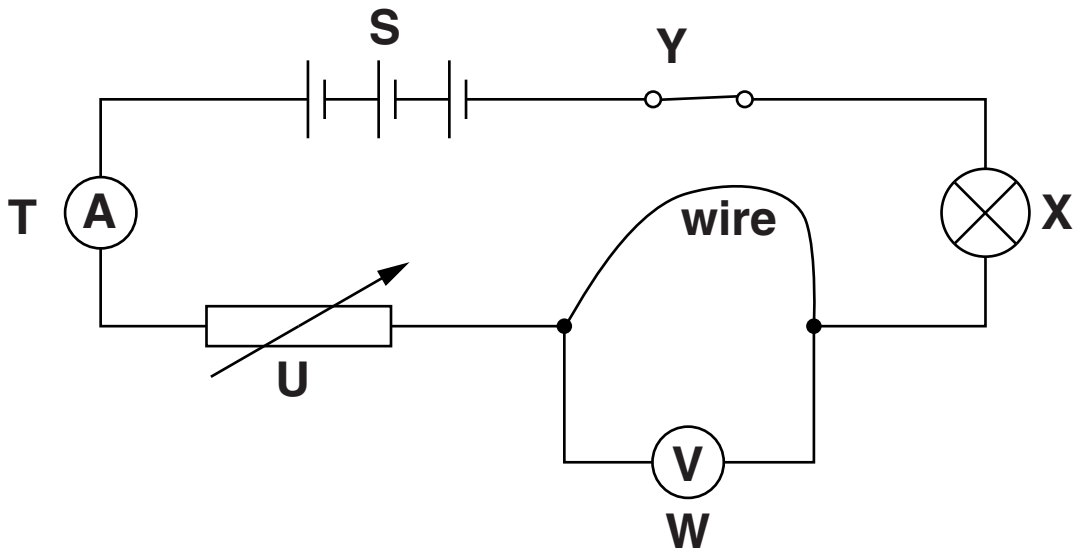
_____

_____

_____ **[3]**

[Total: 5]

10 Asif sets up a circuit.



(a) There is a variable resistor (U) in the circuit.

Altering the value of the variable resistor will change other things in the circuit.

Complete the sentence.

Decreasing the resistance of the variable resistor

will INCREASE the _____

in the circuit and _____ the

BRIGHTNESS of component _____ .

[2]

(b) When the circuit is complete Asif writes down two measurements

- **current through the wire = 0.4 A**
- **voltage across the wire = 8V.**

Calculate the RESISTANCE of the wire.

The equations on pages 4 and 5 may help you.

_____

_____

_____

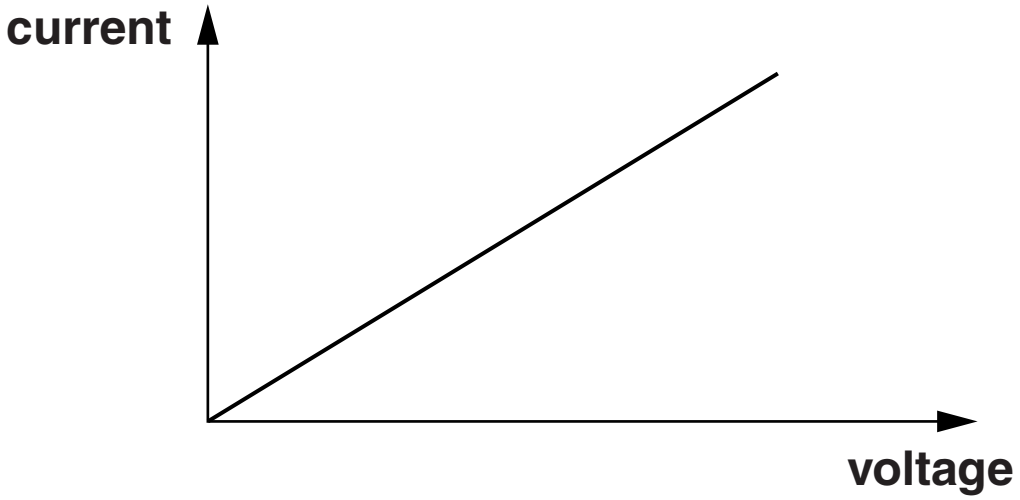
_____

answer _____ Ω **[2]**

(c) Asif adjusts the variable resistor.

