

2006 Physics

Intermediate 1

Finalised Marking Instructions

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Physics – Marking Issues

The current in a resistor is 1.5 amperes when the potential difference across it is 7.5 volts. Calculate the resistance of the resistor.

	Answers	Mark + Comment	Issue
1.	V=IR 7.5=1.5R R=5.0 Ω	(½) (½) (1)	Ideal answer
2.	5.0 Ω	(2) Correct answer	GMI 1
3.	5.0	(1½) Unit missing	GMI 2 (a)
4.	4.0 Ω	(0) No evidence/wrong answer	GMI 1
5.	_____ Ω	(0) No final answer	GMI 1
6.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 4.0 \Omega$	(1½) Arithmetic error	GMI 7
7.	$R = \frac{V}{I} = 4.0 \Omega$	(½) Formula only	GMI 4 and 1
8.	$R = \frac{V}{I} = \text{_____} \Omega$	(½) Formula only	GMI 4 and 1
9.	$R = \frac{V}{I} = \frac{7.5}{1.5} = \text{_____} \Omega$	(1) Formula + subs/No final answer	GMI 4 and 1
10.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 4.0$	(1) Formula + substitution	GMI 2 (a) and 7
11.	$R = \frac{V}{I} = \frac{1.5}{7.5} = 5.0 \Omega$	(½) Formula but wrong substitution	GMI 5
12.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 5.0 \Omega$	(½) Formula but wrong substitution	GMI 5
13.	$R = \frac{I}{V} = \frac{7.5}{1.5} = 5.0 \Omega$	(0) Wrong formula	GMI 5
14.	V = IR 7.5 = 1.5 × R R = 0.2 Ω	(1½) Arithmetic error	GMI 7
15.	V = IR $R = \frac{I}{V} = \frac{1.5}{7.5} = 0.2 \Omega$	(½) Formula only	GMI 20

Marks

1. Which colours of light are mixed on a colour TV screen?

- A Red, blue and yellow
- B Red, green and yellow
- C Blue, green and yellow
- D Blue, green and white
- E Blue, green and red

Answer E

1

2. Which row in the table describes the components in a telephone handset?

	<i>Mouthpiece</i>	<i>Earpiece</i>
A	loudspeaker	microphone
B	amplifier	microphone
C	microphone	transmitter
D	microphone	loudspeaker
E	receiver	loudspeaker

Answer D

1

3. Which row in the table describes an eye defect?

	<i>Defect</i>	<i>Near object</i>	<i>Distant object</i>
A	long sight	blurred	clear
B	long sight	clear	clear
C	long sight	clear	blurred
D	short sight	blurred	clear
E	short sight	blurred	blurred

Answer A

1

4. Sound level is measured in

- A hertz
- B joules
- C decibels
- D hertz per second
- E metres per second.

Answer C

1

Marks

5. A student makes the following three statements about a tennis ball.

- I If the ball is hit with more force it will have a greater speed.
- II The surface of the court does not affect the height of the bounce.
- III The angle of the shot affects the range of the ball.

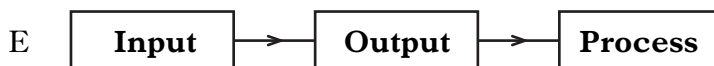
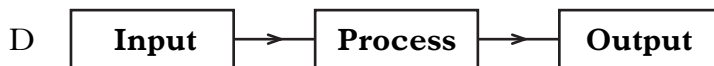
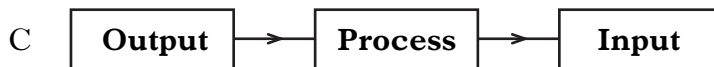
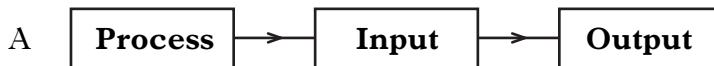
Which of these statements is/are correct?

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

Answer C

1

6. Which of the following block diagrams shows the main parts of an electronic system?



Answer D

1

7. A thermistor is

- A an output device with a constant resistance
- B an output device whose resistance changes with light level
- C an output device whose resistance changes with temperature
- D an input device whose resistance changes with light level
- E an input device whose resistance changes with temperature.

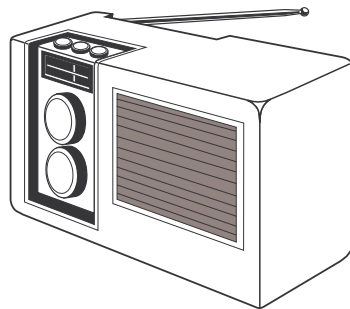
Answer E

1

Marks

8. Read the following passage taken from a student's diary.

“Gran thinks my new picture mobile phone is like magic. Wait till she sees Dad's hand held TV! She can remember when her family got their first wireless. There were only a few radio stations at that time. Gran now likes to listen to news programmes and Scottish music. I prefer to listen to Rock 104 FM.”



