

FOR OFFICIAL USE

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Total  
Marks

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**X069/10/02**

NATIONAL TUESDAY, 5 MAY  
QUALIFICATIONS 9.00 AM – 10.30 AM  
2015

PHYSICS  
INTERMEDIATE 1

Fill in these boxes and read what is printed below.

Full name of centre

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Town

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Forename(s)

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Surname

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Date of birth

Day Month Year

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Scottish candidate number

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Number of seat

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Reference may be made to the Physics Data Booklet.

**Section A – Questions 1–20 (20 marks)**

Instructions for completion of **Section A** are given on page two.

For this section of the examination you must use an **HB pencil**.

**Section B (60 marks)**

All questions should be attempted.

The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, **and must be written clearly and legibly in ink**.

Rough work, if any should be necessary, should be written in this book, and then scored through when the fair copy has been written. If further space is required, a supplementary sheet for rough work may be obtained from the Invigilator.

Additional space for answers will be found at the end of the book. If further space is required, supplementary sheets may be obtained from the Invigilator and should be inserted inside the **front** cover of this booklet.

Before leaving the examination room you must give this book to the Invigilator. If you do not, you may lose all the marks for this paper.



## SECTION A

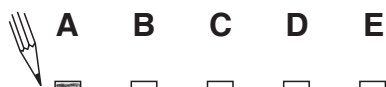
- 1 Check that the answer sheet provided is for Physics Intermediate 1 (Section A).
- 2 For this section of the examination you must use an **HB pencil** and, where necessary, an eraser.
- 3 Check that the answer sheet you have been given has **your name, date of birth, SCN** (Scottish Candidate Number) and **Centre Name** printed on it.  
Do not change any of these details.
- 4 If any of this information is wrong, tell the Invigilator immediately.
- 5 If this information is correct, **print** your name and seat number in the boxes provided.
- 6 The answer to each question is **either** A, B, C, D or E. Decide what your answer is, then, using your pencil, put a horizontal line in the space provided (see sample question below).
- 7 There is **only one correct** answer to each question.
- 8 Any rough working should be done on the question paper or the rough working sheet, **not** on your answer sheet.
- 9 At the end of the exam, put the **answer sheet for Section A inside the front cover of this answer book.**

### Sample Question

The energy unit measured by the electricity meter in your home is the

- A kilowatt-hour
- B ampere
- C watt
- D coulomb
- E volt.

The correct answer is **A**—kilowatt-hour. The answer **A** has been clearly marked in **pencil** with a horizontal line (see below).



### Changing an answer

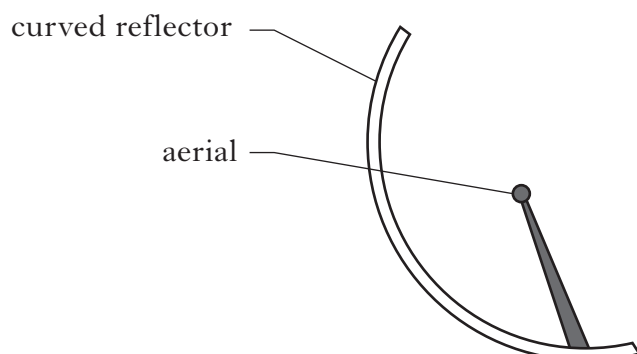
If you decide to change your answer, carefully erase your first answer and, using your pencil, fill in the answer you want. The answer below has been changed to **E**.



## SECTION A

Answer questions 1–20 on the answer sheet.

1. The diagram shows part of a satellite dish.

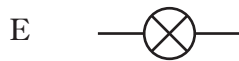
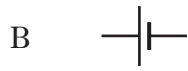
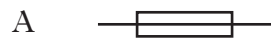


The curved reflector is used to

- A stop the signals reaching the aerial
  - B change the frequency of the signals at the aerial
  - C slow down the signals at the aerial
  - D pick out one signal from all the signals at the aerial
  - E make the signals stronger at the aerial.
2. In a tank of water, 20 waves are produced in 4 seconds.
- The frequency of the waves is
- A 0.25 hertz
  - B 4.0 hertz
  - C 5.0 hertz
  - D 20 hertz
  - E 80 hertz.

**[Turn over**

3. The symbol for a fuse is



4. A student connects a 12 watt lamp to a 6.0 volt supply.

The current in the lamp is

A 0.50 amperes

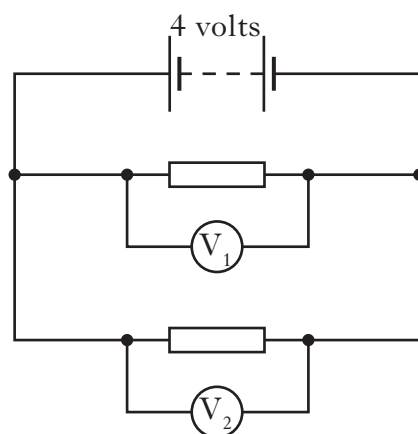
B 2.0 amperes

C 6.0 amperes

D 18 amperes

E 72 amperes.

