FOR OFFICIAL USE

Total Marks

X069/101

NATIONAL QUALIFICATIONS 2011

MONDAY, 23 MAY
1.00 PM – 2.30 PM

PHYSICS
INTERMEDIATE 1

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth
Day Month Year

Scottish candidate number

Number of seat

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

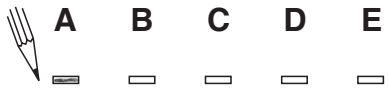
B ampere

C watt

D coulomb

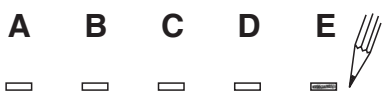
E volt.

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 unit of frequency for radio waves is

A hertz

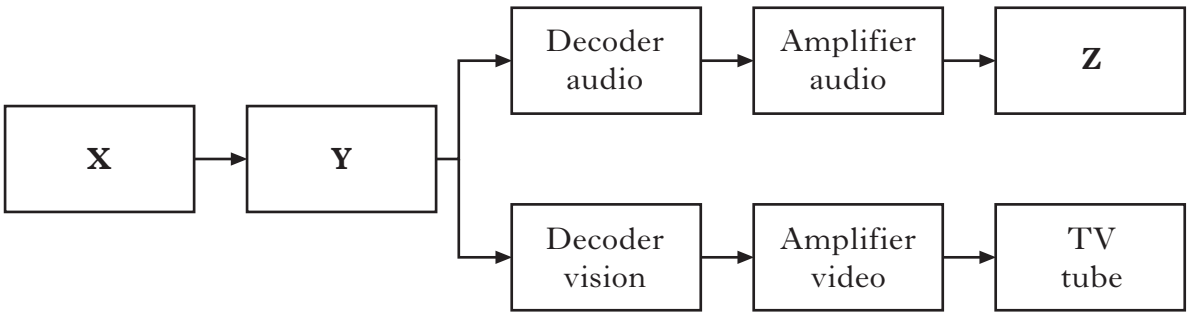
B metres

C seconds

D decibels

E metres per second.

2. The block diagram represents the main parts of a television receiver.

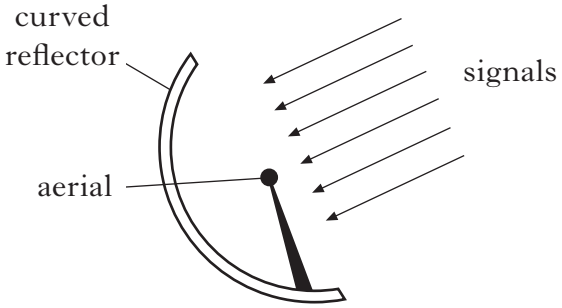


Which row in the table identifies parts **X**, **Y** and **Z**?

	X	***Y***	***Z***
A	aerial	loudspeaker	tuner
B	aerial	tuner	loudspeaker
C	loudspeaker	aerial	tuner
D	tuner	loudspeaker	aerial
E	tuner	aerial	loudspeaker

[Turn over

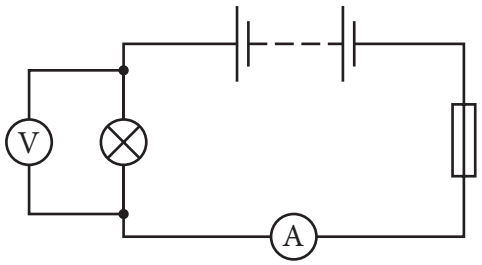
3. A curved reflector is used to receive radio signals.



The curved reflector improves the received signal by

A absorbing the signal
B making more signals
C reflecting the signal to the transmitter
D reflecting the signal away from the aerial
E reflecting the signal to a focus at the aerial.

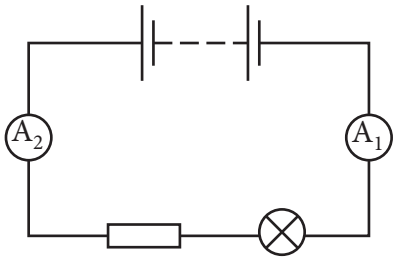
4. A circuit is set up as shown.



The electrical energy in this circuit is provided by the

A fuse
B lamp
C battery
D ammeter
E voltmeter.

