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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE PHYSICS A

A332/01

Unit 2: Modules P4 P5 P6 (Foundation Tier)

OCE/33814

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: 40 minutes

A33201

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 **2**.
- The total number of marks for this paper is **42**.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

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

change in energy = work done

change in GPE = weight × vertical height difference

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

Electric Circuits

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

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

energy transferred = power × time

power = potential difference × current

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

The Wave Model of Radiation

wave speed = frequency × wavelength

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Question 1 starts on page 4

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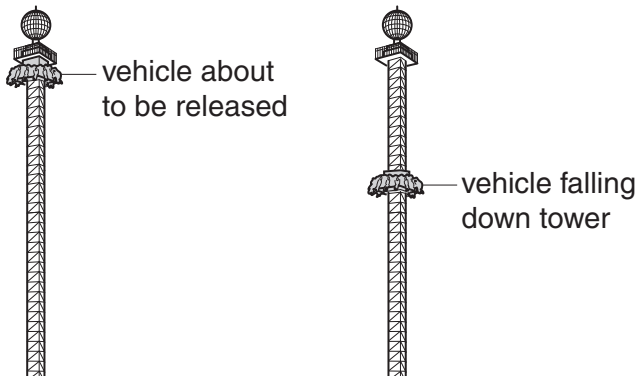
Answer **all** the questions.

1 This question is about a theme park ride.



Riders sit in a vehicle.

It is pulled up to the top of the tower.

It is then dropped from the top of the tower.

It falls to the ground.

The vehicle is stopped by brakes as it nears the bottom.

(a) (i) The gravitational potential energy of the vehicle changes during the ride.

Complete the table to show these changes.

Put a tick (✓) in one box in each row. One row has been done for you.

	gravitational potential energy		
	stays the same	**increases**	**decreases**
vehicle waiting at bottom of tower	✓		
vehicle moving up the tower			
vehicle stopped at top of tower			
vehicle falling to bottom of tower			

[2]

(ii) Work is done against gravity when the vehicle is pulled upwards.

Work is also done against **another** force when the vehicle is pulled upwards.

Put a (ring) around the correct force.

electric **friction** **magnetic** **twist**

[1]

(b) The ride is 40 metres high. The vehicle has a weight of 20 000 N.

What is the change in gravitational potential energy of the vehicle when it goes from the bottom of the ride to the top of the ride?

Put a (ring) around the correct answer.

0.5 kJ **50 kJ** **200 kJ** **500 kJ** **800 kJ** **800 000 kJ**

[1]

(c) Work is done by gravity as the vehicle falls.

(i) Assume gravity is the only force on the vehicle.

What is the largest possible kinetic energy of the vehicle at the bottom of the ride?

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

the same as the change in gravitational potential energy	☐
less than the change in gravitational potential energy	☐
greater than the change in gravitational potential energy	☐

[1]

(ii) The vehicle does not actually gain this much kinetic energy.

Which of the following statements is the best explanation of this?

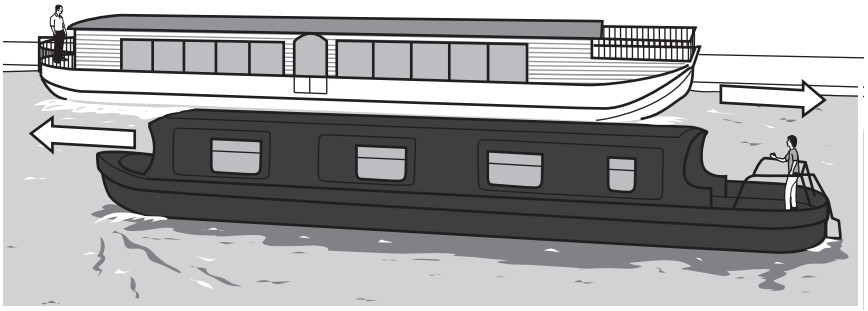
Put a tick (✓) in the box next to the correct answer.

A breeze provides extra energy.	☐
There are more people on the ride.	☐
Energy is lost due to friction.	☐
It gets faster as it falls.	☐

[1]

[Total: 6]

2 Two boats pass each other on a canal.



(a) The black boat moves 100 m in 20 s. What is its average speed?

