OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE PHYSICS A

A332/01

Unit 2: Modules P4 P5 P6 (Foundation Tier)

OCE/15314

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 1 February 2010
Afternoon

Duration: 40 minutes

A3320 1

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.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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 **2**.
- The total number of marks for this paper is **42**.
- This document consists of **16** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

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

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

Electric Circuits

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

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

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

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

The Wave Model of Radiation

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Answer **all** the questions.

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

(a) On its first journey the lorry is travelling along a straight road.

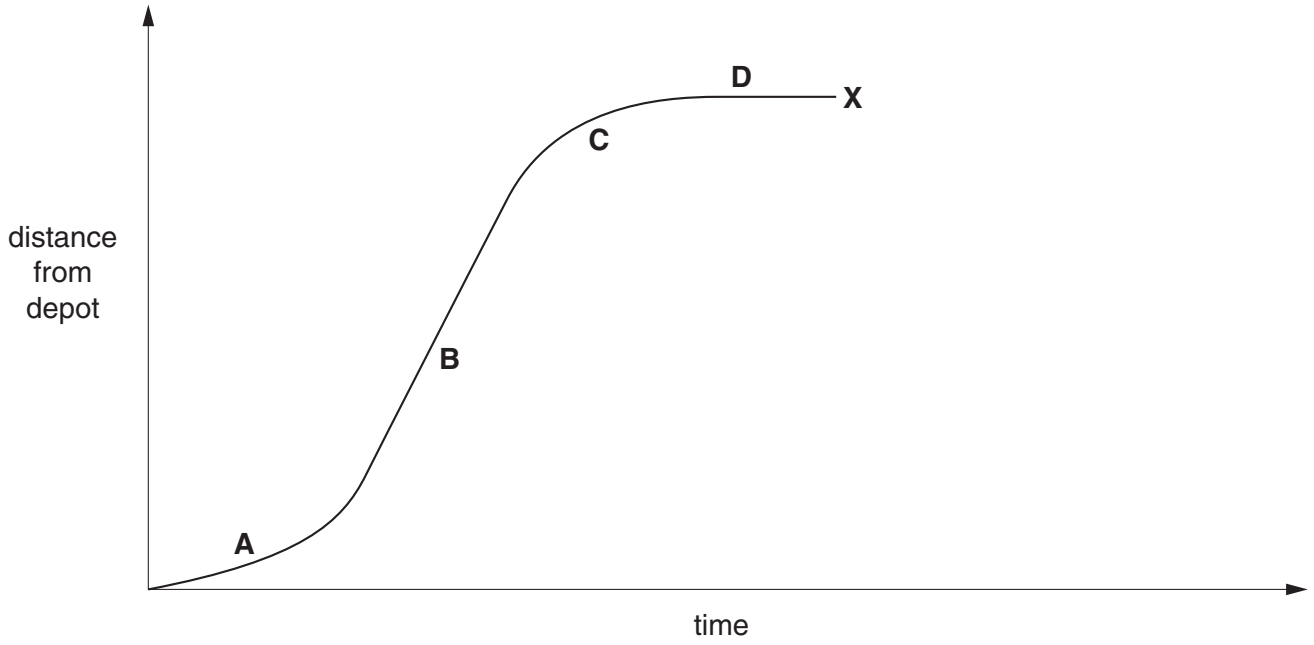
The lorry travels 6 km and then turns around and travels 3.6 km back.

(i) What is the total distance travelled by the lorry? ..... km **[1]**

(ii) How far is the lorry from its starting point? ..... km **[1]**

(b) On its second journey the lorry started from its depot.

A distance–time graph for this journey is shown below.



