

FOR OFFICIAL USE

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Section B Total
Marks

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NATIONAL QUALIFICATIONS 2014

PHYSICS INTERMEDIATE 1

THURSDAY, 22 MAY
9.00 AM – 10.30 AM

X069/10/02

Fill in these boxes and read what is printed below.

Full name of centre

Town

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Forename(s)

Surname

Number of seat

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Date of birth

Day

Month

Year

Scottish candidate number

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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.

Use **blue** or **black** ink only.



* X 0 6 9 1 0 0 2 0 1 *

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 part of the television receiver that converts electrical energy to sound energy is the
- A aerial
 - B tuner
 - C amplifier
 - D loudspeaker
 - E TV tube.
2. Optical fibres transmit
- A electrical signals
 - B light signals
 - C ultrasound signals
 - D radio signals
 - E sound signals.
3. A mobile phone contains an earpiece.
The earpiece is a
- A receiver and contains a microphone
 - B receiver and contains a loudspeaker
 - C transmitter and contains a loudspeaker
 - D transmitter and sends out coded messages
 - E receiver and changes sound to electrical energy.

4. A student writes the following sentence.

An electric current is a flow of M and is measured in N .

Which row in the table shows the words represented by the letters M and N ?

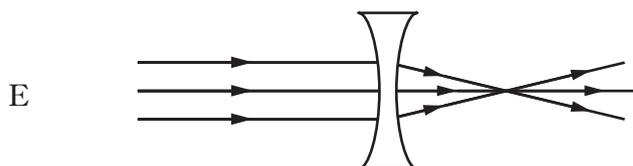
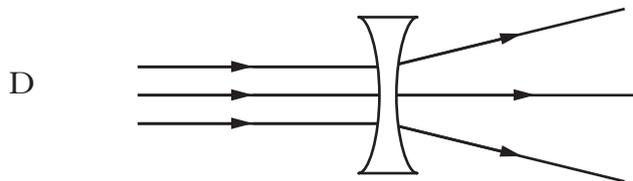
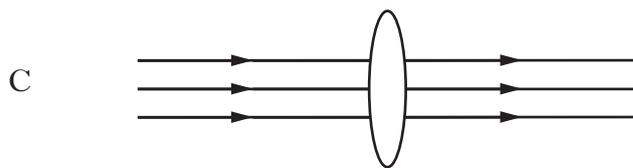
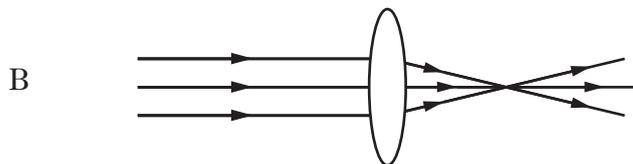
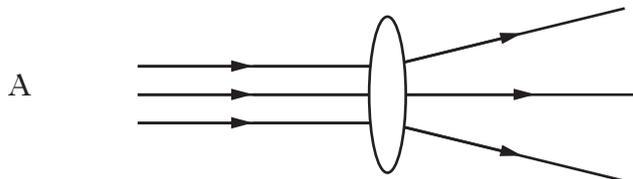
	M	N
A	voltage	volts
B	resistance	ohms
C	charge	ohms
D	resistance	amperes
E	charge	amperes



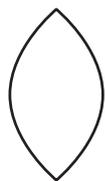
5. Which row in the table shows the symbols for a resistor and a variable resistor?

	<i>Resistor</i>	<i>Variable Resistor</i>
A		
B		
C		
D		
E		

6. Which diagram shows a diverging lens and the effect it has on parallel rays of light?



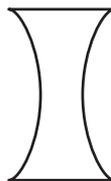
7. The diagram shows four different lenses W, X, Y and Z.



W



X



Y



Z

A student is long sighted.

Which of the lenses could be used to correct this sight defect?

- A X only
 - B Z only
 - C W and X only
 - D Y and Z only
 - E W, X, Y and Z
8. A student makes the following statements about X-rays.

