OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

PHYSICS B

Unit 2 Modules P4 P5 P6 (Higher Tier)

B652/02

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)

Monday 31 January 2011
Afternoon

Duration: 1 hour

B652020

B621950111

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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- Do **not** write in the bar codes.

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 page two.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

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

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

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

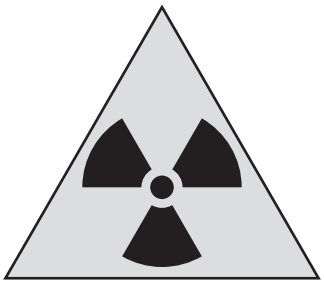
$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$V_p I_p = V_s I_s$$

Answer **all** the questions.

Section A – Module P4

1 This question is about nuclear radiation.



(a) Nuclear radiation is given out by the nucleus of an unstable atom.

Two types of nuclear radiation are alpha particles and beta particles.

Complete the sentences.

(i) An alpha particle is a ..... nucleus. **[1]**

(ii) A beta particle is a fast moving ..... . **[1]**

(b) The activity of a radioactive element was 160 decays per second.

After six years the activity has fallen to 20 decays per second.

Calculate the half life of the element.

.....

.....

.....

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

(c) Background radiation can come from natural sources such as food and living things.

It can also come from man-made sources such as testing nuclear weapons.

Give **another** example of each type of source.

natural sources .....

.....

man-made sources .....

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

(d) Ancient wood can be preserved in a peat bog.

Its age can be calculated by measuring the amount of a radioactive element in the wood.

Write down the name of this radioactive element.

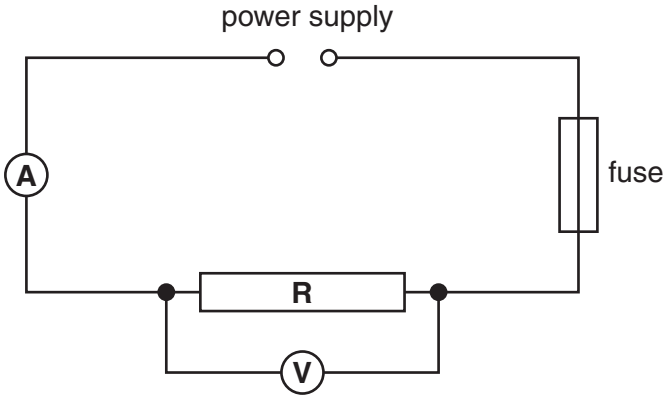
Choose from

argon **carbon** **chlorine** **oxygen**

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

[Total: 6]

2 Raphael sets up a circuit.



He measures the current in the resistor, **R**, and the voltage across it.

Look at his results.

current = 0.5 amps

voltage = 6 volts

Calculate the resistance of **R**.

The equations on page 2 may help you.

.....

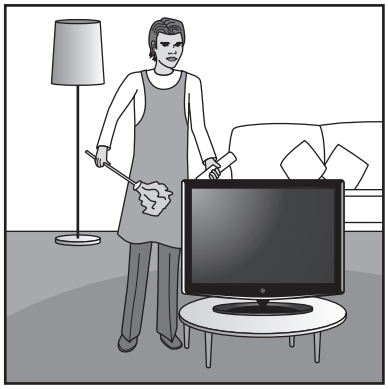
.....

.....

answer ..... Ω **[2]**

[Total: 2]