(i) Write the correct letter, **A**, **B**, **C** or **D**, in each box to show when…

…the lorry is travelling fastest. ☐

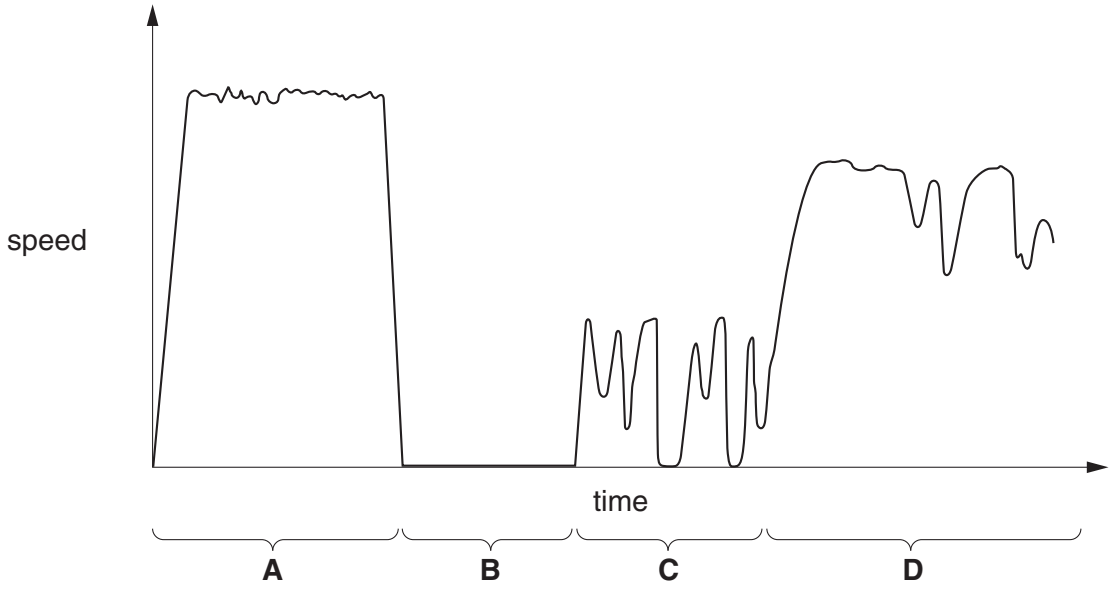
…the lorry is stationary. ☐

[2]

(ii) Continue the line from **X** to show the lorry returning to its depot. **[1]**

(c) A tachograph is a graph that shows how a vehicle's speed changes during a journey.

On its third journey part of the lorry's tachograph looks like this. The letters **A**, **B**, **C** and **D** label different parts of the journey.



From the tachograph we can tell what is happening in each part of the journey.

A shows the lorry driving along a motorway.

B shows a rest period.

C shows the lorry driving through a town.

D shows the lorry driving along a busy main road.

Part **B** was a rest period because the tachograph shows that the lorry was not moving.

Explain how the tachograph shows what is happening during **A**, **C** and **D**.

.....

.....

.....

.....

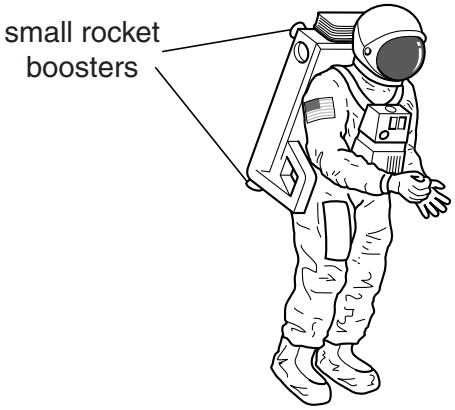
..... **[3]**

[Total: 8]

2 This question is about work done and energy transfers.

(a) 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 **force** **kinetic energy** **potential energy** **work**

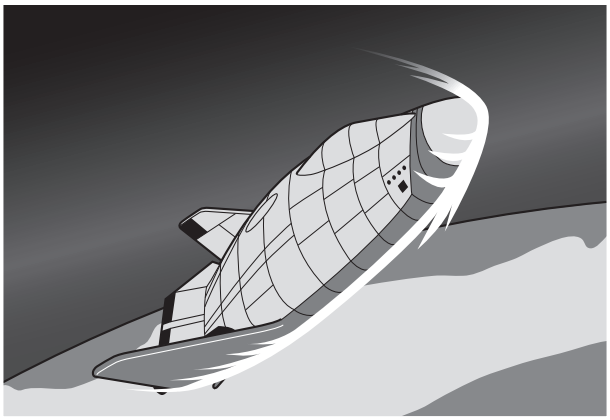
The rocket boosters exert a ……..…… on the astronaut.

The astronaut speeds up. This means the boosters must be doing

……..…… .