- (a) Why is a radio sometimes called a *wireless*?

**There are no wires between transmitter and receiver
OR signals received by radio waves to the aerial**

1

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

A radio signal has a higher/lower frequency than a TV signal.

1

- (c) State the speed of radio and TV waves in air.

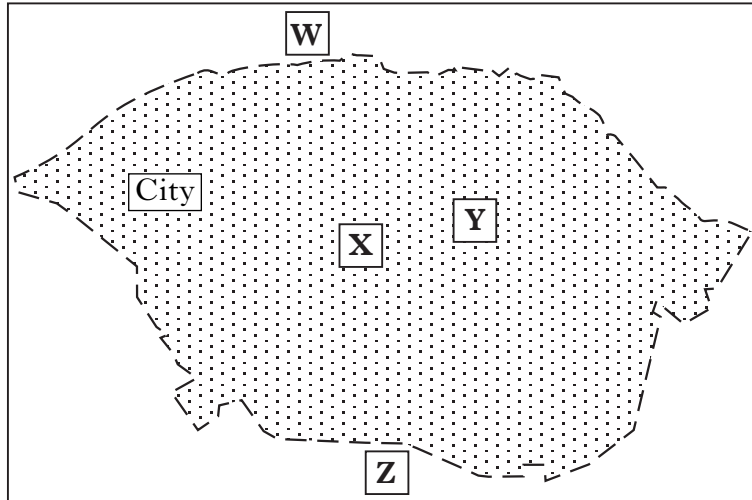
300 million metres per second (note: $\frac{1}{2}$ unit deduction)

1

Marks

8. (continued)

- (d) An engineer has to choose suitable frequencies for radio stations W, X, Y and Z. The transmissions from the different stations must not interfere with each other. Only three frequencies are available for the four stations. Complete the table to show the frequency for each transmitter.



<i>Transmitter</i>	<i>Frequency in millions of hertz</i>
X	89.4
W	94.3
Z	94.3
Y	98.2

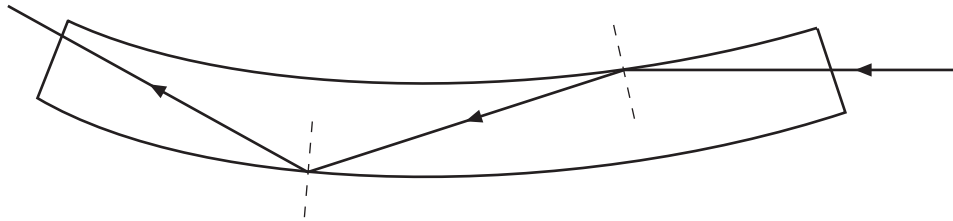
1

X and Y are interchangeable.

W and Z are interchangeable.

Marks

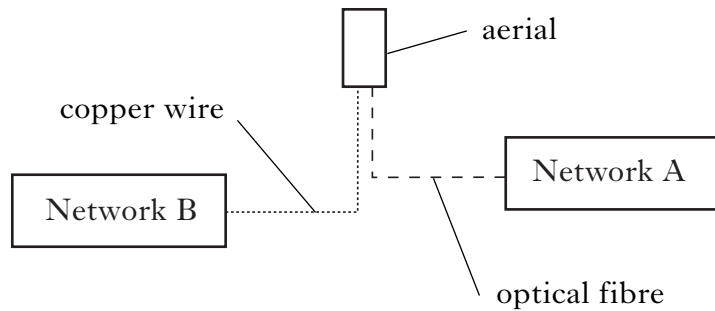
9. (a) Complete the path of the ray of light through the optical fibre shown below.



1

- (b) Two computer networks are connected to the same aerial. Network A is connected using optical fibre, network B is connected using copper wire. The aerial is struck by lightning. Only one network is damaged.