5. A circuit is set up as shown.



A group of students make the following statements about this circuit.

I The circuit is a parallel circuit.

II The readings on ammeters A_1 and A_2 are different.

III The readings on ammeters A_1 and A_2 are the same.

Which of the following statements is/are correct?

A I only

B II only

C III only

D I and II only

E I and III only

6. An ohmmeter measures

A current

B energy

C power

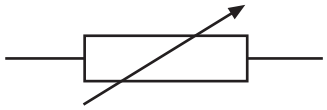
D resistance

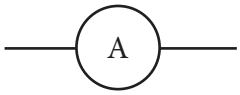
E voltage.

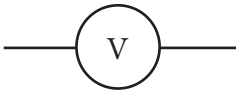
[Turn over

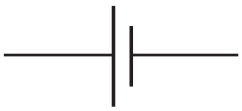
7. Which of the circuit symbols shown below is the symbol for a variable resistor?

A 

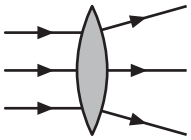
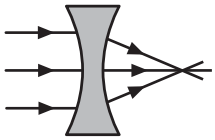
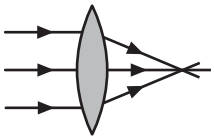
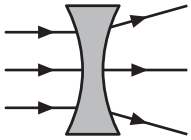
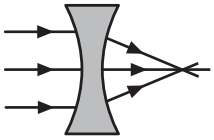
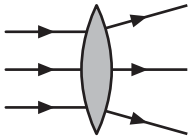
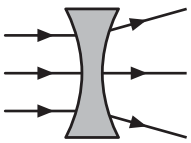
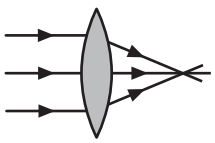
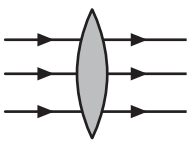
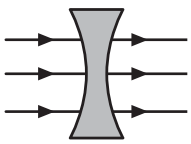
B 

C 

D 

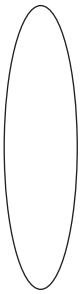
E 

8. Which row shows the shapes of converging and diverging lenses, and the effect each lens has on parallel rays of light?

	Converging lens	*Diverging lens*
A		
B		
C		
D		
E		

9. A student has a sight defect.

The shape of the lens used to correct the sight defect is shown.



Without this correcting lens, which row describes this sight defect and how objects appear?

	Sight defect	*Near object*	*Distant object*
A	short sight	blurred	clear
B	short sight	clear	blurred
C	long sight	clear	blurred
D	long sight	blurred	clear
E	long sight	blurred	blurred

10. Sound travels through

A a solid and a liquid but not through a gas

B a solid and a liquid but not through a vacuum

C a gas and a liquid but not through a solid

D a gas, a liquid and a vacuum

E a solid, a gas and a vacuum.

[Turn over

11. A dog whistle produces ultrasound.

The frequency of the ultrasound is

A 10 hertz

B 50 hertz

C 230 hertz

D 2000 hertz

E 23 000 hertz.

12. The input voltage to an amplifier is 0·3 volts.

The frequency of the input signal is 150 hertz.

The output voltage is 3·0 volts.

The frequency of the output signal is

A 10 hertz

B 50 hertz

C 150 hertz

D 450 hertz

E 1500 hertz.

13. The output voltage from an amplifier is 10 volts.

The input voltage to the amplifier is 0·5 volts.

The voltage gain of the amplifier is

A 5·0

B 9·5

C 10

D 10·5

E 20.

14. Which of the following will improve the streamlining of a car?

A Increasing the size of the engine in the car.

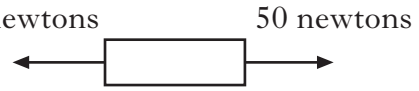
B Making the outside of the car a smooth shape.

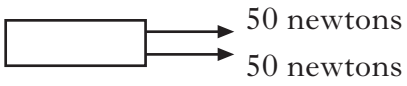
C Increasing the weight of the car.

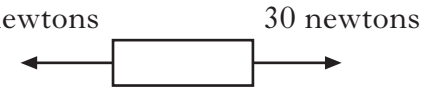
D Decreasing the weight of the car.