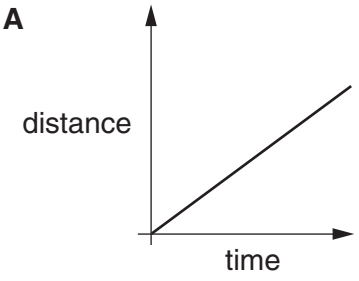
Put a (ring) around the correct answer.

0.2 m/s **5 m/s** **20 m/s** **100 m/s** **2000 m/s** **[1]**

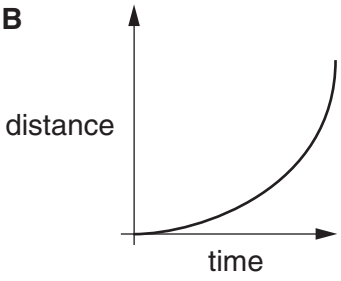
(b) The black boat is moving at a constant speed.

Which distance-time graph, **A**, **B**, **C** or **D**, shows the motion of the black boat?

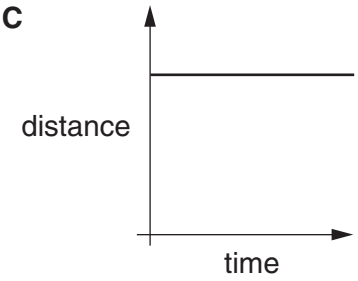
A



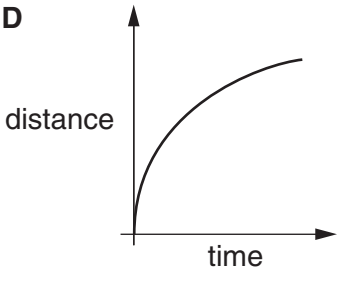
B



C

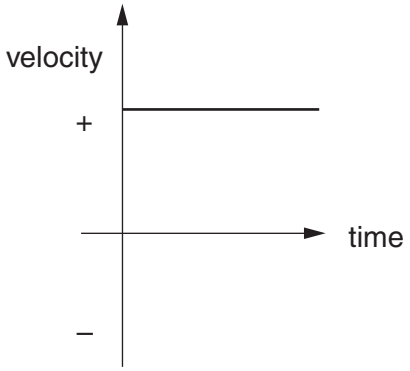


D



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

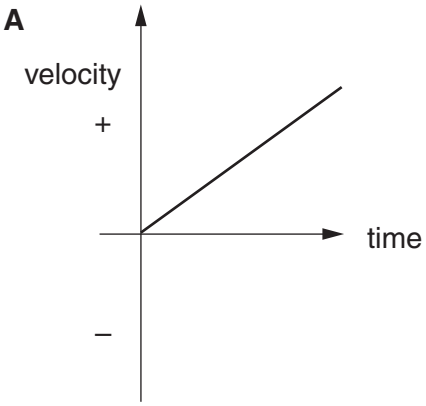
(c) This is the velocity-time graph for the black boat.



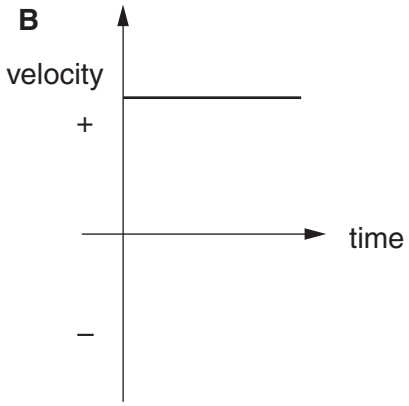
The white boat is moving at the same speed in the opposite direction.

Which graph shows the correct velocity-time graph for the white boat?