State which network is damaged. You **must** explain your answer.



copper wire network OR network B (1)

because optical fibres are not affected by electrical interference OR copper conducts electric current (1)

2

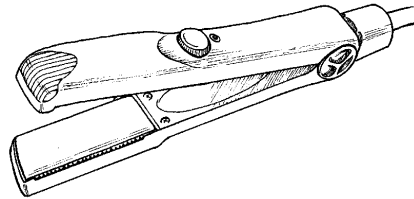
- (c) Give **one** disadvantage of using optical fibre in a communication system.

optical fibres are difficult to join together

1

Marks

10. A student uses a pair of ceramic hair straighteners. They operate at 230 volts with a power rating of 805 watts.



- (a) (i) Calculate the current in the straighteners when switched on.

$$\text{current} = \frac{\text{power}}{\text{voltage}} \left(\frac{1}{2}\right) = \frac{805}{230} \left(\frac{1}{2}\right) = 3.5 \text{ amperes (1)}$$

2

- (ii) Which fuse should be used in the plug attached to the straighteners? The following fuses are available. **Circle your choice.**

3 amperes

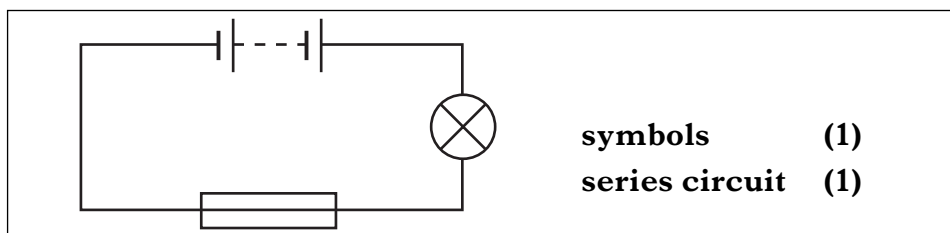
5 amperes

13 amperes

1

- (b) The straighteners stop working. The student removes the fuse from the plug to test it. The student makes a continuity tester using a battery, lamp and wires.

- (i) Draw a circuit diagram to show how the continuity tester is used to test the fuse.



2

- (ii) The lamp does not light. The student concludes that the fuse has blown. What name is given to this fault?

open circuit

1

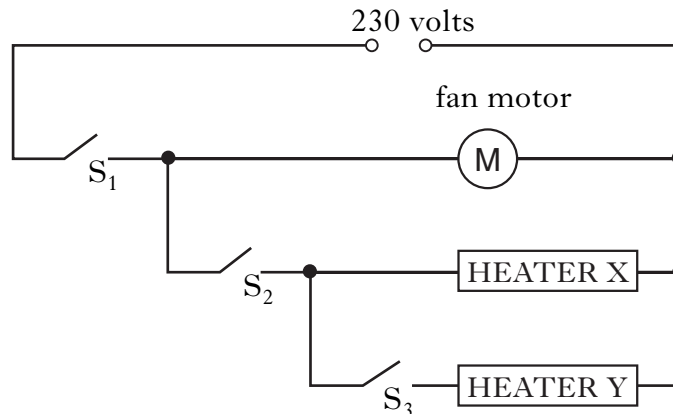
- (c) The ceramic straighteners give off heat radiation. Give another name for heat radiation.

infrared (radiation)

1

Marks

11. The following circuit diagram shows a fan heater which can provide cold, warm or hot air.



- (a) (i) Which switch or switches must be closed so that the heater provides a stream of warm air?

switches S_1 and S_2

1

- (ii) State the energy change that takes place in the motor.

electrical (energy) to kinetic (energy)

1

- (b) The supply voltage is 230 volts.

- (i) State the voltage across the motor when the fan is on.

230 volts

1

- (ii) State the voltage across heater X when the heater is set at hot.

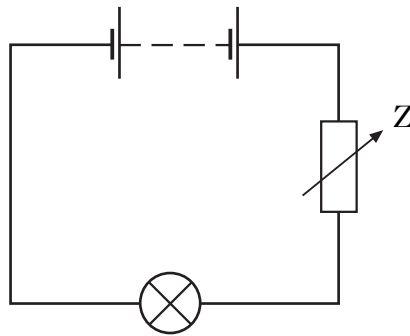
230 volts

1

Note: $\frac{1}{2}$ unit deduction in both (b)(i) and (b)(ii)

Marks

12. A student builds the following circuit.



- (a) What is component Z?

variable resistor

1

- (b) The current in the lamp is 0.5 amperes. The voltage across the lamp is 4 volts. Calculate the resistance of the lamp.

$$\text{resistance} = \frac{\text{voltage}}{\text{current}} \left(\frac{1}{2}\right) = \frac{4}{0.5} \left(\frac{1}{2}\right) = 8 \text{ ohms } (1)$$

2

- (c) Suggest **two** changes you could make to the circuit to make the lamp brighter.