This is equal to the ……..…… gained by the astronaut. **[3]**

(b) Buzz's spacecraft re-enters the Earth's atmosphere.



The spacecraft has a gravitational potential energy of 8 MJ on re-entry.

(i) What is the maximum possible increase in the kinetic energy of the spacecraft as it falls?

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

(ii) Explain **why** the actual increase in kinetic energy of the spacecraft will be less than your answer in part **(i)**.

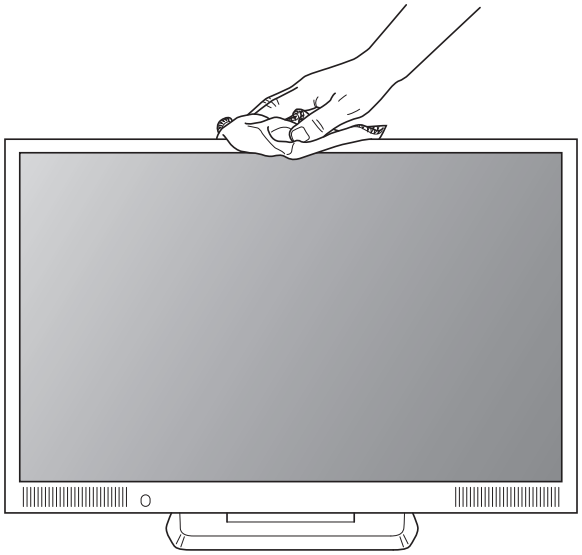
.....

.....

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

[Total: 6]

3 John is cleaning his television.



(a) The television casing becomes charged when it is rubbed with a duster.

This is because electrons are transferred **from** the duster **to** the casing.

Complete the following sentence using one of the words in this list.

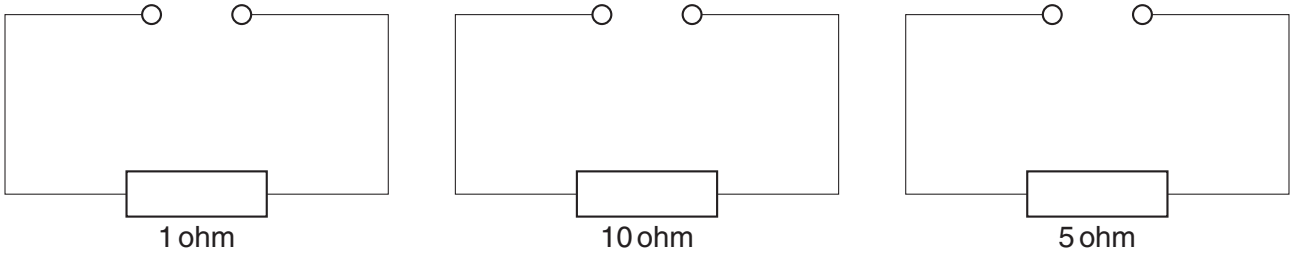
positive **neutral** **negative**

An electron carries a …… charge. **[1]**

(b) Inside the television set there are lots of different circuits.

(i) Three of these circuits are drawn below.

The voltage across each circuit is the same.



circuit **A** circuit **B** circuit **C**

Put these circuits in order of the size of their current. Write the correct letter, **A**, **B** or **C**, in each box.

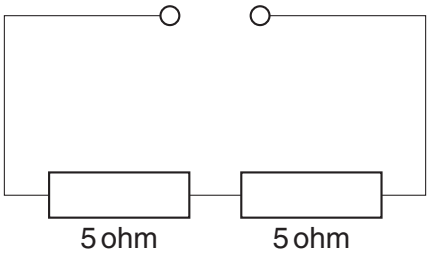
smallest | | | | largest

[1]

(ii) Fred is a television repair man.

He adds an extra 5 ohm resistor to circuit **C**.

He puts it in series.



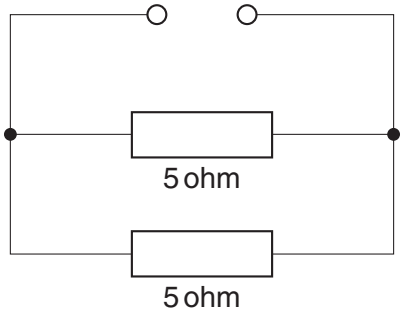
What happens to the resistance of the circuit?