- I X-rays are visible to the naked eye.
- II X-rays can be used to detect broken bones.
- III X-rays can be detected by photographic film.

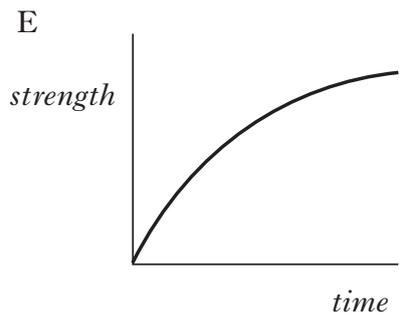
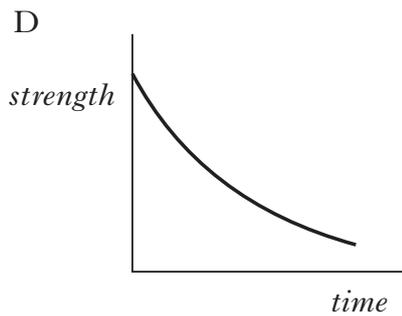
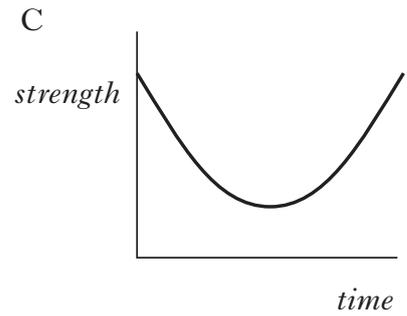
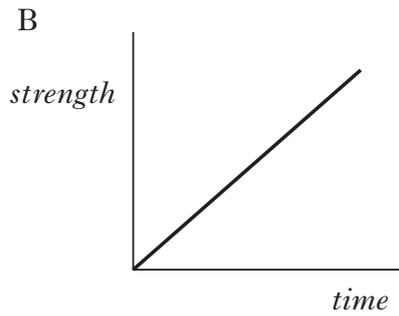
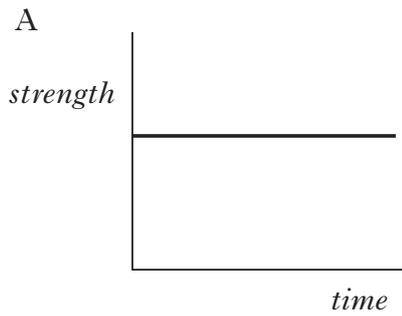
Which of these statements is/are correct?

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

[Turn over



9. Which of the following graphs shows how the strength of a radioactive source changes with time?



10. Security pens use “invisible” ink to mark valuable items.

These markings become visible when exposed to

- A infrared radiation
 - B ultraviolet radiation
 - C microwaves
 - D X-rays
 - E visible light.
11. A student carries out an experiment with a vibrating guitar string.
- Which of the following would produce the lowest frequency of sound?
- A Halving the length of the string
 - B Doubling the length of the string
 - C Keeping the length the same and tightening the string
 - D Halving the length of the string and tightening the string
 - E Doubling the length of the string and tightening the string



12. The length of an iron rail is 250 metres.
One end of the rail is tapped with a hammer.
The sound produced takes 0.05 seconds to travel to the other end of the rail.
The speed of sound in the rail is

- A 12.5 metres per second
- B 50 metres per second
- C 500 metres per second
- D 5000 metres per second
- E 10 000 metres per second.

13. Ferrets can hear sounds with frequencies between 16 hertz and 44 000 hertz.



Ferrets and humans can both hear sounds with a frequency of

- A 10 hertz
 - B 16 hertz
 - C 1500 hertz
 - D 25 000 hertz
 - E 30 000 hertz.
14. A bag of sugar has a mass of 2.0 kilograms.
The weight of the bag of sugar is
- A 0.20 newtons
 - B 2.0 kilograms
 - C 2.0 newtons
 - D 20 kilograms
 - E 20 newtons.



15. A car is moving along a road.



The brakes of the car provide a force to change its speed.