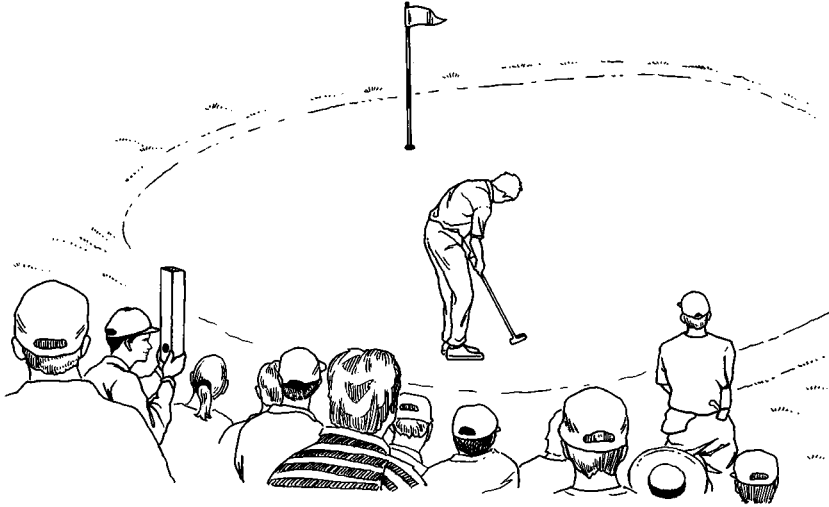
add more batteries OR increase the voltage (1)

decrease resistance of variable resistor OR remove variable resistor (1)

2

Marks

13. A spectator at the Open Golf Championship uses a viewer to see over the heads of the crowd.

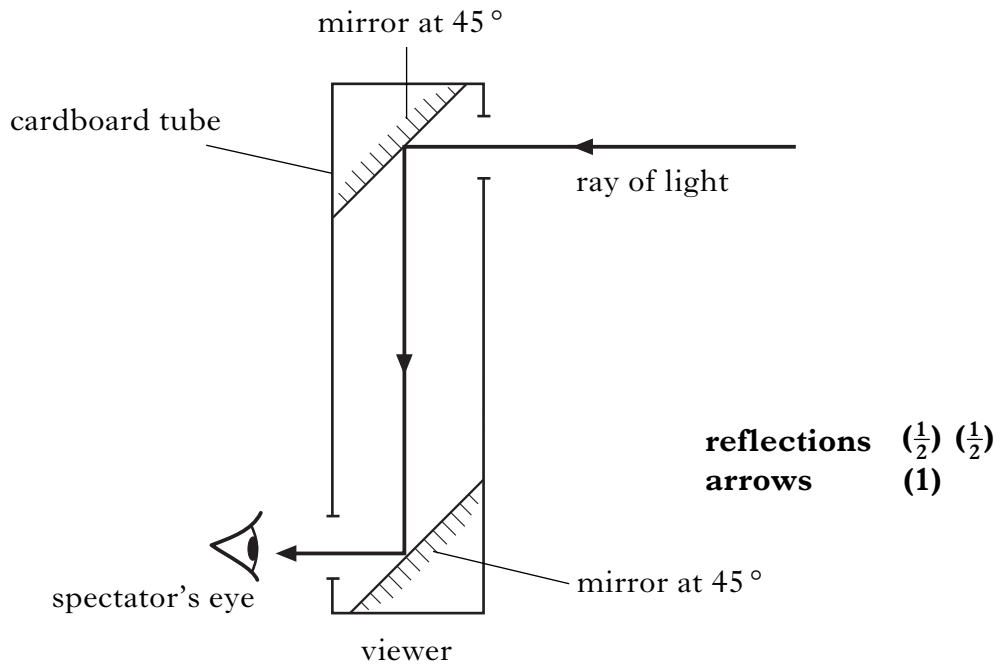


- (a) What happens to a ray of light when it hits a mirror?

reflected

1

- (b) Complete the diagram below to show the path of the ray of light through the viewer to the spectator's eye.



2

Marks

13. (continued)

(c) The spectator uses his mobile phone to tell a friend the result of the game.



Complete the sentences below by choosing from the wordbank. Words may be used more than once.

sound **microphone** **radio** **loudspeaker**
LED **electrical** **LDR** **light**

The mouthpiece of the mobile phone contains a **microphone ($\frac{1}{2}$)**.

This device changes **sound ($\frac{1}{2}$)** energy to **electrical ($\frac{1}{2}$)** energy.

An **LED ($\frac{1}{2}$)** is used to light up the keypad.

This device changes **electrical ($\frac{1}{2}$)** energy to **light ($\frac{1}{2}$)** energy.

3

Marks

14. Shown below are some uses of different types of radiation.

treating muscle strain
checking security markings on banknotes
scanning baggage at airports
detecting leaks from cracked pipes
night vision binoculars
detecting broken bones
treating acne
sterilising surgical instruments

Complete the table using the above information.