He records different values of current and voltage on the meters.

Look at his graph.



Describe how he can use the graph to calculate the RESISTANCE of the wire.

_____

_____

_____ **[2]**

[Total: 6]

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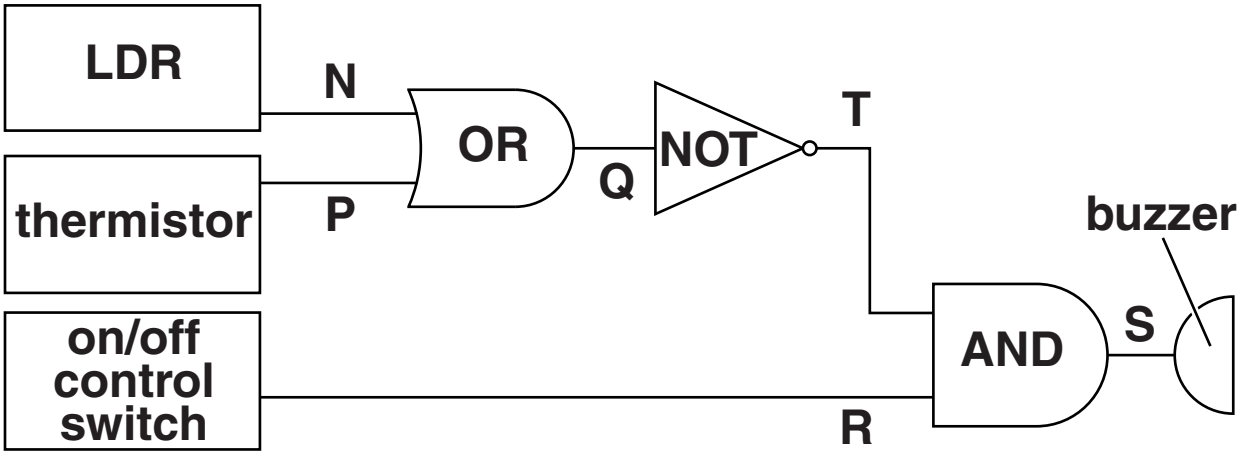
11 Georgina grows tomatoes in large greenhouses.

She wants to protect the tomatoes.

She designs an electronic system with three logic gates.

A buzzer sounds if it gets too COLD during the NIGHT.

Look at the diagram of the electronic system.



(a) The resistances of the LDR and the thermistor can change.

Complete the sentence about the LDR.

The resistance of the LDR INCREASES when

_____

_____ **. [1]**

(b) Georgina draws the truth table for her system.

It can describe how an electronic system works.

PART of her truth table is shown.

Complete the part of the truth table for Georgina's system.

Use it to explain how the system will alert Georgina when she needs to protect the tomato crop.

INPUTS TO GATES			Q	T	S
N	P	R			
0	0	0			
0	0	1			
0	1	0			
1	0	0			
1	1	1			

Explanation.