5. A circuit is set up as shown.



Which row in the table shows the readings on voltmeters  $V_1$  and  $V_2$ ?

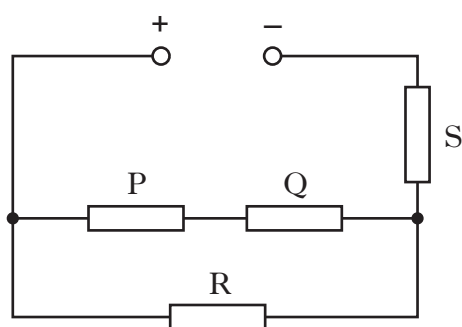
	<i>Reading on <math>V_1</math> in volts</i>	<i>Reading on <math>V_2</math> in volts</i>
A	2	2
B	4	4
C	4	8
D	4	2
E	2	4

6. Which row in the table shows the colour of the insulation on the live, neutral and earth wires in a mains flex?

	<i>Live</i>	<i>Neutral</i>	<i>Earth</i>
A	blue	green/yellow	brown
B	green/yellow	brown	blue
C	blue	brown	green/yellow
D	brown	green/yellow	blue
E	brown	blue	green/yellow

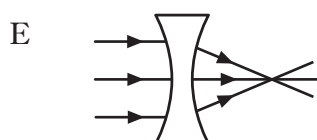
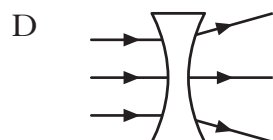
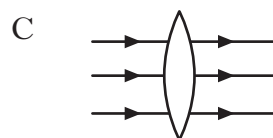
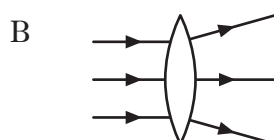
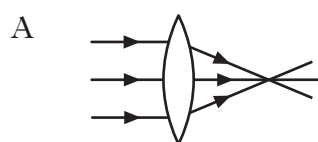
**[Turn over**

7. In the circuit below, resistors P, Q, R and S are identical.

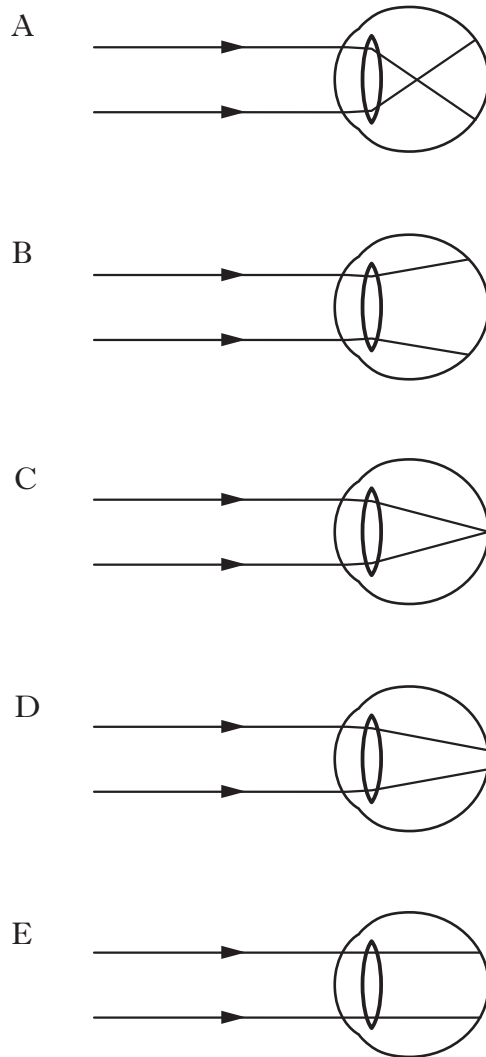


The current is the same in which **two** resistors?

- A P and R
  - B P and Q
  - C R and S
  - D Q and S
  - E Q and R
8. Parallel rays of light are directed onto different glass lens shapes.
- Which diagram shows the effect of a converging lens shape on parallel rays of light?



9. A student is short sighted. Which diagram shows how light from a distant object travels inside the student's eye?



10. A student writes the following statements about X-rays.

- I X-rays are invisible to the naked eye.
- II X-rays are detected by photographic film.
- III X-rays damage living cells.

Which of these statements is/are correct?

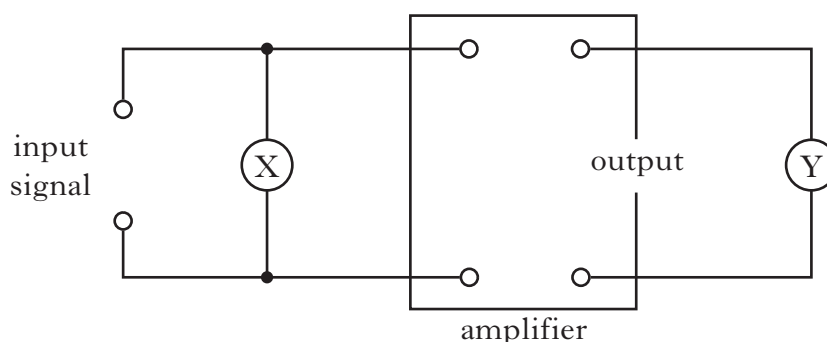
- A I only
- B II only
- C III only
- D II and III only
- E I, II and III

11. During a thunderstorm, the lightning is seen before the thunder is heard.  
This is because
- A the eye is more sensitive than the ear
  - B the thunder is produced before the lightning
  - C the lightning is produced before the thunder
  - D light travels faster than sound
  - E sound travels faster than light.