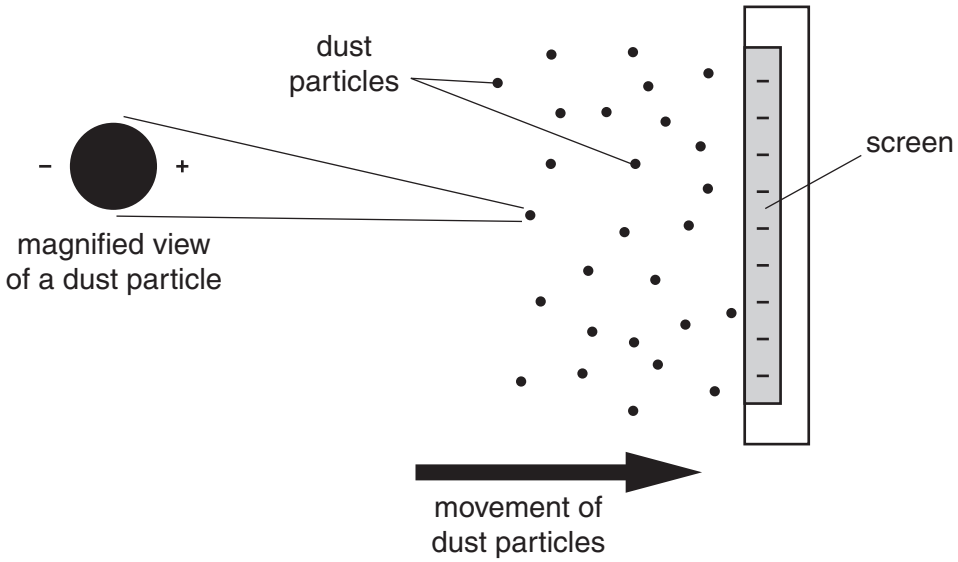
3 This question is about a **problem** caused by electrostatics.



Kyle dusts his television screen.

The next day the screen is very dusty again.

Look at the diagram below that shows why the screen becomes dusty.



Explain how the screen becomes dusty again.

In your answer write about

- electrostatic charge
- electrons
- attraction and repulsion.

.....

.....

.....

.....

.....

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

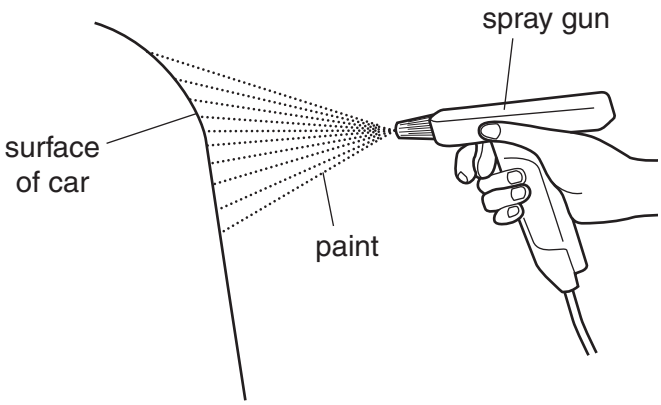
[Total: 3]

4 This question is about a **use** of electrostatics.

Cars are spray painted. The paint particles are all positively charged (+).

Spray painting

- gives an **even** coat of paint
- paints **all** parts of the car
- wastes **less** paint.



Complete the sentences to describe how static electricity is useful for spray painting.

The paint particles are all positively charged.

This causes the paint particles to ..... each other and produce a ..... spray.

The surface of the car has ..... electrostatic charge so the paint is ..... to it. **[2]**

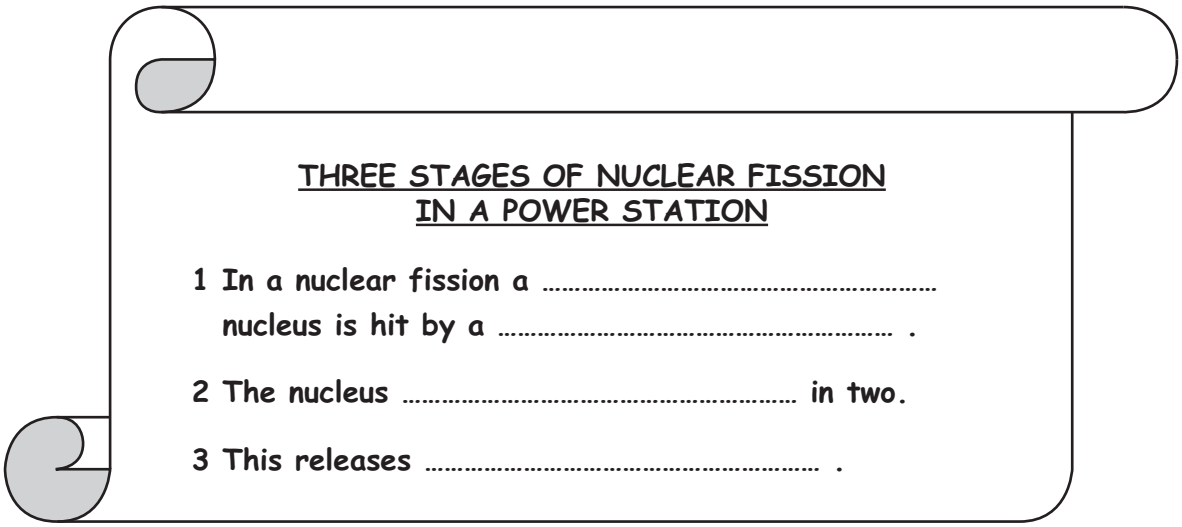
[Total: 2]