The largest change in speed is produced by

- A a force of 2000 newtons acting for 4 seconds
 - B a force of 2000 newtons acting for 8 seconds
 - C a force of 4000 newtons acting for 2 seconds
 - D a force of 6000 newtons acting for 4 seconds
 - E a force of 8000 newtons acting for 8 seconds.
16. A student is investigating the rebound height of a ball after it is dropped and hits a surface.

A student makes the following statements.

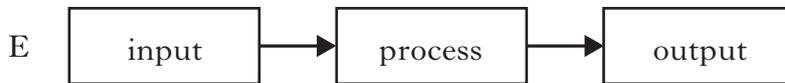
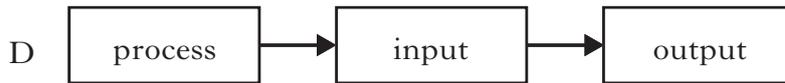
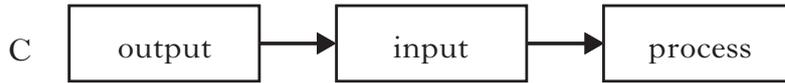
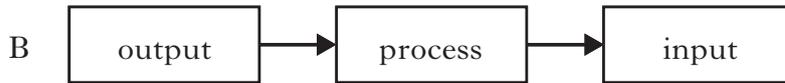
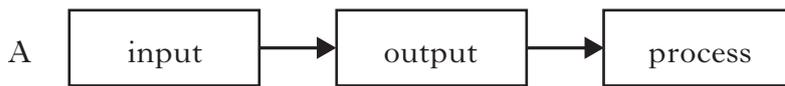
- I Changing the surface that the ball drops onto could change the rebound height.
- II Changing the material that the ball is made from will **not** change the rebound height.
- III Changing the speed at which the ball hits the surface will change the rebound height.

Which of these statements is/are correct?

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



17. Which block diagram shows the correct order of the subsystems of an electronic system?



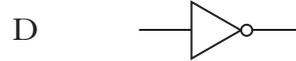
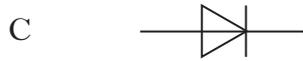
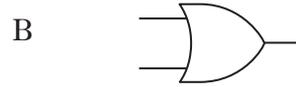
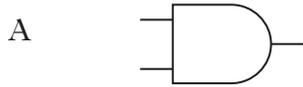
18. An electronic system is designed to switch on a lamp when it gets dark.
Which of the following devices could be used as the input device for the system?

- A LED
- B Microphone
- C LDR
- D Lamp
- E Thermistor

[Turn over



19. Which of the following is the symbol for a NOT gate?



20. The digital signal shown below is applied to the input of a NOT gate.



digital signal

The output signal from the NOT gate is



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

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Answer questions 21–32 in the spaces provided.

21. A radio receiver can detect signals from many radio stations.

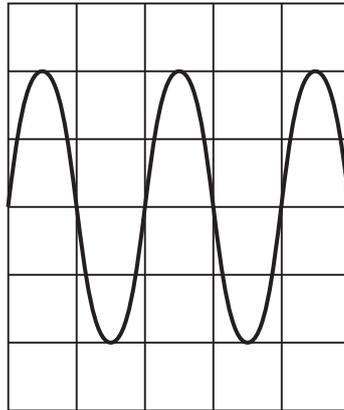
(a) Which part of the radio receiver detects the radio signals?

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1

(b) An engineer is investigating signals from different radio stations using an oscilloscope.

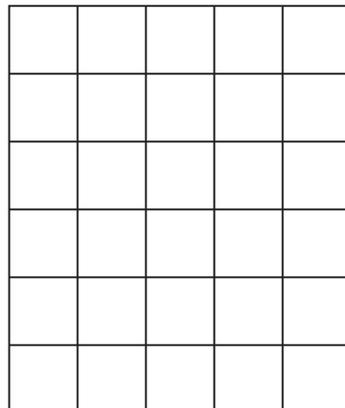
The trace from the first signal is shown below.



(i) The second signal is now investigated. It has a higher frequency and a lower amplitude than the first signal.