12. A student makes the following statements about sound.
- I Sound can travel through a solid.
  - II Sound can travel through a liquid.
  - III Sound can travel through a vacuum.

Which of these statements is/are correct?

- A I only
  - B II only
  - C III only
  - D I and II only
  - E I, II and III
13. The diagram shows two voltmeters, X and Y, connected to an amplifier.



The reading on voltmeter X is 0.04 volts.

The reading on voltmeter Y is 20 volts.

The voltage gain of the amplifier is

- A 0.002
- B 0.8
- C 8
- D 50
- E 500.

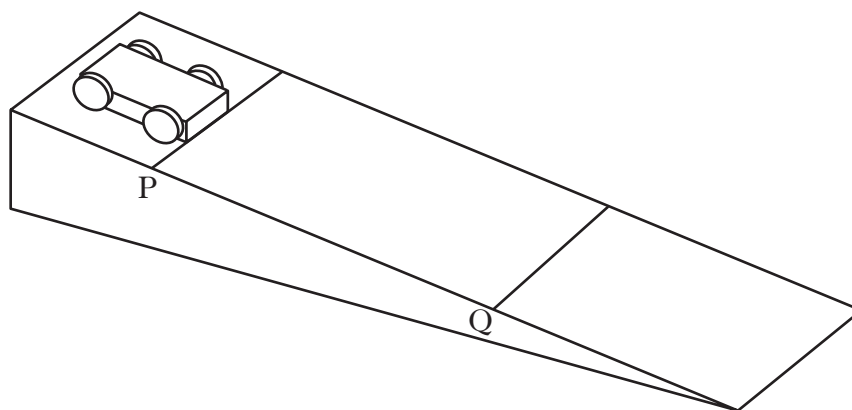


14. Two blocks, X and Y, have forces acting on them as shown.

Which pair of diagrams shows one balanced and one unbalanced set of forces acting on the blocks?



15. A trolley is released from position P on a slope as shown.



The length of the trolley is 0.1 metres.

To calculate the instantaneous speed of the trolley at Q, we also need to know

- A the distance from position P to position Q
- B the time taken by the trolley to move from position P to position Q
- C the speed of the trolley at position P
- D the time taken for the trolley to pass position P
- E the time taken for the trolley to pass position Q.

16. The acceleration of a car is 2 metres per second per second.

This means that

- A the car travels 2 metres in one second
- B the car will speed up by 2 metres per second every second
- C the average speed of the car is 2 metres per second
- D the maximum speed of the car is 2 metres per second
- E the force acting on the car is 2 newtons per second.

17. A ball is thrown upwards at an angle.

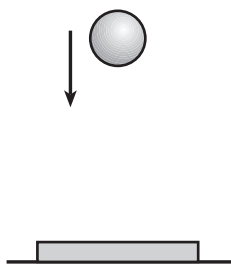
A student makes the following statements about the range of the ball.

- I The range depends on the force applied to the ball.
- II The range depends on the speed of throw.
- III The range depends on the angle of throw.

Which of these statements is/are correct?

- A I only
- B I and II only
- C I and III only
- D II and III only
- E I, II and III

18. A ball is dropped onto a surface.



A student makes the following statements about the height to which the ball rebounds.

- I The height is affected by the material of the ball.
- II The height is not affected by the material of the surface.
- III The height is affected by the speed the ball hits the surface.

Which of these statements is/are correct?

- A III only
- B I and II only
- C I and III only
- D II and III only
- E I, II and III

19. The block diagram for an electronic system is shown.



Which row in the table shows the input, process and output devices for a security light system?

	<i>Input</i>	<i>Process</i>	<i>Output</i>
A	logic gates	motion sensor	lamp
B	logic gates	lamp	motion sensor
C	lamp	logic gates	motion sensor
D	motion sensor	lamp	logic gates
E	motion sensor	logic gates	lamp

20. Which of the following devices is used to convert electrical energy into other forms of energy?
- A Motor
  - B LDR
  - C Microphone
  - D Switch
  - E Thermistor

**Candidates are reminded that the answer sheet for Section A MUST be placed INSIDE the front cover of the answer book.**

**[Turn over for Section B on *Page twelve***

## SECTION B

Answer questions 21–30 in the spaces provided.

21. Radio and television signals are used to send information.



- (a) Which has the higher frequency, radio or television signals?

1

- (b) Television images are made up of different colours. Which **three** colours of light are mixed together to produce all the other colours?

1

- (c) Indicate which of the following statements about television are true or false by circling the appropriate word.