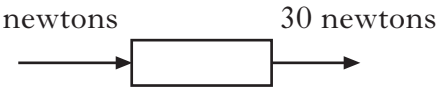
E Driving the car at high speeds.

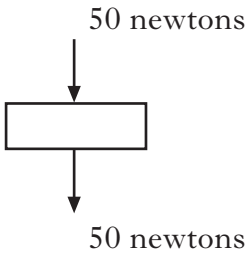
15. Which diagram shows balanced forces acting on a box?

A 

B 

C 

D 

E 

16. A sky diver is falling towards the ground at constant speed.

A student makes the following statements about the forces acting on the sky diver at this point.

I The forces on the sky diver are balanced.

II The weight of the sky diver is greater than the air friction acting on the sky diver.

III The air friction acting on the sky diver is greater than the weight of the sky diver.

Which of the statements is/are correct?

A I only

B II only

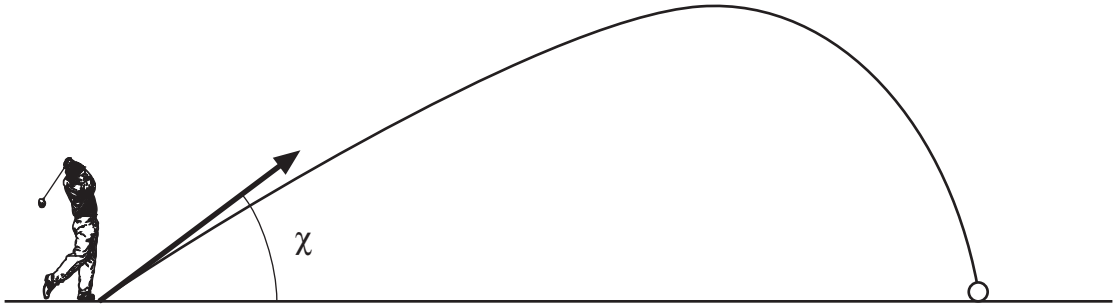
C III only

D I and II only

E I and III only

[Turn over

17. A golf club strikes a golf ball. The ball travels through the air as shown.



Range

A student writes the following statements to identify factors that affect the range of the golf ball.

I The speed of the ball when it leaves the club.

II The angle at which the ball leaves the club.

III The force of the club on the ball.

Which of the statements is/are correct?

A I only

B II only

C III only

D I and II only

E I, II and III

18. A possible energy change in an electronic **input** device is

A heat to sound

B heat to light

C light to heat

D electrical to sound

E sound to electrical.

19. Which list contains only output devices?

A lamp, LDR, loudspeaker

B LDR, thermistor, microphone

C LED, thermistor, microphone

D LED, electric motor, buzzer

E buzzer, loudspeaker, LDR

20. A student builds an electronic system to turn on a lamp automatically when it gets dark.

The input device that should be used is

A an LDR

B an LED

C a thermistor

D an electric motor

E a variable resistor.

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

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

SECTION B

Answers questions 21–34 in the spaces provided.

21. A radio station transmits a signal at a frequency of 909 000 Hertz.

(*a*) State the speed of the radio signal in air.

1

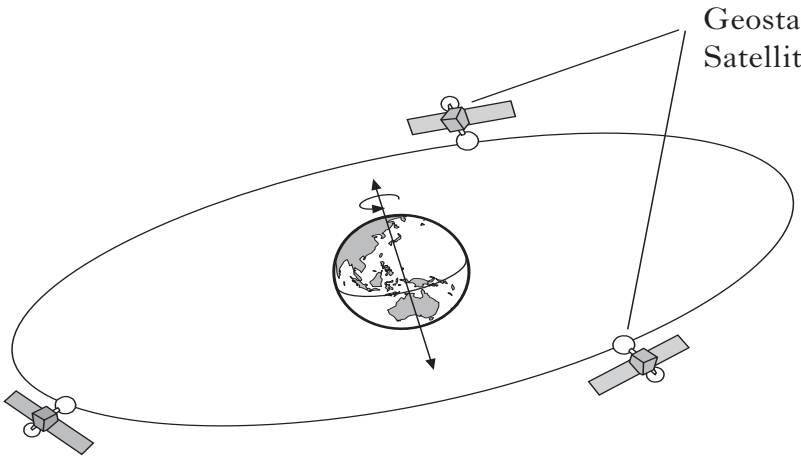
(*b*) A radio receiver picks up the signal.
Which part of the radio receiver selects a particular radio station?