The oscilloscope controls are not changed.

Draw the trace that the engineer could now see on the oscilloscope.



2



21. (b) (continued)

(ii) Complete the sentences below using some of these words.

amplifier amperes decoder hertz tuner 340 300 000 000

The of a radio receiver selects one radio frequency from many different frequencies.

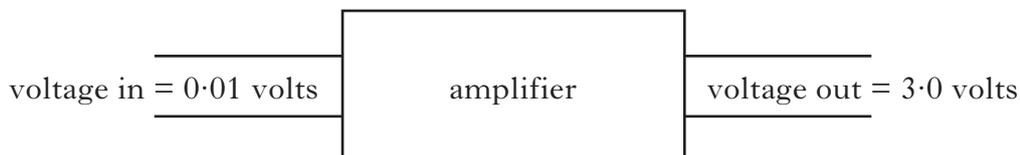
The received signal is very weak and is increased in strength by the . The frequency of the signal is measured in .

The speed of the radio signal is metres per second.

2

(c) The radio receiver contains an amplifier.

The input voltage to the amplifier is 0.01 volts. The output voltage from the amplifier is 3.0 volts.



Calculate the voltage gain of the amplifier.

2



Marks

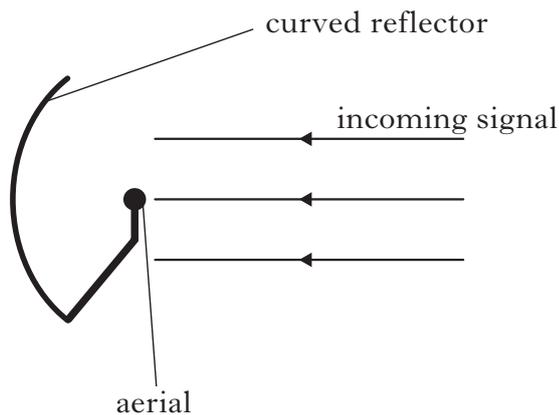
22. Television signals from the Commonwealth Games in Glasgow will be sent all over the world using geostationary satellites.

(a) State what is meant by a geostationary satellite.

1

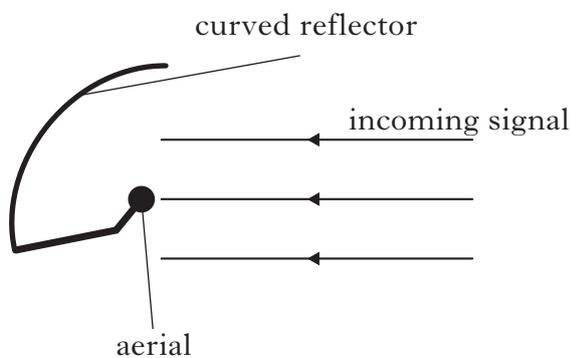
(b) A curved reflector is placed behind the aerial as shown in the diagram.

(i) Complete the diagram below to show the effect of the curved reflector on the signals.



1

(ii) High winds move the curved reflector to a new position, shown below in the diagram.



Marks

22. (b) (ii) (continued)

(A) State the effect that this has on the signal received at the aerial.

1

(B) Explain your answer.

1

[Turn over



Marks

23. The rating plate for an electric lawn mower is shown below.

Type	Code
G26	UK-14
230 Volts ~	50 Hertz
1380 Watts	



(a) What does the symbol shown below indicate?



1

(b) (i) Calculate the current in the lawn mower when it is operating.

2

(ii) From the list of fuses below, **circle** the most appropriate fuse needed to protect the lawn mower flex.

3 amperes 5 amperes 10 amperes 15 amperes

1



23. (continued)

(c) The lawn mower has a warning label.

DO NOT USE IN WET WEATHER

Explain why it is unsafe to use the lawn mower in wet weather.