5 **(a)** Samuel learns about **nuclear fission** in nuclear power stations.

His teacher tells him to get information about this from the internet.

Samuel writes a summary of what he finds out.

Finish the sentences to complete Samuel's findings.



[2]

(b) Samuel also learns that **radioactive decay** is a different process to nuclear fission.

Sometimes electromagnetic radiation is emitted from a radioactive element.

Complete the sentences.

Choose from

electron

gamma

light

nucleus

outer part

X-ray

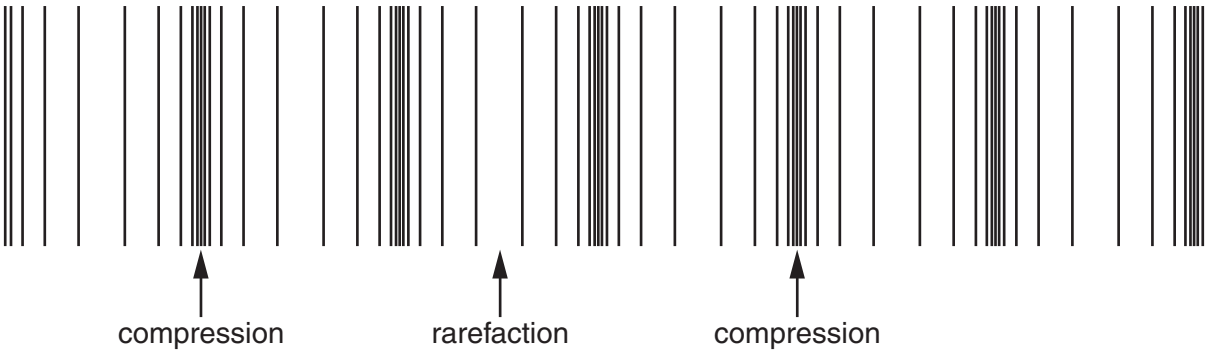
The electromagnetic radiation emitted in radioactive decay is ..... radiation.

This radiation is emitted from the ..... of a radioactive atom. **[2]**

[Total: 4]

6 Ultrasound is a longitudinal wave.

Look at the diagram of a longitudinal wave.



(a) Ultrasound waves travel through the air.

Air molecules in an ultrasound wave move.

The sentences describe the motion of the air molecules.

Complete the sentences.

The air molecules move ..... and ..... .

The air molecules move in the ..... that the ..... is travelling.

[2]

(b) Why can humans **not** hear ultrasound?

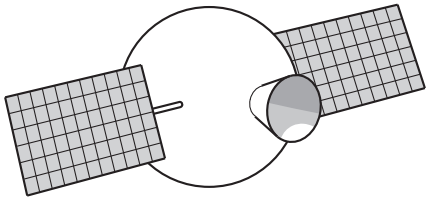
.....

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

[Total: 3]

Section B – Module P5

7 Artificial satellites orbit the Earth.



(a) Geostationary satellites orbit the Earth.

To maintain circular motion these satellites need a centripetal force.

(i) What provides the centripetal force for these satellites?

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

(ii) What is meant by a satellite in **geostationary** orbit?

.....