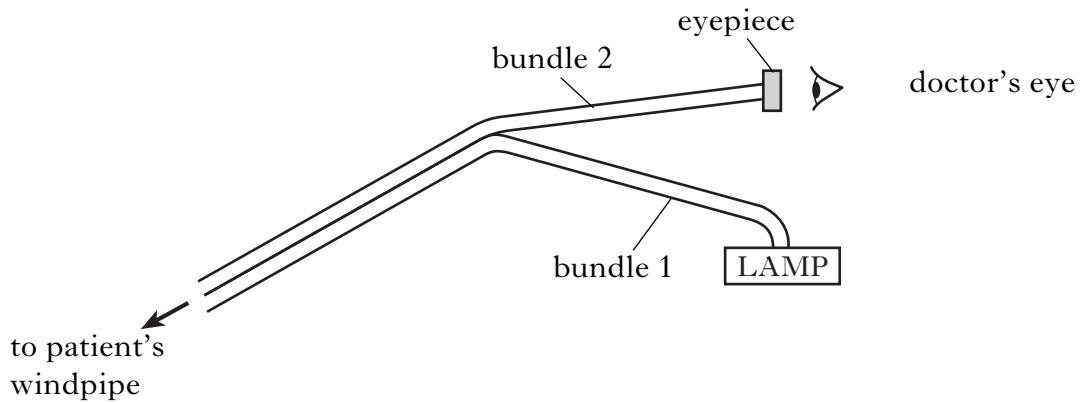
Only **one** entry should appear in each box.

<i>Radiation</i>	<i>Medical uses</i>	<i>Non-medical uses</i>
X-rays	detecting broken bones ($\frac{1}{2}$)	scanning baggage at airports ($\frac{1}{2}$)
Gamma	sterilising surgical instruments ($\frac{1}{2}$)	detecting leaks from cracked pipes ($\frac{1}{2}$)
Infrared	treating muscle strain ($\frac{1}{2}$)	night vision binoculars ($\frac{1}{2}$)
Ultraviolet	treating acne ($\frac{1}{2}$)	checking security markings on bank notes ($\frac{1}{2}$)

4

Marks

15. A doctor uses the device shown to examine the inside of a patient's windpipe.



(a) There are 2 bundles of optical fibres.

(i) State the purpose of bundle 1.

carries the light into the patient OR into the windpipe

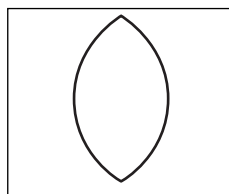
1

(ii) State the purpose of bundle 2.

carries light out of the patient OR allows doctor to see the windpipe

1

(b) The eyepiece contains a converging lens. Draw the shape of this lens.



1

(c) The doctor identifies a small growth that he wants to remove. The filament lamp is replaced by a laser. The laser light passes through the optical fibre.

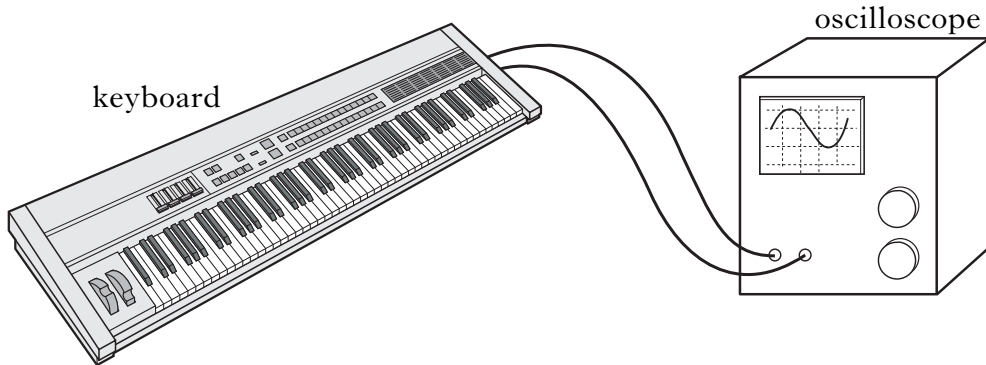
State **one** difference between light from a filament lamp and light from a laser.