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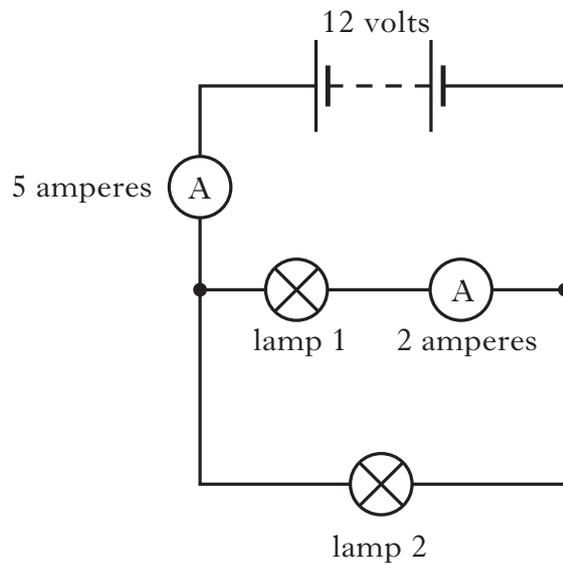
1

[Turn over



Marks

24. A student sets up the circuit below to demonstrate the way lamps inside a caravan are connected.



- (a) (i) Complete the diagram to show a voltmeter connected to measure the voltage across lamp 2.

1

- (ii) State the voltage across lamp 2.

1

- (iii) What is the current in lamp 2?

1

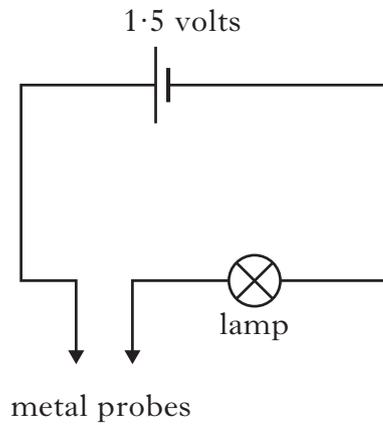
- (b) Lamp 1 “blows” and goes out. Explain why lamp 2 stays on?

1



24. (continued)

(c) The student uses a continuity tester to check for faults in a circuit.



(i) How could the student check that the continuity tester is working properly?

1

(ii) The continuity tester is found to be faulty.
State **one** possible reason why the continuity tester is not working.

1



25. All radiations in the electromagnetic spectrum travel at the speed of light.

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MARGIN

Marks

(a) Gamma radiation is used as a tracer.

(i) Describe how gamma radiation can be used for this purpose.

1

(ii) The radiation from a gamma source is monitored.

In 10 minutes 6000 counts are detected.

Calculate the number of counts detected per second.

2

(b) When X-rays are being used the warning sign shown has to be displayed.



(i) Why is it necessary for this sign to be displayed when X-rays are in use?

1



25. (b) (continued)

(ii) Describe **one** use of X-rays in industry.

--

1

(c) The different radiations in the electromagnetic spectrum are shown below.

radio	television	microwaves	infrared	visible light	ultraviolet	X-rays	gamma rays
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The radiations are placed in order of frequency.

Using your knowledge of radio and television signals, state whether visible light has a higher or lower frequency than television signals.

--

1

[Turn over



Marks

26. Colour images called thermograms are used to detect temperature variations in a patient's body. Unhealthy tissue is warmer than healthy tissue and can be seen on a thermogram as different colours.



- (a) (i) State the type of radiation used to produce a thermogram.

1

- (ii) Drugs are used to treat the unhealthy tissue.

Describe how thermograms are used to show if the drugs are working.

1

- (b) State **one** other medical use for the radiation used to produce thermograms.

1



Marks

26. (continued)

- (c) Over exposure to sunlight can cause damage to the skin.
State the type of radiation that causes this damage.