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

(iii) How long does it take a geostationary satellite to orbit the Earth?

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

(b) Artificial satellites can orbit at different heights above the Earth.

Satellites in lower orbits travel faster.

Explain why.

.....

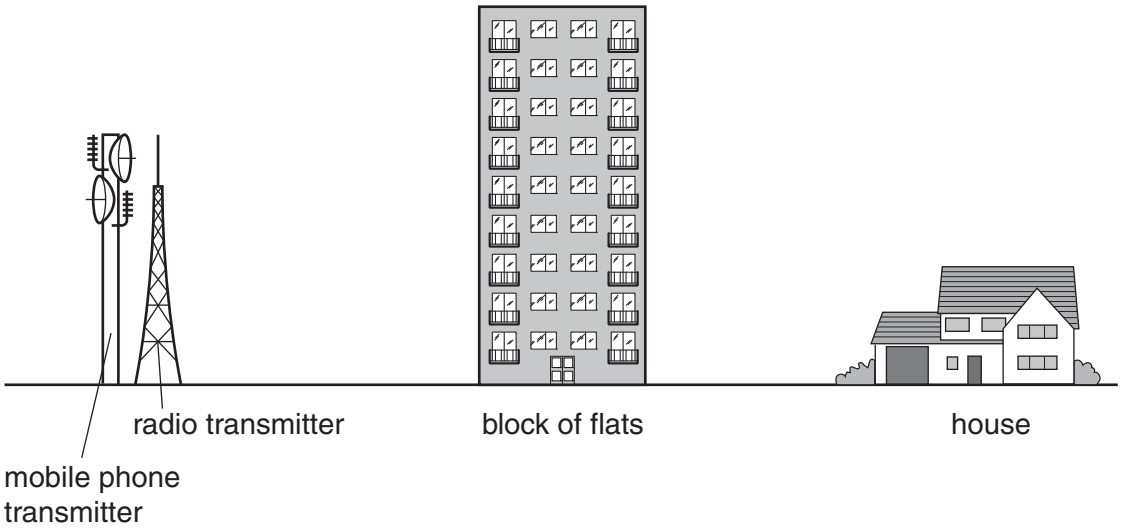
..... **[1]**

[Total: 4]

8 This question is about communicating with waves.

(a) Waves are emitted from two different transmitters.

Look at the diagram.



The two transmitters have equal power.

The **mobile** phone transmitter uses microwaves.

The **mobile phone** signals are very weak when they reach Jenny's house.

Radio signals are strong when they are received by the aerial in Jenny's house.

Explain why the radio signals are stronger than the microwaves at Jenny's house.

In your answer use ideas about

- diffraction
- wavelength.

.....

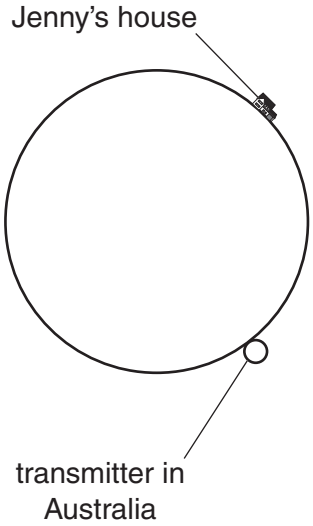
.....

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

(b) Jenny has satellite TV fitted. She watches a live broadcast from Australia.

Show how the waves get from Australia to her house.

Draw your answer on a **labelled** diagram, and **name** the type of waves used.



not to scale

[2]

[Total: 4]

9 This question is about **velocity** and **momentum**.

(a) Look at the diagram of the car accelerating.

(i) The car is travelling with a velocity of 5 m/s.

It then accelerates at 0.5 m/s^2.

Calculate the final velocity after 12 s.

The equations on page 2 may help you.

.....

.....