Put a (ring) around the correct answer.

increases **stays the same** **decreases**

[1]

(iii) Fred now puts the extra resistor in parallel.



What happens to the resistance of the circuit?

Put a (ring) around the correct answer.

increases **stays the same** **decreases**

[1]

(iv) All these resistors will heat up when the television is turned on.

Why does turning on the television cause the resistors to heat up?

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

(v) Temperature can be detected with a thermistor.

How does the resistance of a thermistor change with temperature?

.....

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

(c) John's television has a power rating of 500 watts.

He uses it for 4 hours every day.

The cost of electricity is 8 pence per kWh.

How much does his television cost to run in pence per day?

Put a (ring) around the correct calculation.

500 × 4 × 8p $\quad \frac{500}{1000} \times 4 \times 8p$ **500 × 4p** $\quad \frac{500}{1000} \times 4 \times 60 \times 60 \times 8p$

[1]

(d) Domestic electricity meters measure the electrical energy used in a house in kilowatt hours and not in joules.

Complete the following sentence using one of the words in this list.

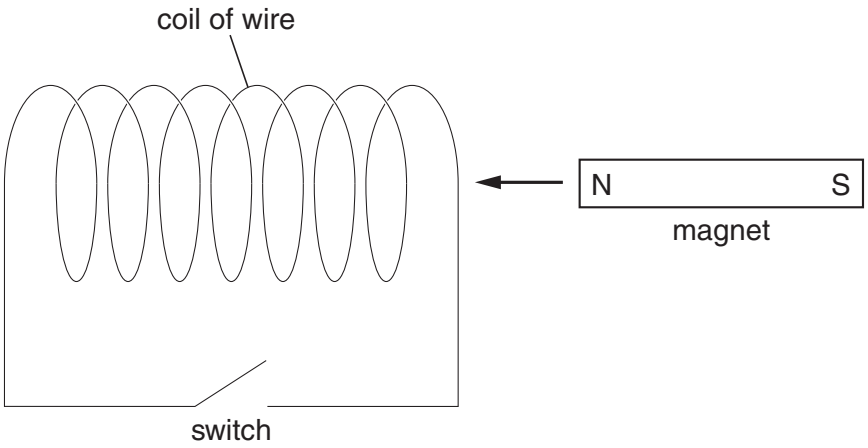
small **large** **useful** **wasteful**

This is because a joule is a very …… amount of energy compared to a kilowatt hour. **[1]**

[Total: 8]

4 Michael has a coil of wire and a magnet.

(a) He moves the magnet into the coil as shown below.



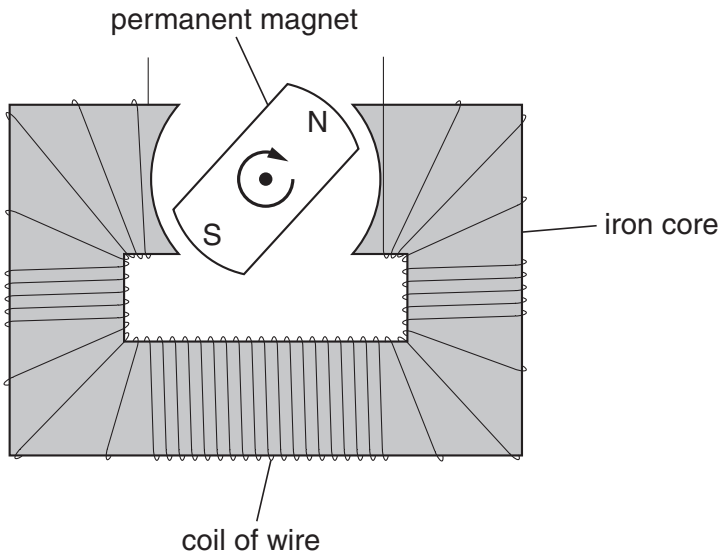
Put a (ring) around the correct words in each sentence.

Whenever the magnet moves then a **voltage / power / charge** is induced across the coil.

If the switch is closed **the resistance increases / a current flows / the voltage increases**.

[2]

(b) The diagram shows a simple generator.



Describe how a simple generator produces electricity.