laser light has one colour OR laser light is concentrated

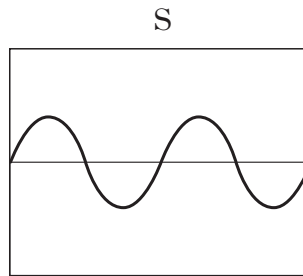
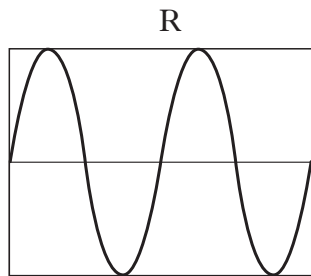
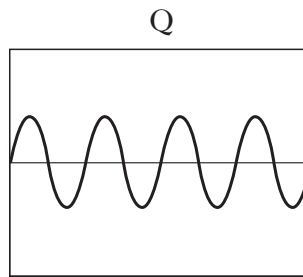
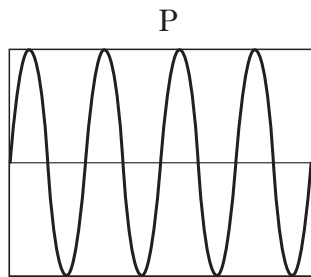
1

Marks

16. An electronic keyboard is connected to an oscilloscope.



The following traces are produced on the oscilloscope when four notes are played on the keyboard.



(a) (i) Which trace shows a loud, low frequency note?

R

1

(ii) Which trace shows a quiet, high frequency note?

Q

1

(b) What is the normal frequency range of human hearing?

20 hertz to 20 000 hertz

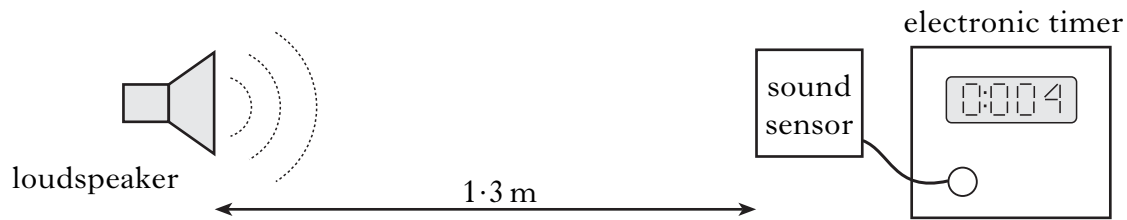
Note: $\frac{1}{2}$ unit deduction

1

Marks

16. (continued)

- (c) A sound sensor is placed 1.3 metres from the keyboard's loudspeaker.

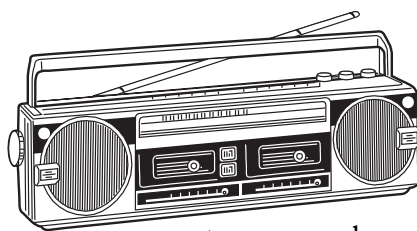


An electronic timer records that the sound takes 0.004 seconds to travel from the loudspeaker to the sensor. Use these figures to calculate the speed of the sound in air.

$$\text{speed} = \frac{\text{distance}}{\text{time}} \left(\frac{1}{2}\right) = \frac{1.3}{0.004} \left(\frac{1}{2}\right) = 325 \text{ metres per second (1)}$$

2

- (d) A student records her friend singing. They listen to the recording.



tape recorder



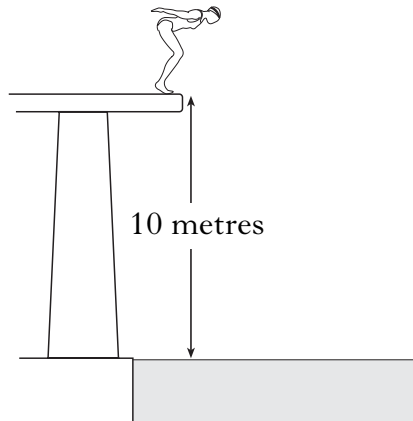
The singer does not recognise her recorded voice but her friend says that it sounds just like her. Explain why.

we hear our own voice (by vibrations) in bones and in air (1)
we hear a recording (by vibrations) in air only (1)