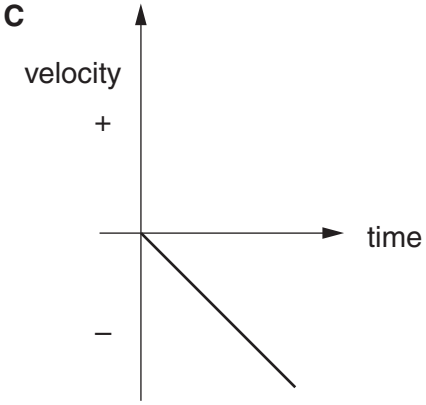
A



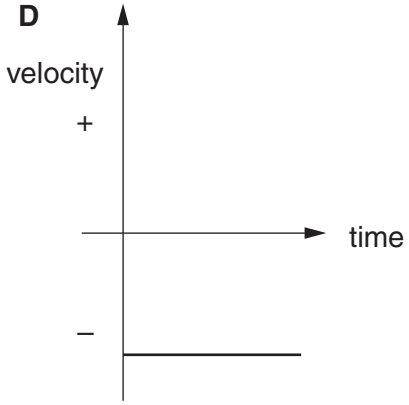
B



C



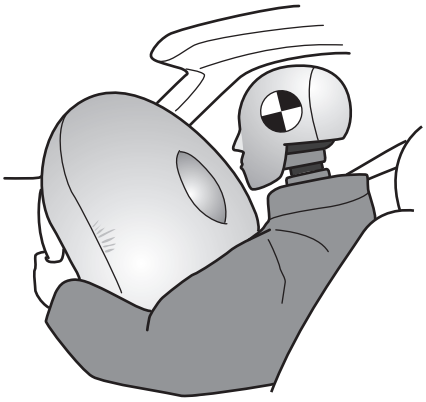
D



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

[Total: 3]

3 Cars can be fitted with air bags.



Kalo is a scientist who tests car safety.

Kalo

We test the forces on car passengers by using crash test dummies.
We investigate how the momentum and force change during a crash.
We do tests on cars with airbags and cars without air bags.

(a) How would Kalo work out the momentum of the dummy before the crash?

Include in your answer

- what measurements she would take
- how she would use the measurements.

.....

.....

.....

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

(b) (i) Air bags help to prevent injuries in a car crash.

Complete the sentences to explain how air bags protect passengers.

Put a (ring) around the correct choice to complete each sentence.

Air bags cause the time taken for the impact of passengers to **increase / decrease / stay the same.**

This means the force of the impact of passengers **increases / decreases / stays the same.**

[2]

(ii) What other safety measure is built into cars to prevent injury during a crash?

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

electric windows	☐
registration plates	☐
seat belts	☐
exhaust pipes	☐

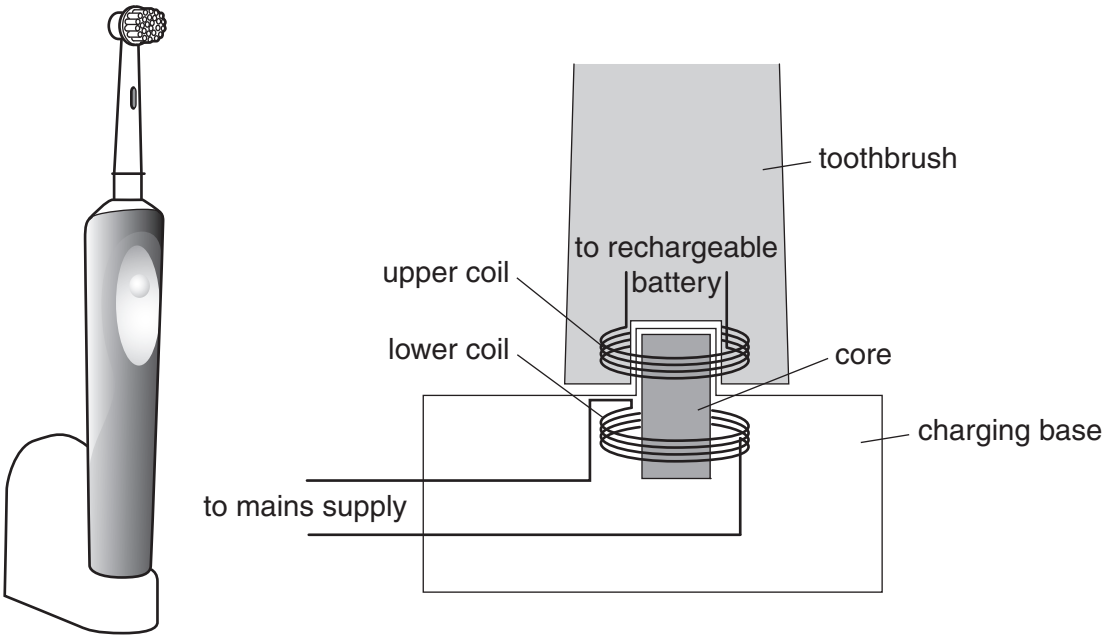
[1]

[Total: 6]

4 An electric toothbrush contains a rechargeable battery.

It is charged from a separate charging base.