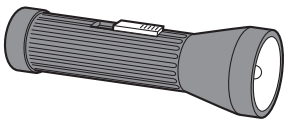
.....

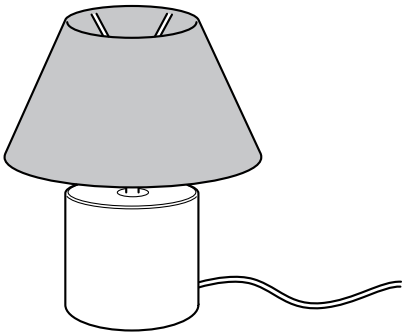
.....

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

(c) Michael has an electric torch that uses a battery.

He also has a table lamp that uses mains electricity.





Complete the sentences using words from this list.

alternating **digital** **direct** **2** **110** **230**

In a torch the battery produces …… current.

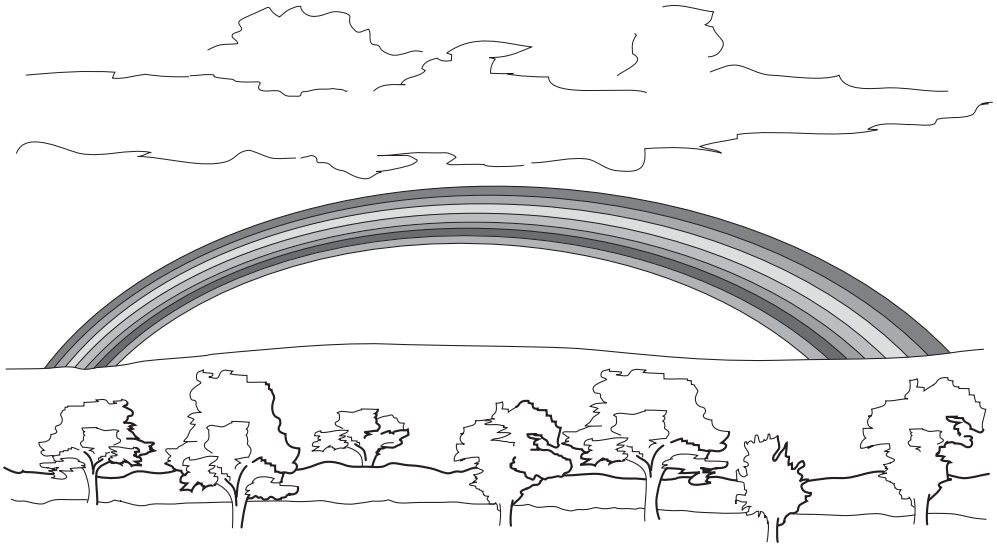
The mains electricity in the table lamp is …… current.

The mains voltage supply to our homes is …… volts. **[3]**

[Total: 7]

5 This question is about the properties of waves.

(a) When we look at a rainbow we see the different colours of the spectrum.



Finish the sentence below by choosing the **correct** word from this list.

wavelength **speed** **amplitude** **intensity**

Each colour of light always has a different …… . **[1]**

(b) Put a (ring) around the type of wave which is **not** part of the electromagnetic spectrum.

radio waves **sound** **visible light** **X-rays**

[1]

(c) Which of the following statements is true for all electromagnetic waves travelling through a vacuum?

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

They all have the same wavelength. ☐

They all have the same frequency. ☐

They all have the same speed. ☐

They all have the same amplitude. ☐

[1]

(d) In an electromagnetic beam of radiation, the energy is carried by photons.

Here are four statements about photons. Some statements are correct, the others are not.

Put a tick (✓) in the box next to each of the **two** correct statements.

The greater the frequency of the radiation the lower the energy of its photons.	☐
The intensity of a beam of light depends on the number of photons arriving per second.	☐
Photons travel at the speed of light.	☐
The greater the energy of the photon the faster it moves.	☐

[2]

(e) Different parts of the electromagnetic spectrum have different properties.

They can be used for different purposes.

Draw a straight line from each **use of a wave** to the **property** that makes it suitable for the use.

use of a wave	property
Radio waves can be used to carry information over long distances ...	... because they are absorbed by water molecules.
Some microwaves can be used to heat food ...	... because they are not absorbed by the atmosphere.
Infrared rays can be used to carry information along optical fibres ...	... because they can travel through glass without becoming significantly weaker.