An aerial selects one television frequency                      TRUE              FALSE

An amplifier makes the signal stronger                      TRUE              FALSE

A television has two decoders and two amplifiers                      TRUE              FALSE

Television stations can be identified by the frequency of the signal they transmit                      TRUE              FALSE

2

- (d) Satellite television signals are transmitted from geostationary satellites.  
Explain why geostationary satellites are used.

1

22. Cables laid on the seabed link Scotland and America. The cables provide internet links and telephone communication links. The table shows information about two different cables.

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- (a) Complete the table below.

<i>Subsea Cable Name</i>	<i>Cable Material</i>	<i>Type of Signal carried</i>	<i>Speed of Signal in Cable (metres per second)</i>
<b>Atlantic Crossing-1</b>	<i>Optical Fibre</i>		
<b>TAT-7</b>		<i>Electrical</i>	

2

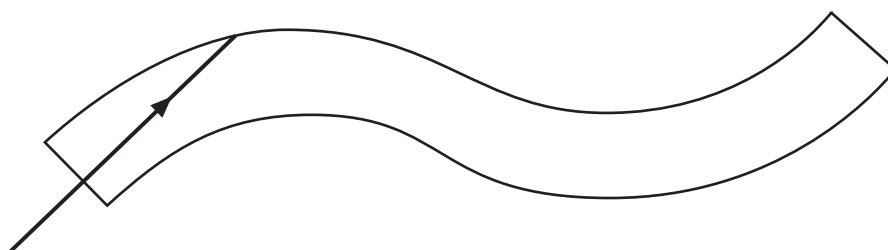
- (b) What is an optical fibre?

1

- (c) Suggest **one** advantage that Atlantic Crossing-1 cable has over TAT-7 cable.

1

- (d) The diagram shows a section of optical fibre.



Complete the diagram to show the path of the signal along the optical fibre.

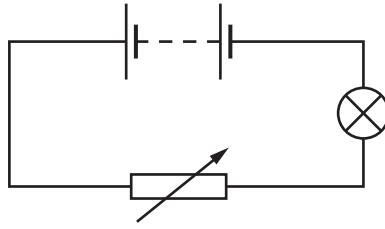
1

- (e) Explain **one** possible difficulty of having cables located on the seabed.

1

23. A student sets up the circuit shown.

Marks

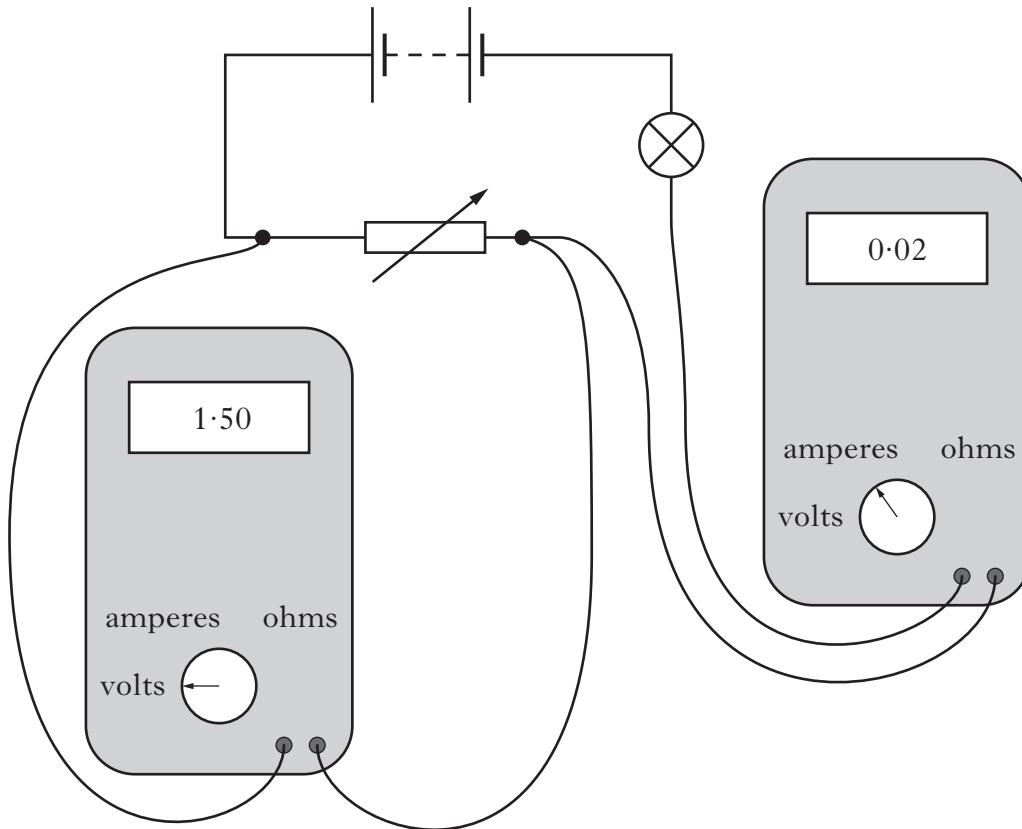


- (a) In the sentence below, circle **one** word in the box to make the statement correct.