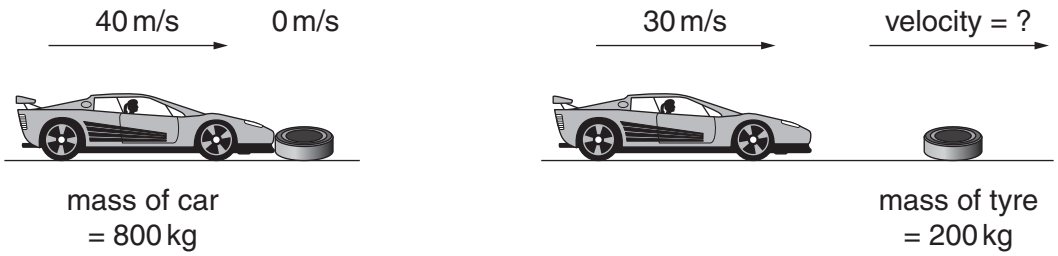
answer ..... m/s **[2]**

(ii) What happens to the **momentum** of the car when it accelerates?

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

(b) A fast moving car hits a large tyre. This slows the car down.

Look at the diagrams.



The tyre moves away from the car very quickly.

Calculate the velocity of the tyre as it moves away.

The equations on page 2 may help you.

.....

.....

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.....

.....

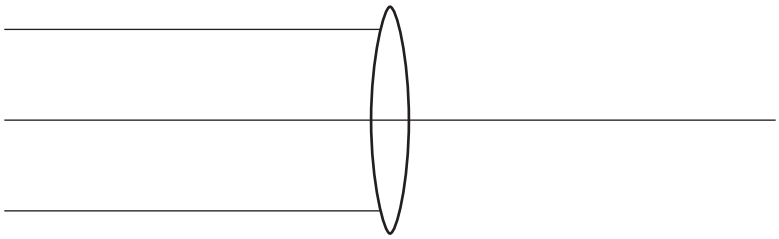
answer ..... m/s **[2]**

[Total: 5]

10 This question is about using light.

(a) A parallel beam of light hits a **convex** lens.

Look at the diagram.

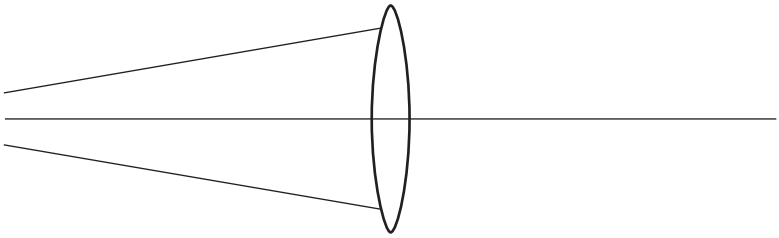


The light travels through the lens.

Complete the diagram to show what happens to the light. **[1]**

(b) A diverging beam of light hits the same convex lens.

Look at the diagram.

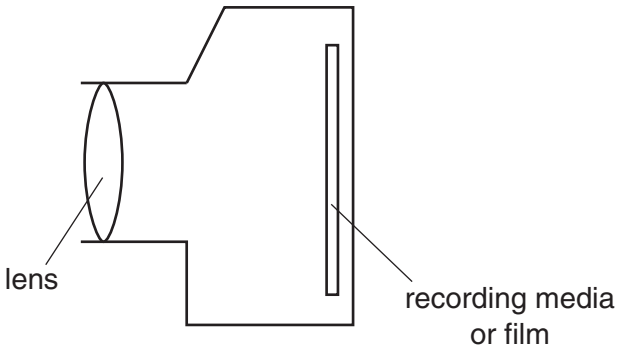


The light travels through the lens.

Complete the diagram to show what happens to the light. **[1]**

(c) Convex lenses are used in cameras.

Look at the diagram.



The camera can be focussed to give a sharp picture.

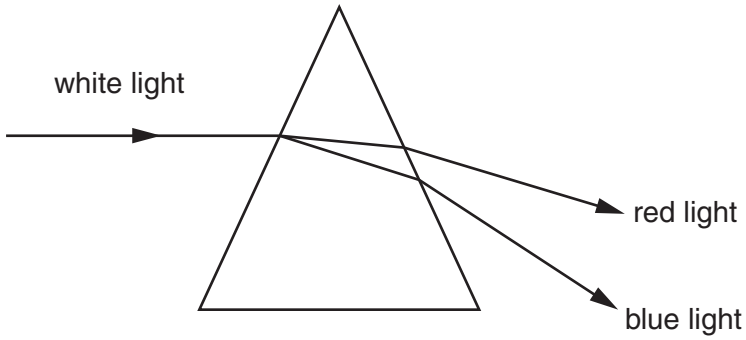
What happens to the lens when the camera is being focussed?