2

Marks

17. A girl dives from the 10 metre board. She has a mass of 65 kilograms.

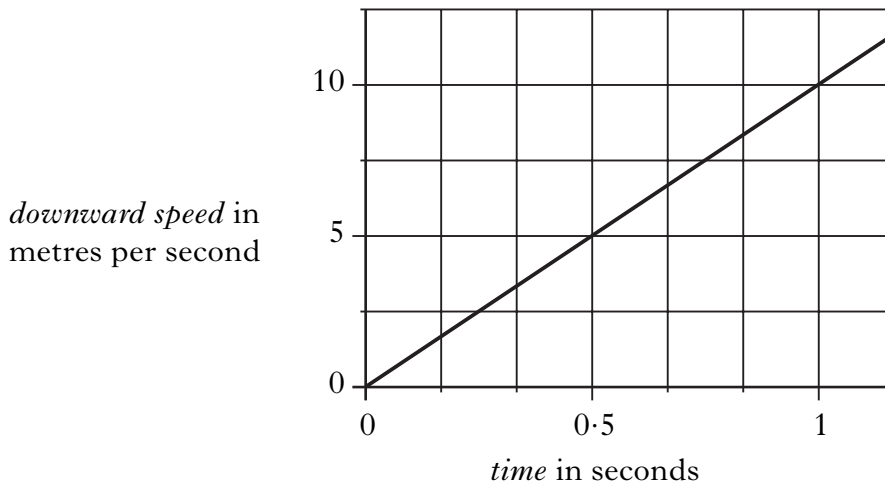


(a) Calculate the weight of the diver.

weight = 10 × mass ($\frac{1}{2}$) = 10 × 65 ($\frac{1}{2}$) = 650 newtons (1)

2

(b) The following graph shows the downward speed of the diver.



(i) What is the speed of the diver after 0.5 seconds?

**5 metres per second
(note: $\frac{1}{2}$ unit deduction)**

1

(ii) What is the speed of the diver after 1 second?

**10 metres per second
(note: $\frac{1}{2}$ unit deduction)**

1

(iii) What name is given to this increase in speed?

acceleration

1

Marks

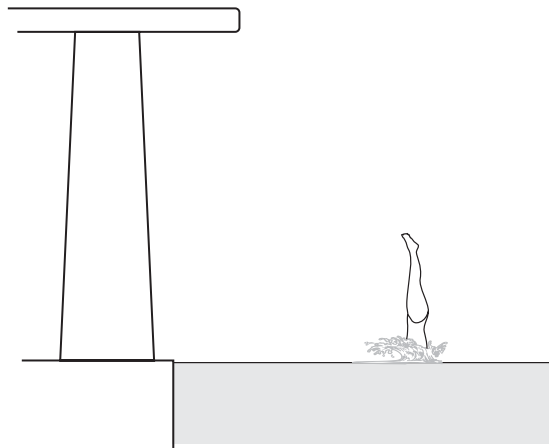
17. (continued)

- (c) The diver takes one second to fall the first 5 metres. Will she take more, less or the same time to fall the second 5 metres? You **must** give a reason for your answer.

she takes less time (1)
because she is accelerating (1)
(note: first mark only available if explanation attempted)

2

- (d) The diver enters the water.



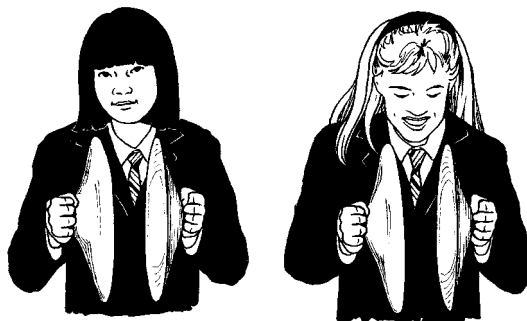
Explain why her speed decreases on entering the water.

friction due to the water (is greater than friction due to the air)

1

Marks

18. Two music students are playing the cymbals in the school band. One of the students says that the cymbals can be used in an experiment to measure the speed of sound in the school grounds.



- (a) (i) What measurements would be made to measure the speed of sound?

distance (from cymbals to timer) ($\frac{1}{2}$)
time (between seeing cymbals clash and hearing the sound) ($\frac{1}{2}$)

1

- (ii) What equipment would be used to make these measurements?

measuring tape ($\frac{1}{2}$)
stop watch ($\frac{1}{2}$)

1

- (iii) How would these measurements be used to calculate the speed of the sound?

speed = distance/time

1

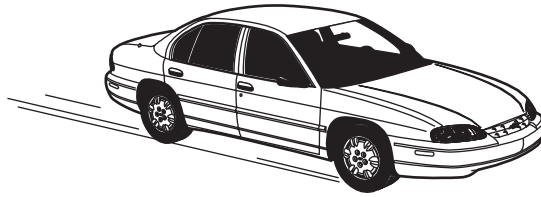
- (b) Suggest **one** factor which could make the students' measurements inaccurate.

reaction time
OR
wind

1

Marks

19. A car is driven along a road. The two horizontal forces acting on the car are the engine force and friction.



- (a) What can you say about the sizes and directions of these forces when the car is travelling at a steady speed?

forces are balanced (2)
OR
the forces are equal (1) and opposite (1)

2

- (b) The car travels a distance of 8100 metres through a city. The journey takes 15 minutes.