1

The student has set up a series / parallel circuit.

- (b) Meters are added to the circuit as shown.



Use the readings on the meters to calculate the resistance of the variable resistor.

2

*Marks***23. (continued)**

(c) The resistance of the variable resistor is now increased.

(i) What effect does this have on the brightness of the lamp?

**1**

(ii) Explain your answer.

**1**

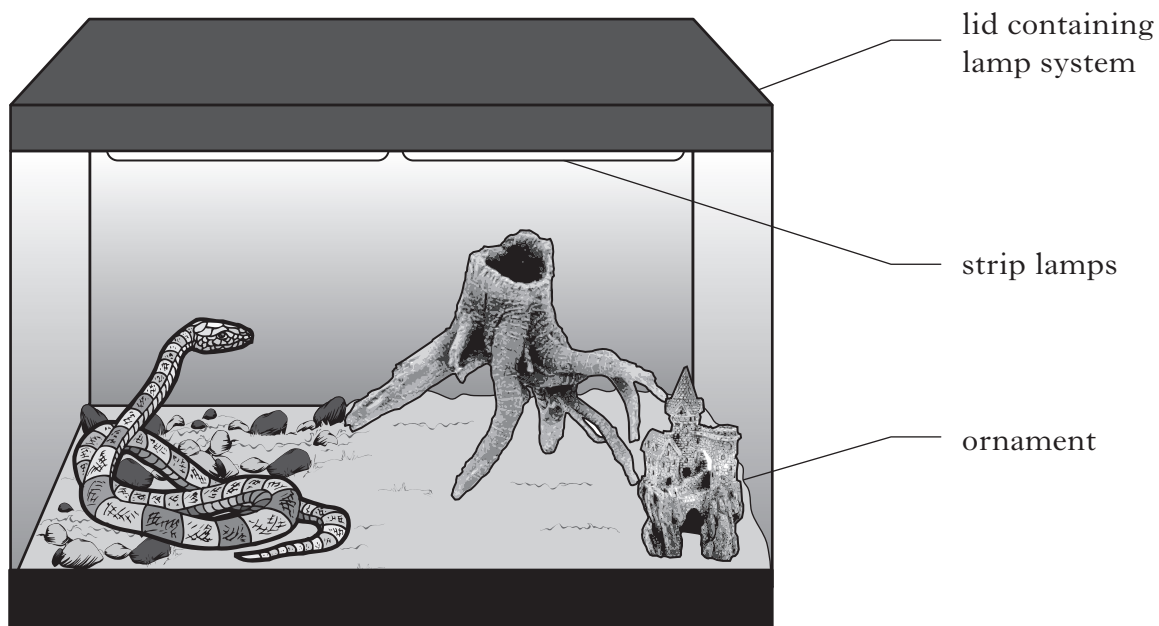
(d) A variable resistor can be used in a dimmer switch for a lighting circuit.

State **one** other practical use of a variable resistor.

**1****[Turn over**

Marks

24. A snake is kept in a large glass box that provides the appropriate living conditions.



- (a) A lamp in the glass box radiates heat.

- (i) What is another name for heat radiation?

1

- (ii) Give another non-medical use for this type of radiation.

1

- (b) A second lamp in the glass box makes an ornament fluoresce in the tank.

- (i) Which type of radiation is emitted by this lamp?

1

- (ii) What medical problem can be caused by overexposure to this type of radiation?

1



## 24. (continued)

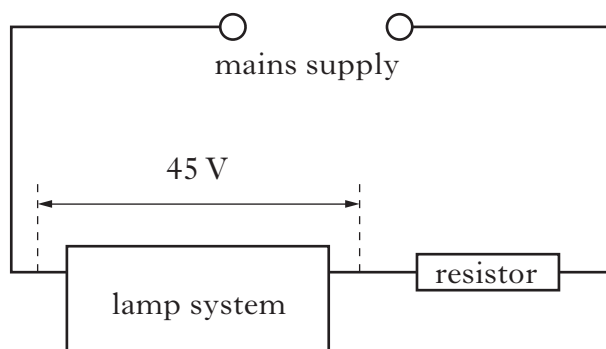
Marks

- (c) Name **one** other type of radiation that is invisible to the naked eye.

--

1

- (d) The lamp system in the lid is connected to the mains supply.



For the circuit to operate the lamp system requires 45 volts.  
Calculate the voltage across the resistor.

--

2

- (e) An electronic system is used to monitor the temperature and light level in the glass box.

Complete the sentence indicating the component used in the system.