.....

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

(d) A prism can be used to split up white light.

Look at the diagram.



White light is refracted when it enters the prism.

(i) What happens to the **speed** of light when it enters the prism?

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

(ii) What happens to the **wavelength** of light when it enters the prism?

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

(iii) The light splits into different colours.

Blue light is refracted more than red light.

Explain why. In your answer use ideas about

- speed
- wavelength.

.....

.....

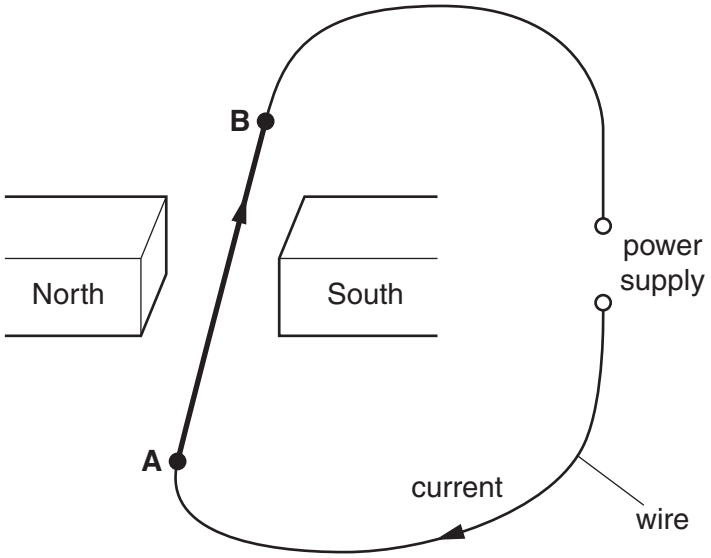
.....

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

[Total: 7]

Section C – Module P6

11 Look at the diagram of a wire in a magnetic field.



The current flows in the direction shown in the diagram.

The wire moves **downwards**.

(a) The current is reversed. It now flows from **B** to **A**.

The magnet has not changed.

In which direction will the wire now move?

Choose from

upwards

downwards

to North pole of magnet

to South pole of magnet

towards A

towards B

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

Turn over for the remainder of question 11

(b) The current now flows in its original direction from **A** to **B**.

The magnetic field is reversed.

In which direction will the wire now move?

Choose from

upwards

downwards

to North pole of magnet

to South pole of magnet

towards A

towards B

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

[Total: 2]

12 Glynn's house has temperature controls. These contain thermistors.

Look at the table.

temperature in °C	current in mA
15	6.5
20	6.9
25	7.3
30	7.6

(a) The table shows how the temperature affects the current in the thermistor.

The voltage across the thermistor is constant.

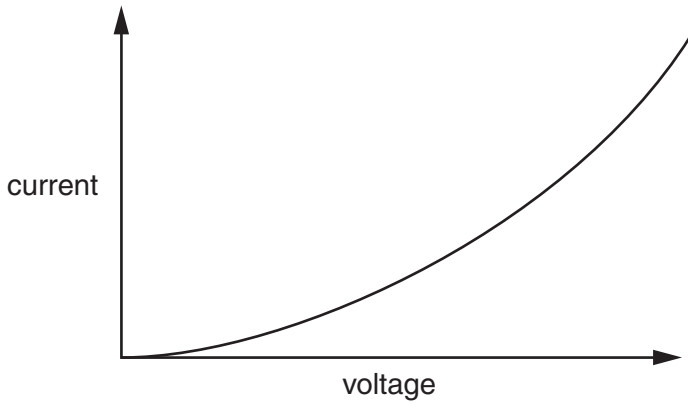
Use the table to complete the sentence.