	1	
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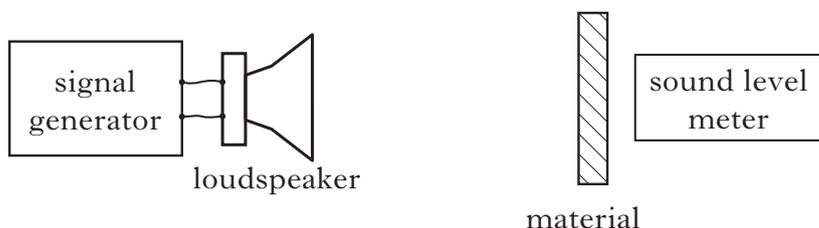
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Marks

27. A student carries out an experiment to investigate the ability of different materials to reduce sound level.

The student uses a signal generator, loudspeaker, sound level meter, and different materials. Each different material is 5 millimetres thick.



The volume on the signal generator is kept constant.

- (a) Complete the following passage using some of the words below.

vibrate waves frequency amplify energy

For sound to be produced the loudspeaker must .

Sound is a wave that transfers . 1

- (b) The following results were recorded.

<i>Material</i>	<i>Sound Level</i> (decibels)
none	111
glass	72
metal	83
plastic	78
wood	75

- (i) Which material absorbs the most sound?

1



Marks

27. (b) (continued)

(ii) Explain your answer.

1

(c) The volume of sound reaching the ear is halved when a sound level is reduced by 3 decibels.

When the volume of sound reaching the ear is quartered, what is the reduction in decibels?

1

[Turn over



28. (a) Two students are measuring the speed of sound in air.
They are given an air horn, a flag, a measuring tape and a timer.



air horn

Describe an experiment the students could carry out using this apparatus to measure the speed of sound in air.

Your description must include:

- (i) the measurements the students would make;

- (ii) how the speed of sound is calculated.

2



Marks

28. (continued)

(b) The students use their measurements to calculate the speed of sound. The value they obtain is not what they expected.

Suggest a reason why their measurements do not give the expected value for the speed of sound.

1

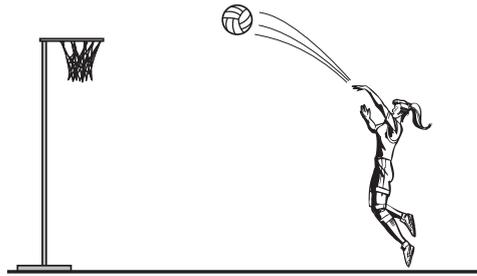
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29. Netball is one of the sports at the Commonwealth Games in Glasgow.

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A player stands 5 metres from the net. She throws the ball into the net to score.

- (a) The player now stands closer to the net and throws the ball at the same speed.

What other change to the throw would be needed to score now?

1

- (b) After scoring, the player runs back to a different position on the court.

She runs 7.0 metres in 2.0 seconds.

Calculate her average speed.

2

- (c) The player wears trainers to prevent herself slipping on the court.
Name the force that prevents the player from slipping on the court.

1



29. (continued)

- (d) After watching a game, two students investigate how the speed of the throw affects the range of the ball.

Their results are shown in the table.

<i>Speed of launch</i> in metres per second	<i>Range</i> in metres
4	3.0
8	8.0
12	16
16	27

- (i) What conclusion can the students make from their investigation?

1

- (ii) Estimate a value for the range of the ball thrown at 10 metres per second.

1

[Turn over



30. Two boats are competing in a sailing race.

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(a) Complete the sentences below using some of these words.

direction **weights** **forces** **unbalanced**
streamlined **balanced** **gravity**

When a boat travels at a constant speed the

acting on the boat are .

The shape of the boat is to allow the
boat to travel faster through the water.

When forces acting on the boat are not balanced the speed and

of the boat could change.

2



* X 0 6 9 1 0 0 2 3 0 *

30. (continued)

(b) At the start of the race the boats accelerate.

The table below gives details of the two boats.

<i>Boat name</i>	<i>Maximum speed in miles per hour</i>	<i>Time to go from 0 to 10 miles per hour in seconds</i>
Fair Lady	10	25
Wind Dancer	10	33

(i) Which boat has the greater acceleration?

1

(ii) Explain your answer.