A component whose resistance changes with light level changes is a

--

1

**[Turn over]**

25. An engineer is testing underground pipes.

Marks



Diagram 1

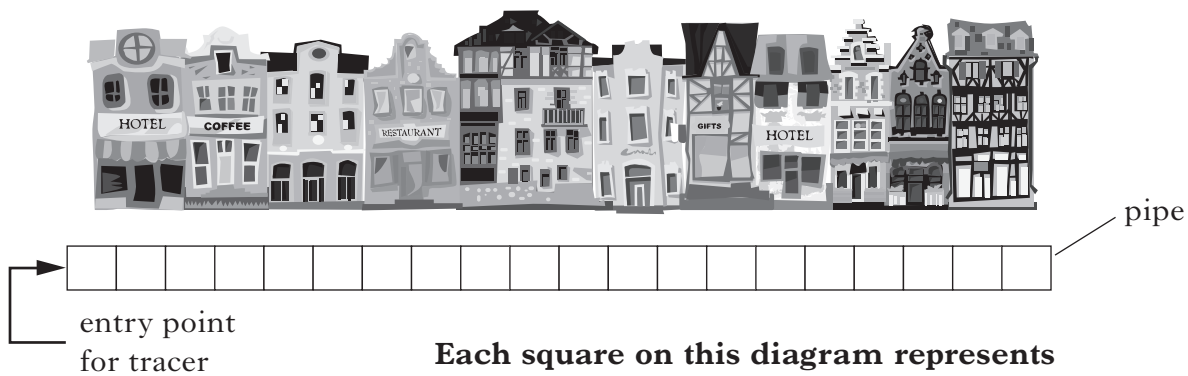


Diagram 2

(a) The engineer tests for cracks and leaks using a type of nuclear radiation. A radioactive tracer is poured into the pipe.

(i) Name the type of radiation the tracer must emit.

1

(ii) Explain your answer.

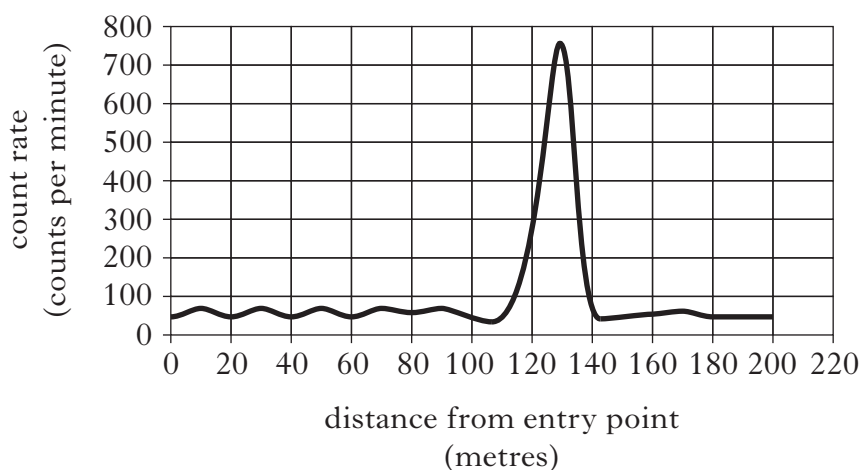
1

Marks

## 25. (continued)

- (b) A detector is used to measure the radioactivity at the road surface.

The graph below is produced on a computer as the detector is moved along the road surface.



Mark an "X" on the square on **Diagram 2** where there is a crack in the pipe. **1**

- (c) Suggest **one** precaution that the engineer should take when handling this type of radiation.

**1**

- (d) What happens to the strength of this type of radiation as time passes?

**1****[Turn over]**

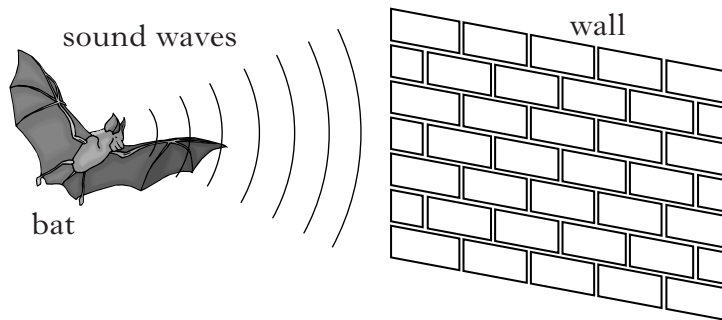
26. (a) What name is given to sounds of frequency greater than 20 000 hertz?

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1

(b) Bats send out very high frequency sounds to help them navigate in the dark.



The bat sends out a pulse of sound, which reflects from a nearby wall.

The bat hears the sound 0.2 seconds later.

(i) Determine the time the sound takes to travel from the bat to the wall.

1

(ii) The bat is 35 metres from the wall.

Use this information to calculate the speed of sound in air.

2

(c) While flying, the bat accelerates.

What word can be used to describe the forces acting on the bat as it accelerates?