[2]

(f) When water waves travel from deep to shallow water they slow down.

This can cause a change in their direction.

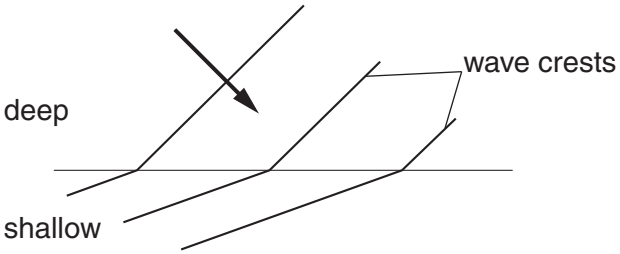


diagram **A**

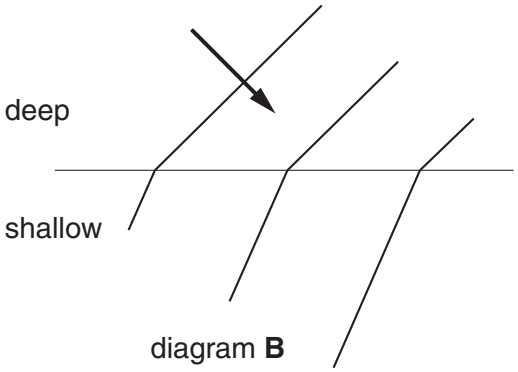


diagram **B**

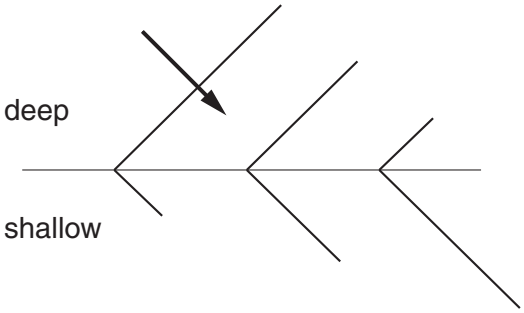
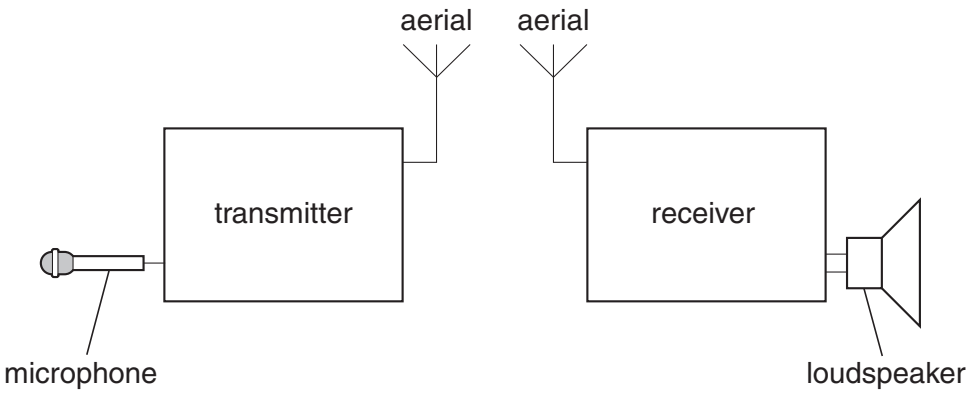


diagram **C**

Which diagram, **A**, **B**, or **C**, correctly shows what happens? ..... **[1]**

[Total: 8]

6 The diagram below shows a very simplified model of a radio system.



The microphone collects the analogue sound signals, which are then converted into digital radio signals. The digital radio signals are sent to a receiver.

(a) What is the difference between an **analogue** signal and a **digital** signal?

Draw diagrams to help you explain the answer.

.....

.....

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

Please turn over for the remainder of question 6.

(b) Complete the following sentences about the radio transmission system.

Use the **best** words from this list.

amplified **analogue** **digital** **loudness** **quality**

Radio signals have to be …… because the further they travel the more they decrease in intensity.

As they travel they pick up unwanted noise. This noise reduces

the signal's …… .

When the signal is amplified the noise is also amplified. It is easier to remove the noise

if the signal is …… . **[3]**

[Total: 5]

END OF QUESTION PAPER