1

Marks

21. (continued)

(*c*) Television signals from the Rugby World Cup in New Zealand are sent via geostationary satellites to Scotland.



(i) What is meant by a geostationary satellite?

1

(ii) When live interviews take place, there is a delay between the interviewer in Scotland asking a question and the person hearing the question.

Explain why there is a delay.

2

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

22. A "hands-free" system for a mobile phone has an earpiece and a microphone.

(*a*) State the useful energy change that takes place in the:

(i) earpiece;

1

(ii) microphone.

1

(*b*) State **one advantage** of using a mobile phone instead of a landline.

1

(*c*) Give **one** reason why it is difficult for a mobile phone to pick up signals in a steep-sided valley.

1

DO NOT WRITE IN THIS MARGIN

Marks

23. A student investigates various types of communication devices including mobile phones and fax machines.

(*a*) What kind of communication is sent by fax?

1

(*b*) The student connects a telephone handset to an oscilloscope and whistles a steady note into the mouthpiece.

Figure 1 shows the pattern observed on the oscilloscope screen.

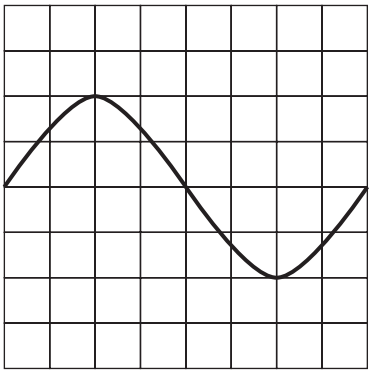


figure 1

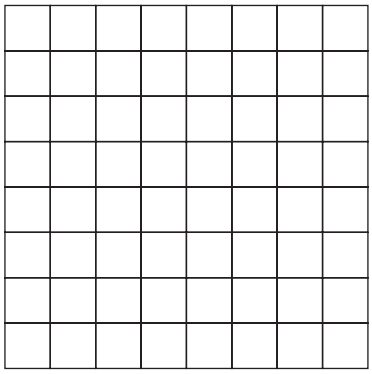


figure 2

(i) The student now whistles a note that is louder **and** at a higher frequency.

On figure 2 sketch the pattern that is now obtained.

The controls on the oscilloscope remain unchanged. **2**

(ii) What is the unit used to measure sound level?

1

(iii) Give **two** examples of noise pollution.

1

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

24. A hairdresser uses a conical styler to produce curls in hair.

The rating plate for the styler is shown below.

BB 513	HD21X
230 volts	50 hertz
1495 watts	

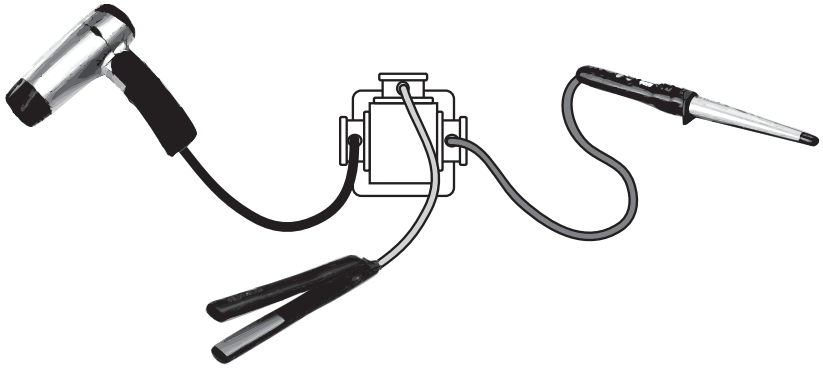
(*a*) Calculate the current in the styler when it is switched on.

2

(*b*) How many wires are in the flex?

1

(*c*) The hairdresser connects a hairdryer, conical styler and hair straighteners to an adaptor as shown.