1

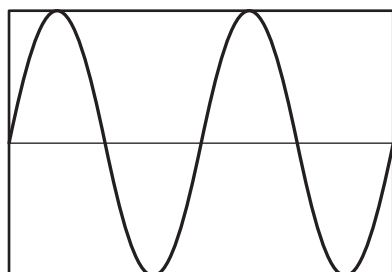
**[Turn over for Question 27 on *Page twenty-two***

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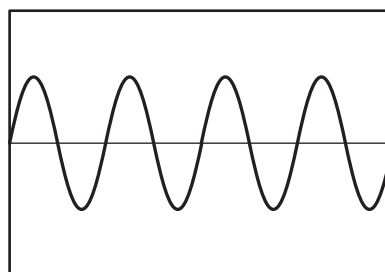
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27. A student investigates sound waves. A microphone is connected to an oscilloscope. Traces from two different sound waves are shown. The control settings are the same for both diagrams.

One sound has double the frequency of the other.



trace A



trace B

- (a) (i) Which trace shows the lower frequency?

1

- (ii) Which trace shows the louder sound?

1

- (iii) Complete the following sentences about sound, using some of the words from the list.

**vibration****octave****second****hertz****decibel****wavelength**

When two sounds are one  apart, the frequency of one sound is double that of the other.

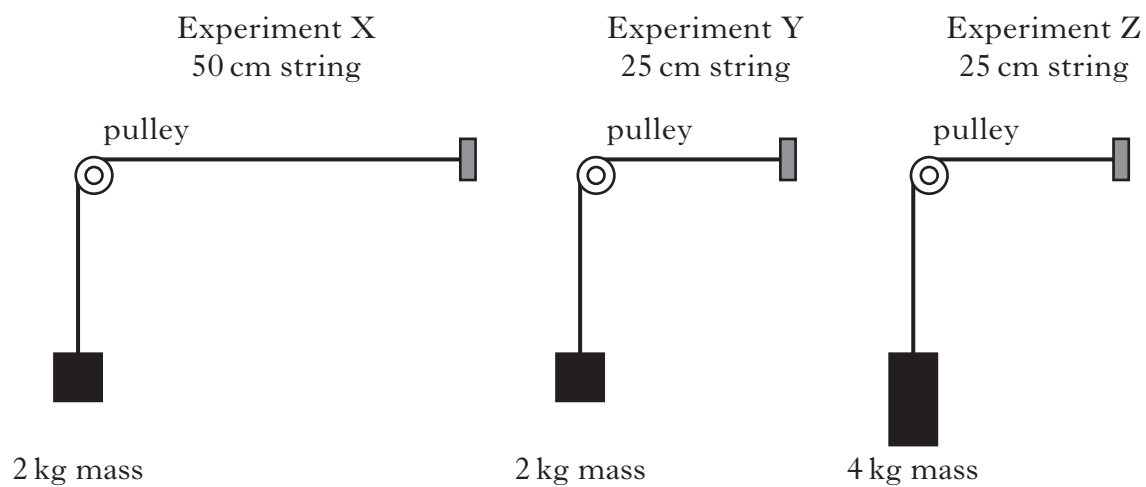
The unit of sound level is the .

2

## 27. (continued)

Marks

(b) A guitar string is cut into three lengths, and stretched as shown.



Each string is plucked to make a sound.

(i) Which experiment produces the lowest frequency sound?

1

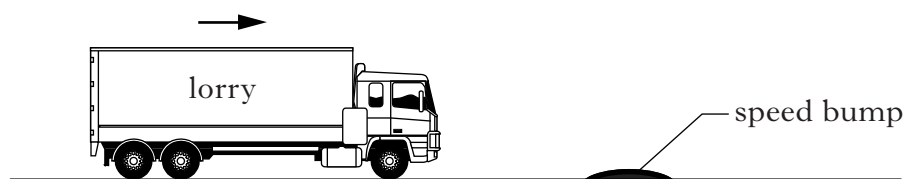
(ii) Explain your answer.

1

[Turn over

Marks

28. A lorry, of mass 10 000 kilograms, approaches a speed bump.



- (a) Calculate the weight of the lorry.

--

2

- (b) The lorry takes 5.5 seconds to travel 99 metres before reaching the speed bump.

Calculate the average speed of the lorry.

--

2

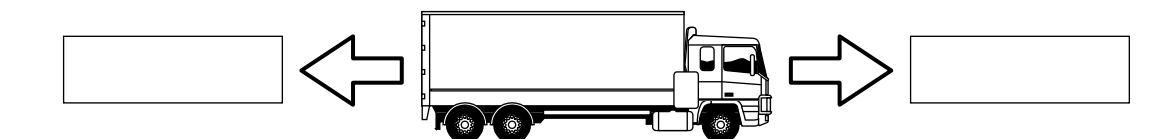


Marks

## 28. (continued)

- (c) As the lorry travels along the road there are forces acting on it as shown.  
Label these forces on the diagram below.

2



- (d) The springs of this lorry are damaged when it goes over the speed bump.  
Would there be more, less or the same damage to the lorry's springs if

- (i) the speed of the lorry is increased?

1

- (ii) the mass that the lorry is carrying is decreased?