1

[Turn over



* X 0 6 9 1 0 0 2 3 1 *

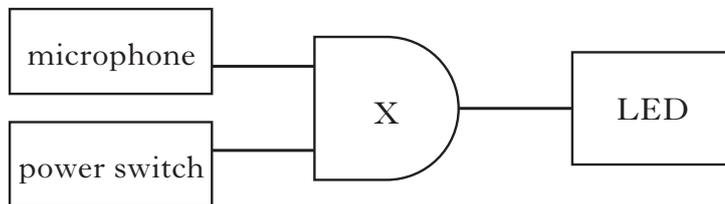
31. An electronic circuit in a karaoke machine is used to switch on an LED when a signal is detected from the microphone and the power switch is on.

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A block diagram of this system is shown below.



- (a) State the main energy change for a microphone.

1

- (b) (i) Name logic gate X.

1

- (ii) Complete the logic table for this system.

<i>microphone</i>	<i>power switch</i>	<i>LED</i>
0	0	
0	1	
1	0	
1	1	

1



31. (continued)

- (c) The LED is rated at a voltage of 6.0 volts and a current of 0.05 amperes.

Calculate the resistance of the light emitting diode.

2

- (d) A student records himself singing on the karaoke machine and plays it back. The student thinks his voice sounds different. Explain why this happens.

1

[Turn over



Marks

32. The following components are found in a box.

- thermistor** **LED** **buzzer**
motor **LDR** **microphone**

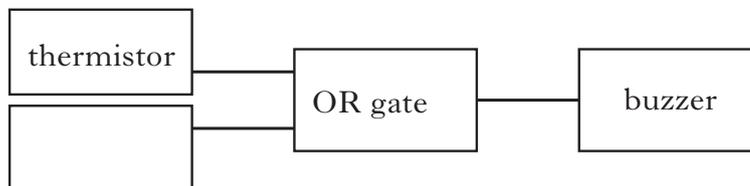
(a) Complete the table below by placing the components in the correct column.

<i>INPUT</i>	<i>OUTPUT</i>
thermistor	buzzer

2

(b) An electronic circuit is required to make a warning sound when signals are received from either a temperature sensor or a light sensor.

(i) Choose the component **from the list above** that completes the block diagram for this circuit.



1

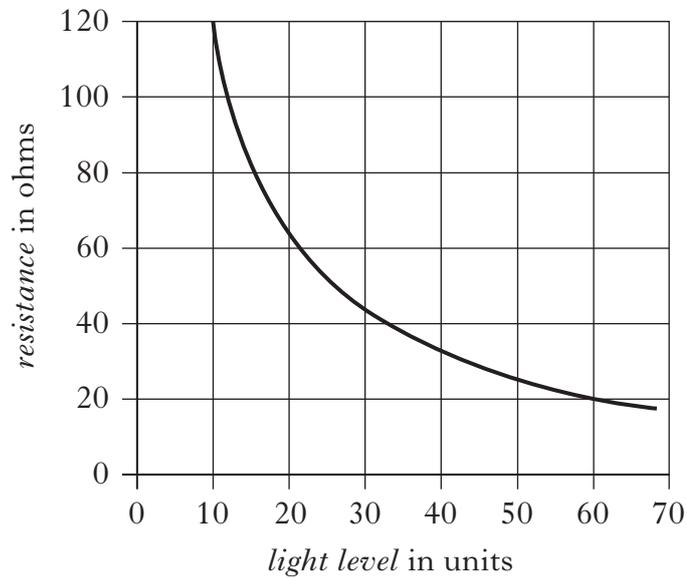
(ii) Explain how this circuit operates when the OR gate receives a signal from either of the sensors.

1



32. (continued)

- (c) The graph shows how the resistance of an LDR changes as the light level changes.



The light level changes from 10 units to 60 units. Use the graph to find the **change in resistance**, in ohms, of the LDR.

1

[END OF QUESTION PAPER]



ADDITIONAL SPACE FOR ANSWERS

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ADDITIONAL SPACE FOR ANSWERS

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Question 26 – 1354934 Shutterstock.com

Question 28(a) – 66455959 Shutterstock.com

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