The toothbrush and charging base contain coils of wire that act as a transformer.



(a) A core passes through both coils of the transformer.

What material is the **core** made from?

Put a ring around the correct answer.

copper **glass** **iron** **plastic**

[1]

(b) The charging base is plugged into the mains supply.

(i) What is the **voltage** of the mains supply in the United Kingdom?

Put a ring around the correct answer.

1.5V **50V** **110V** **230V**

[1]

(ii) How is the mains supply also described?

Put a (ring) around the correct answer.

alternating current	**alternating resistance**	**direct current**	**direct resistance**

[1]

(c) Here are five statements about how the battery is charged.

They are in the **wrong order**.

A This causes a current to flow in the upper coil.

B The battery charges.

C The magnetic field in the core changes.

D A voltage is induced in the upper coil.

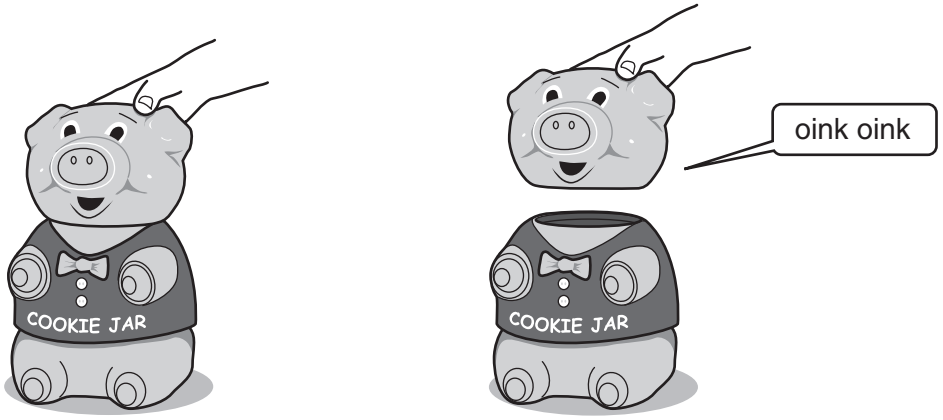
E The mains supply produces a changing current in the lower coil.

Fill in the boxes to show the correct order.

[3]

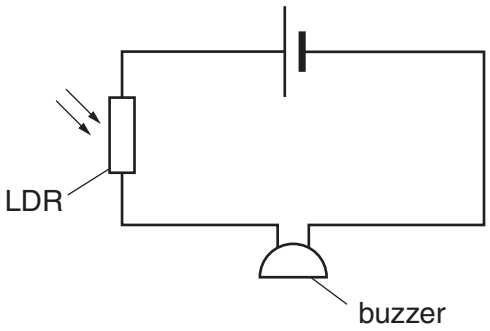
[Total: 6]

5 Mark is given a biscuit jar that makes a noise when it is opened.



He wonders how this works.

He makes this circuit to test his ideas.



The buzzer makes a noise when a current passes through it.

(a) Explain why he uses an **LDR** in the circuit.

Include in your answer

- what the LDR detects
- what this changes in the LDR and in what way.

.....

.....

.....

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

(b) The buzzer needs a voltage of 3V across it in order to work. This gives a current of 0.15 A.

What is the resistance of the buzzer?

Put a (ring) around the correct answer.

0.05 Ω **0.45 Ω** **15 Ω** **20 Ω**

[1]

(c) These are statements about Mark's circuit.

Put a tick (✓) in the correct box after each statement to show whether the statement is **true** or **false**.

	true	**false**
The buzzer and LDR are in parallel.	☐	☐
The total resistance of the circuit is higher than the resistance of the buzzer.	☐	☐
The battery pushes charge through both the buzzer and LDR.	☐	☐

[2]

(d) The jar is made of plastic, which does not conduct electricity.

The metal wires in the circuit **do** conduct electricity.

Complete the table to explain this difference.