Calculate the average speed of the car in metres per second.

$$\text{average speed} = \frac{\text{distance}}{\text{time}} \left(\frac{1}{2}\right) = \frac{8100}{15 \times 60} \left(\frac{1}{2}\right) \left(\frac{1}{2}\right) = 9 \text{ (metres per second)} \left(\frac{1}{2}\right)$$

2

- (c) The average speed for this journey is less than the maximum speed. Explain why.

car may have had to stop on the journey
OR
any other suitable answer involving variable speed on journey

1

Marks

20. (a) A list of electronic devices is shown.

motor	switch	AND gate
LED	buzzer	LDR

(i) From the list select one process device.

AND gate

1

(ii) From the list select one output device.

buzzer or LED or motor

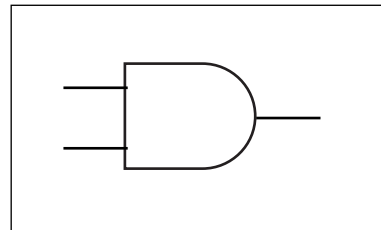
1

(iii) From the list select one input device.

switch or LDR

1

(iv) Draw the symbol for the AND gate.



1

(b) A public address system consists of a microphone, amplifier and loudspeaker. The voltage across the microphone is 0.05 volts. The voltage across the loudspeaker is 20 volts. Calculate the voltage gain of the amplifier.

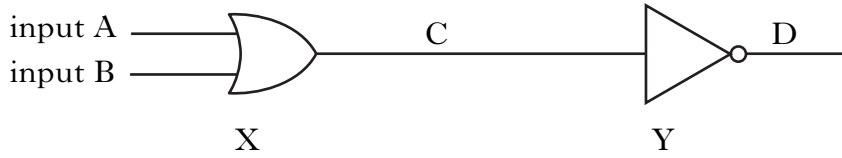
$$\text{voltage gain} = \frac{\text{output voltage}}{\text{input voltage}} \left(\frac{1}{2}\right) = \frac{20}{0.05} \left(\frac{1}{2}\right) = 400 \quad (1)$$

(note: $\frac{1}{2}$ deduction if any unit given)

2

Marks

21. A student investigates the logic gates shown.



(a) (i) Name logic gate X.

OR (gate)

1

(ii) Name logic gate Y.

NOT (gate)

1

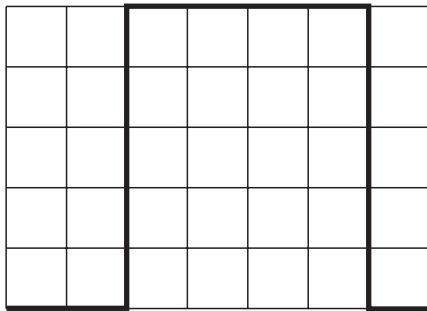
(b) (i) Is a high input voltage known as logic 0 or logic 1?

(Logic) 1

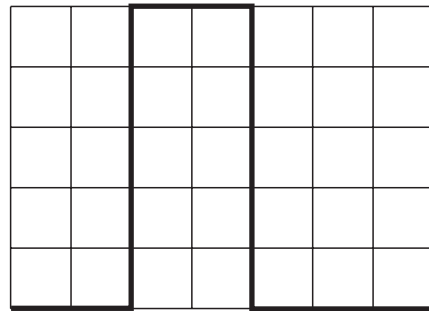
1

(ii) The diagrams below show oscilloscope traces for input A and input B.

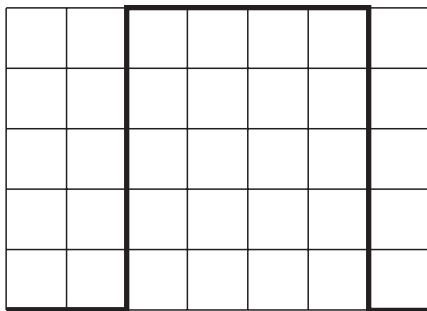
Draw the oscilloscope traces for output C and output D.



Input A

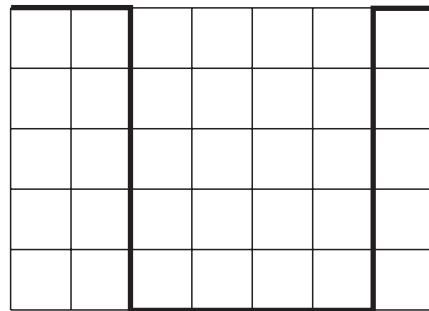


Input B



Output C

(1)



Output D

(1)

2

[END OF MARKING INSTRUCTIONS]