1

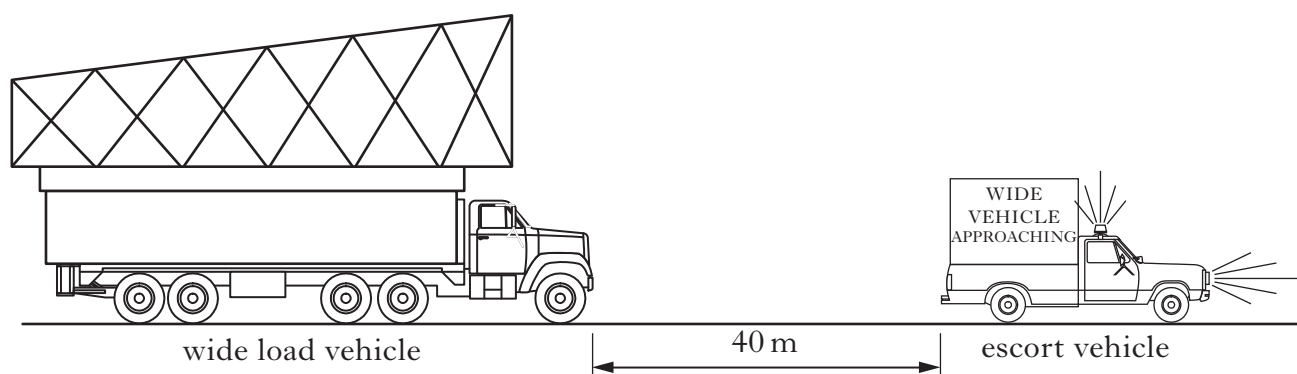
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29. An escort vehicle travels ahead of a wide lorry on a road.

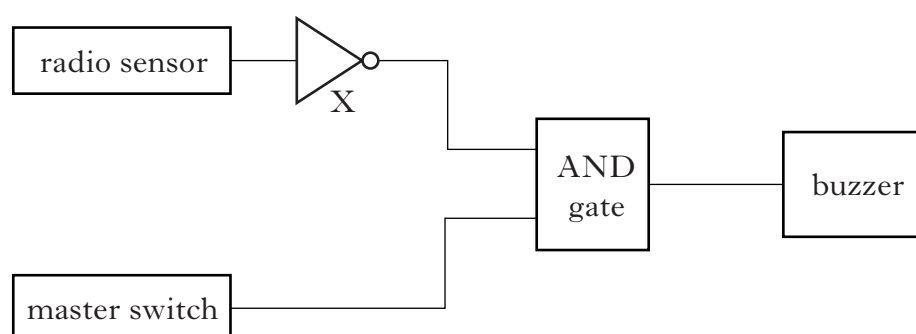
A warning sign and flashing lights on the escort vehicle inform motorists that a wide load is approaching.

The escort vehicle must not be more than 40 metres ahead of the lorry.



The lorry transmits a short range radio signal which is received by the escort vehicle.

When the escort vehicle is more than 40 m ahead, the radio signal becomes too weak, and a buzzer on the escort vehicle sounds. The escort vehicle driver then slows down to get back into the correct position.



(a) (i) Draw the circuit symbol for an AND gate.

1

(ii) Name gate X.

1

Marks

**29. (a) (continued)**

(iii) Complete the table for Gate X.

<i>Input</i>	<i>Output</i>
0	
1	

**1**

(b) State the speed of radio waves in air.

**1**

(c) When the radio sensor receives a strong signal its logic state is HIGH.

When the master switch is switched on its logic state is HIGH.

(i) What is the logic level of the AND gate output, when the escort vehicle goes too far ahead?

**1**

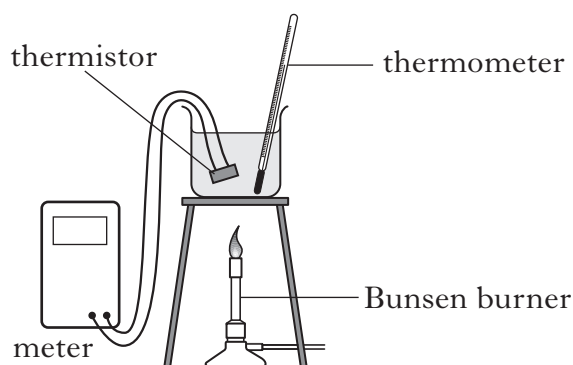
(ii) The master switch stops working, causing its logic state to be LOW all the time.

Explain how this would affect the operation of the buzzer.

**2****[Turn over for Question 30 on Page twenty-eight]**

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30. (a) A group of students set up the following apparatus to investigate how the resistance of a thermistor changes with temperature.



- (i) What name is given to the meter that measures resistance?

1

- (ii) Explain how they should carry out the investigation.

Your answer should include:

- (A) how they should use the equipment;

- (B) what they should measure.

2

- (b) A thermistor is an example of an **input** device.

Give an example of another input device.

1

[END OF QUESTION PAPER]

**ADDITIONAL SPACE FOR ANSWERS**

*Marks*

**ADDITIONAL SPACE FOR ANSWERS**

*Marks*

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## ACKNOWLEDGEMENTS

Question 21 – cobalt88/shutterstock.com

Question 25 – iralu/shutterstock.com

Question 25(b)(ii) – iralu/shutterstock.com