Put a tick (✓) in the correct column for each material.

material	**contains lots of charges free to move**	**contains few charges free to move**
metal		
plastic		

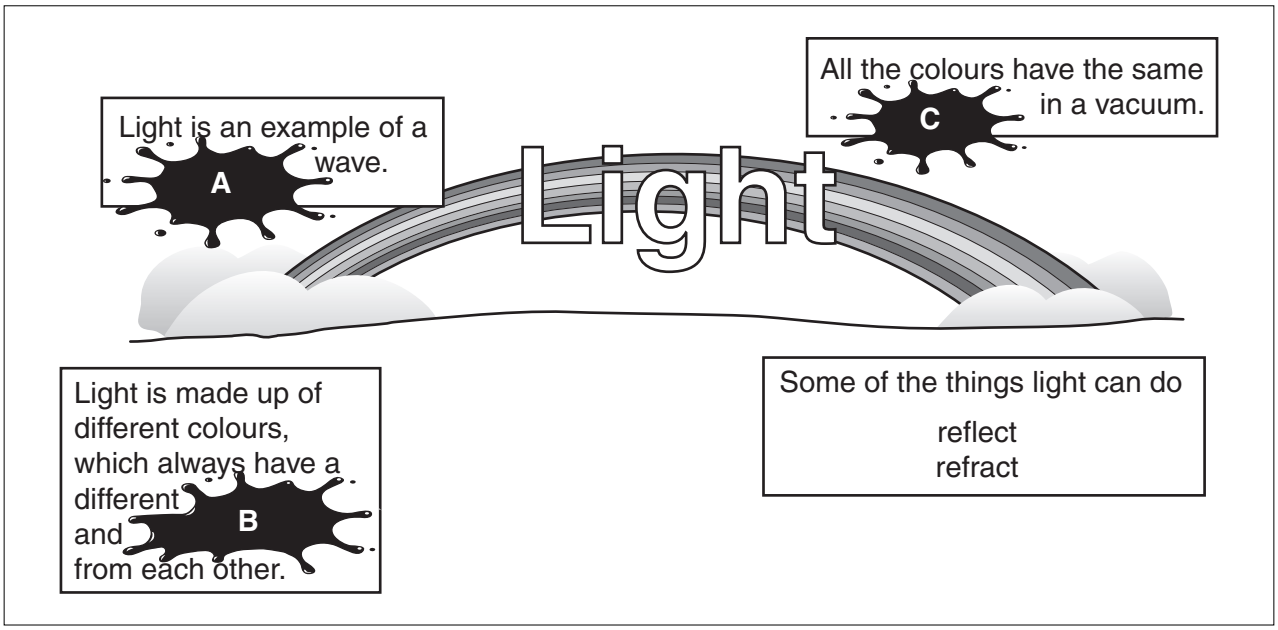
[1]

[Total: 7]

6 Jeff makes a poster about light.

Unfortunately, ink is splashed on the poster.

The ink splashes have been labelled **A**, **B** and **C**.



(a) Which word should be on the poster underneath ink splash **A**?

Put a (ring) around the correct answer.

longitudinal **magnetic** **transverse** **wavelength**

[1]

(b) Which two words should be on the poster underneath ink splash **B**?

Put a (ring) around the **two** correct answers.

frequency **speed** **voltage** **wavelength**

[1]

(c) Which word should be on the poster underneath ink splash **C**?

Put a (ring) around the correct answer.

frequency **speed** **voltage** **wavelength**

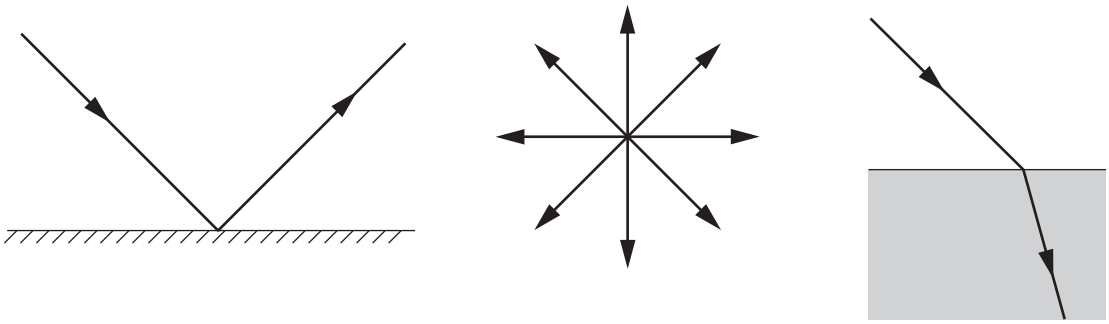
[1]

(d) Jeff reads about how rainbows form.