_____

_____

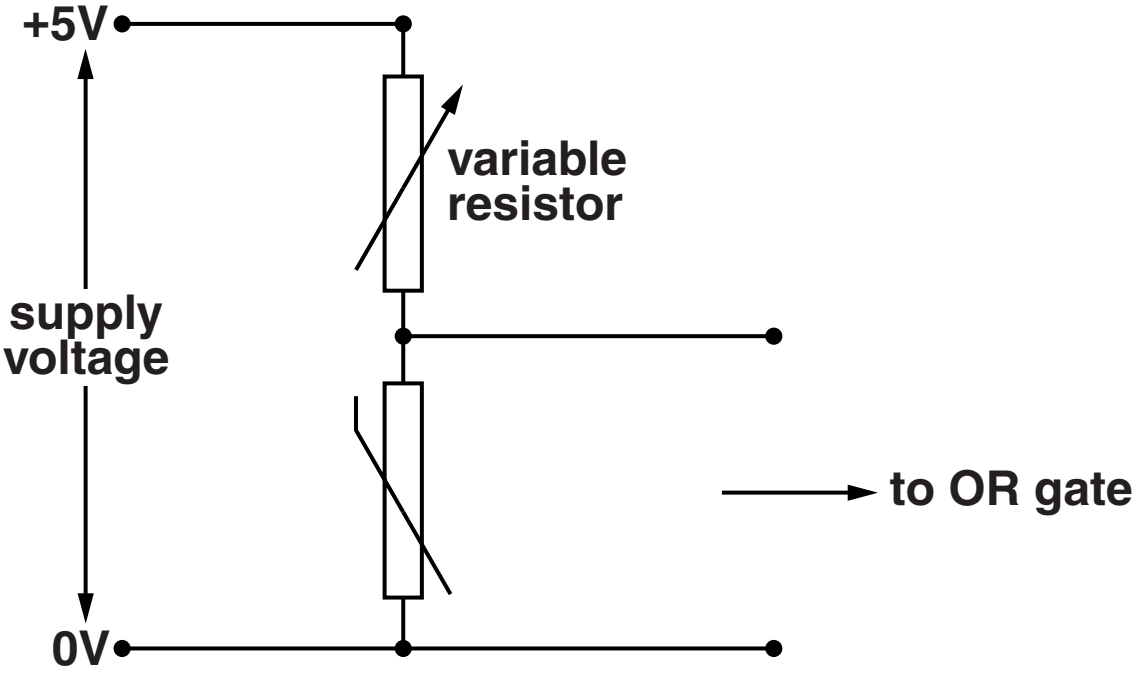
_____

_____

_____ **[3]**

(c) The thermistor part of the system can be improved by using a variable resistor in a potential divider.

Look at the circuit that would do this.



Complete the sentences to explain how this arrangement works.

As the temperature of the thermistor falls its

resistance _____ .