As the temperature increases the resistance of the thermistor ..... . **[1]**

(b) Glynn investigates the properties of the thermistor.

He varies the voltage across it.

The graph shows how the current in the thermistor depends on the voltage across it.



Suggest why the graph is not a straight line.

.....

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

[Total: 2]

13 Electricity is generated when an electromagnet rotates inside a coil of wire.

Describe **three** ways this generator can be changed to produce a **higher** voltage.

.....

.....

.....

.....

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

[Total: 3]

14 Electricity needs to be transmitted around the country from power stations.

(a) Transformers are used to change the size of an alternating voltage.

Transformers are made by winding coils of wire on a core.

(i) What material is used to make the core of a transformer?

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

(ii) Step-up transformers are built differently to step-down transformers.

How are step-up transformers **built** differently?

.....

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

(b) (i) When a current flows through a power line, energy is lost in the form of heat.

Doubling the current wastes four times the amount of energy.

Explain why.

.....

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

(ii) The power station transmits 1000 MW of power.

It is better to transmit at 100 000 V rather than 1000 V to reduce energy loss.

Use calculations to explain why.

The equations on page 2 may help you.

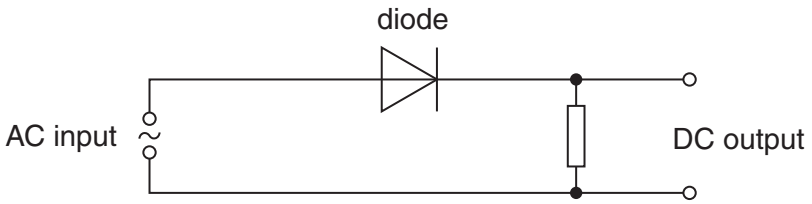
.....

.....

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

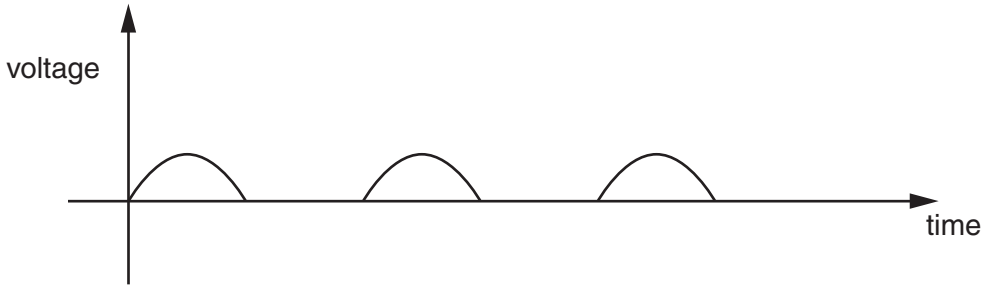
[Total: 5]

15 (a) Jodie sets up the following circuit.



It converts AC to DC.

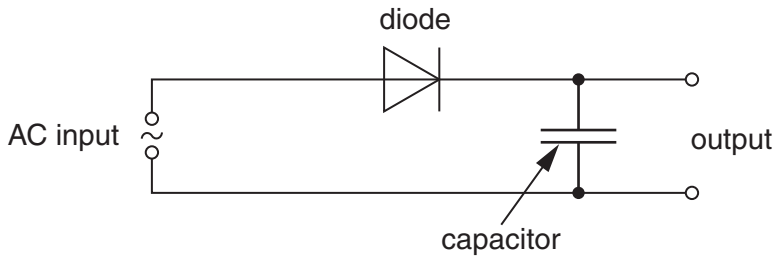
The graph shows the output voltage across the resistor.