This is what he finds out.

Rainbows form when light from the sun is **reflected** and **refracted** by water droplets.

(i) Jeff finds three diagrams.



A **B** **C**

Which diagram, **A**, **B**, or **C**, shows **reflection**?

answer .....

Which diagram, **A**, **B**, or **C**, shows **refraction**?

answer .....

[1]

(ii) White light spreads into different colours when it enters a drop of water.

The different colours of light are **refracted** through different angles.

Explain what happens in **refraction**.

Include in your answer

- what changes when a wave passes from air to water
- what stays the same.

.....

.....

.....

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

[Total: 6]

7 This question is about analogue and digital radio signals.

(a) Read the statements about signals.

Put a tick (✓) in the correct box after each statement to show whether the statement is **true** or **false**.

	true	**false**
Analogue and digital signals both carry information.	☐	☐
To carry a signal, waves can vary in amplitude or frequency.	☐	☐
A signal becomes stronger as it travels away from the transmitter.	☐	☐
Only digital signals can be amplified.	☐	☐

[2]

(b) Which of the following is a reason that someone would choose to buy a digital radio instead of an analogue radio?

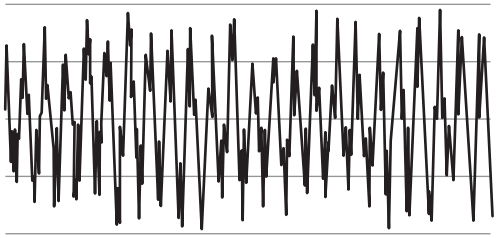
Put a tick (✓) in the box next to the correct answer.

Digital signals change frequency as they travel.	☐
Digital signals can pick up noise.	☐
Digital signals are decoded by the transmitter.	☐
Digital signals can transmit information with a higher quality.	☐

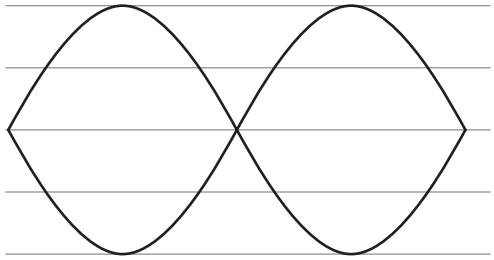
[1]

(c) Diagrams **A**, **B** and **C** show three different types of signal.

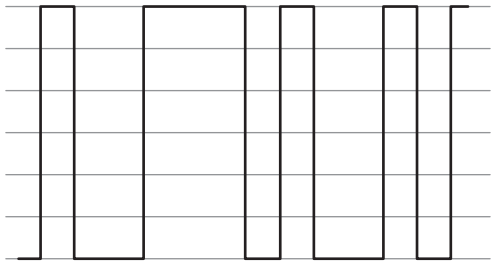
A



B



C



Which diagram shows a digital signal?

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

[Total: 4]

8 Sunni is doing an experiment with a ripple tank.

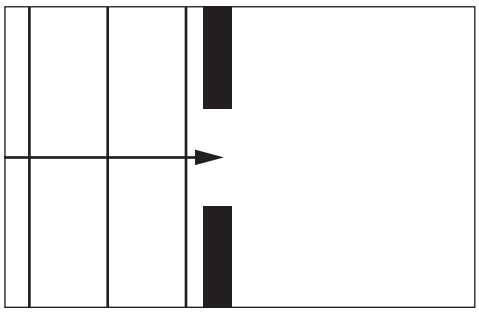
She places a barrier in the tank with a small gap in the middle.

She sends waves with different wavelengths towards the gap and observes what happens.

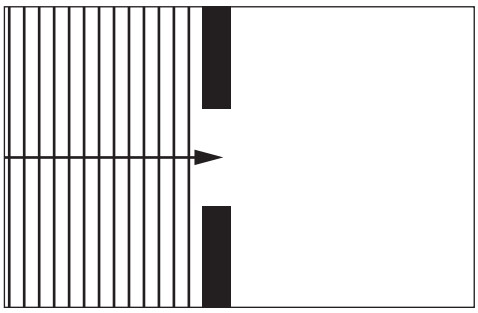
Complete the diagrams **A** and **B** and use them to explain Sunni's observations.

Include in your answer

- the wave process involved
- why the waves behave differently in each case.



A



B

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..... **[4]**

[Total: 4]

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