This causes its share of the supply voltage to

_____ .

This will _____ the

_____ input to the OR gate.

Adjusting the variable resistor will change the

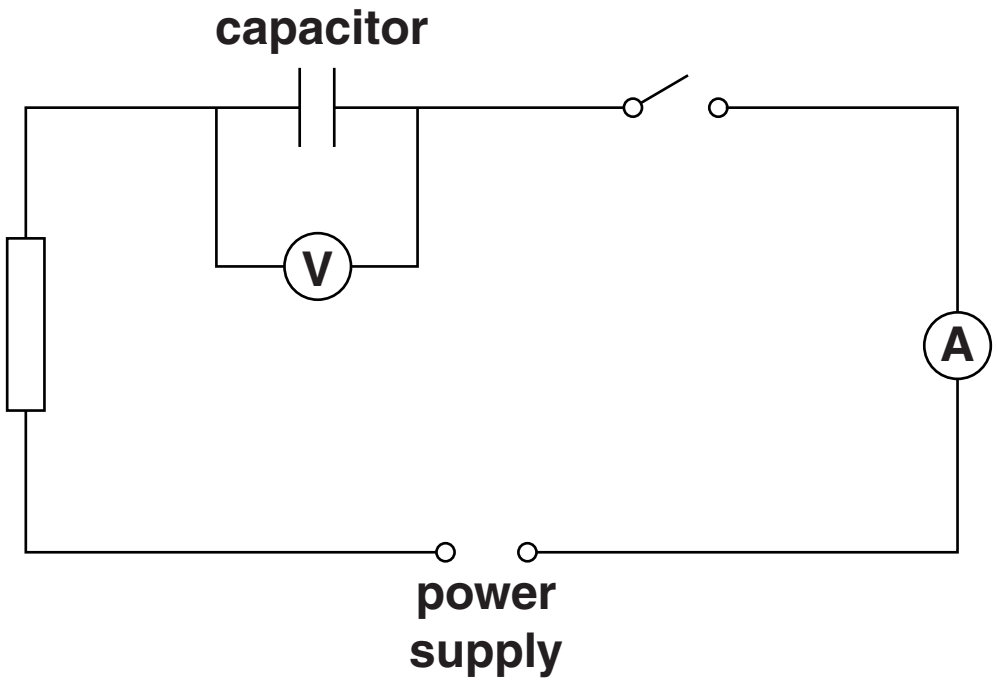
output _____ from the potential

divider and alter the _____ at which the OR gate switches on. [3]

[Total: 7]

12 Jonas sets up a circuit to investigate a CAPACITOR.

Look at the circuit.



Describe what happens when the circuit is switched on.

In your answer include ideas about

- **charge**
- **voltage.**

_____

_____

_____

_____ **[3]**

[Total: 3]

13 This question is about transformers and electric motors.

(a) Transformers are used in many everyday appliances.

There are three types of transformer

- **step up**
- **isolating**
- **step down.**

Which type is used in a bathroom shaver socket?

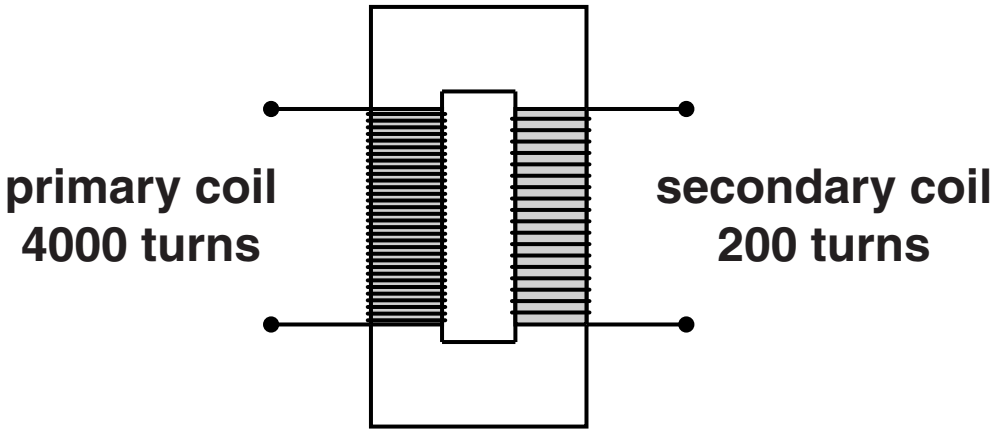
answer _____

Explain how this type of transformer makes the circuit safer.

_____

_____ **[1]**

(b) The diagram represents a transformer.



The following statements describe how a transformer works.

They are NOT in the correct order.

Put numbers in the ORDER boxes to show the correct sequence.

One has been done for you.

STATEMENT	ORDER
This produces an alternating magnetic field in the core.	
This produces an alternating current in the primary coil.	
This induces a voltage in the secondary coil.	
This produces an alternating magnetic field in the primary coil.	
This produces an alternating magnetic field in the secondary coil.	
An alternating voltage is supplied across the primary coil.	1

[2]

(c) Electric motors are used in many household appliances, such as washing machines.

They are different from the simple model motors made in class.

One of the main differences is that the magnets in the practical motor have CURVED poles.

This produces a RADIAL magnetic field.

Explain how this improves the working of the motor.

_____

_____ **[1]**

[Total: 4]

END OF QUESTION PAPER