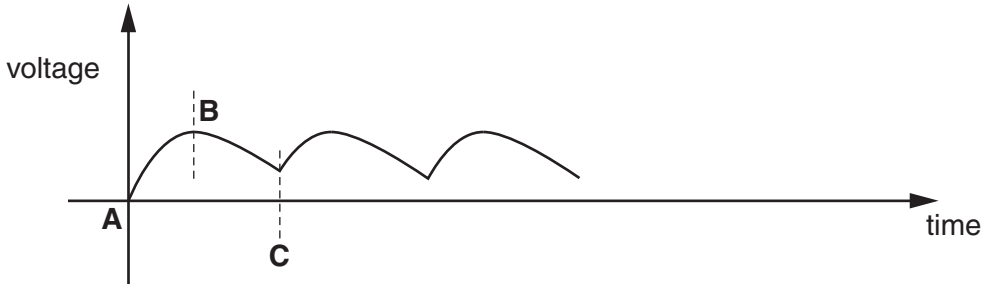
What name is given to this type of output?

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

(b) Jodie puts a capacitor in the circuit. Look at the diagram.



The output changes.



The capacitor smoothes the voltage output.

Explain how.

In your answer write about what the capacitor does

between **A** and **B** .....

.....

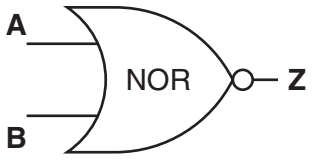
between **B** and **C** .....

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

[Total: 3]

16 This question is about logic gates.

(a) Complete the truth table for a NOR gate.



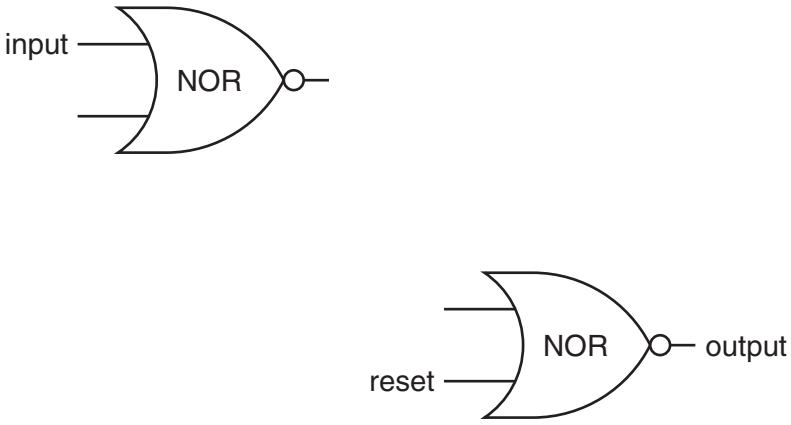
A	B	Z
0	0	
0	1	
1	0	
1	1	

[1]

(b) The alarm on Samantha's car contains two NOR gates.

These make a latch so that the alarm keeps sounding once triggered.

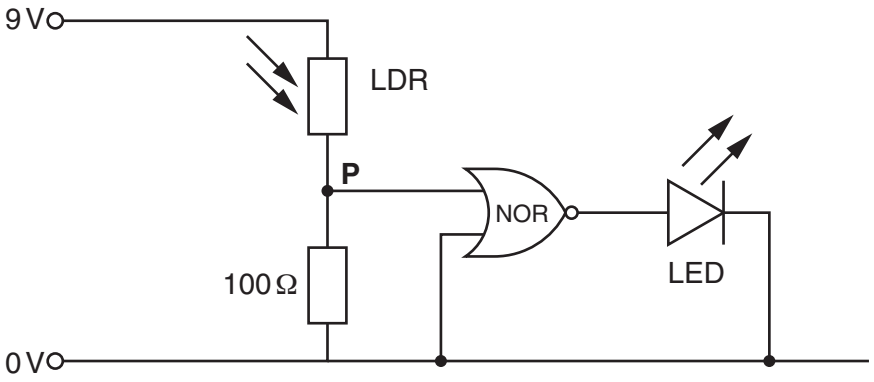
On the diagram below, connect the two NOR gates to make a latch circuit.



[2]

Turn over for the remainder of question 16

(c) Samantha connects the following circuit.



In the light, the resistance of the LDR is 100 Ω.

The LED is **off** when light shines on the LDR.

Calculate the voltage (potential) at **P** and use your answer to explain why the LED is off.

The equations on page 2 may help you.

.....

.....

.....

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

[Total: 5]