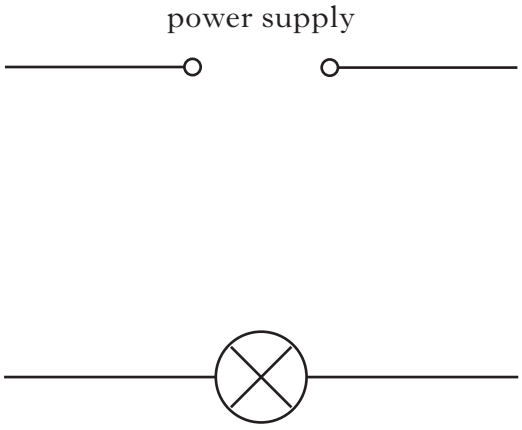
Why could this be dangerous?

1

Marks

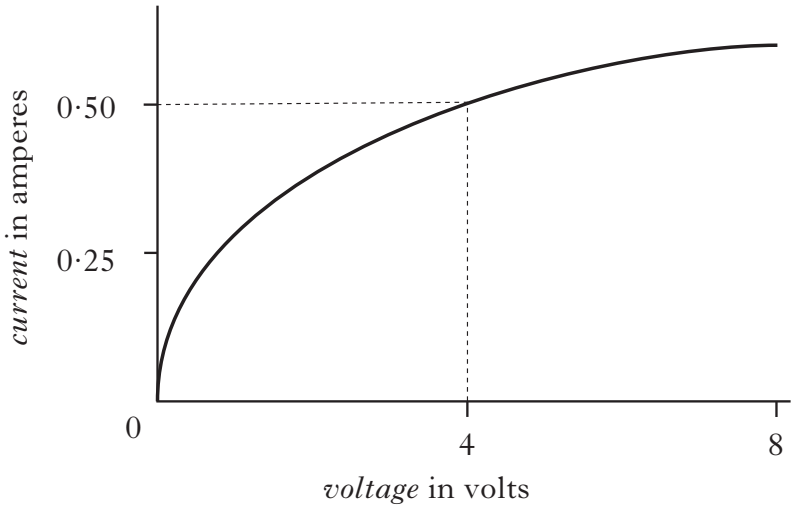
25. A power supply, an ammeter and a voltmeter are used to investigate how the current in a lamp changes as the voltage across the lamp changes.

(*a*) Complete the circuit diagram, including the voltmeter and ammeter, to show how the voltage and current are measured.



3

(*b*) The graph shows the results of the investigation.



Calculate the resistance of the lamp when the voltage across it is 4 volts.

2

DO NOT WRITE IN THIS MARGIN

Marks

26. Different types of radiation are used in medical procedures. X-rays are used to detect broken bones. Gamma radiation is used to kill cancerous cells.

(*a*) (i) State **two** safety precautions needed when dealing with a source of gamma radiation.

1

(ii) State **one other** use of gamma radiation in medicine.

1

(*b*) State **one** detector of x-rays.

1

(*c*) Ultraviolet radiation has advantages and disadvantages for health.

(i) State **one** advantage.

1

(ii) State **one** disadvantage.

1

DO NOT WRITE IN THIS MARGIN

Marks

26. (continued)

(*d*) Lasers have many applications in medicine and technology.

(i) State **one medical** use of lasers.

1

(ii) State **one non-medical** use of lasers.

1

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

27. Some chemicals fluoresce under certain conditions.

(*a*) What is meant by saying a chemical *fluoresces*?

1

(*b*) **Circle** the type of radiation that will make these chemicals fluoresce.

radio **infrared** **ultraviolet** **microwave** **1**

(*c*) These chemicals are used on passports.

State **one** other use for these chemicals.

1

(*d*) At an airport, hand luggage is passed through a scanner that uses a different type of radiation.

Name this type of radiation.

1

Marks

28. While attending a fireworks display, a group of students decide to use a stopwatch to measure the time interval between seeing the flash of a firework exploding and hearing the bang.

(*a*) Why do the students see the flash before they hear the bang?

1

(*b*) The students calculate the speed of sound using this time interval and the distance they are from the point of explosion.

The time interval measured on the stopwatch is 0·7 seconds and the distance from the point of explosion is 210 metres.

Calculate the speed of sound.

2

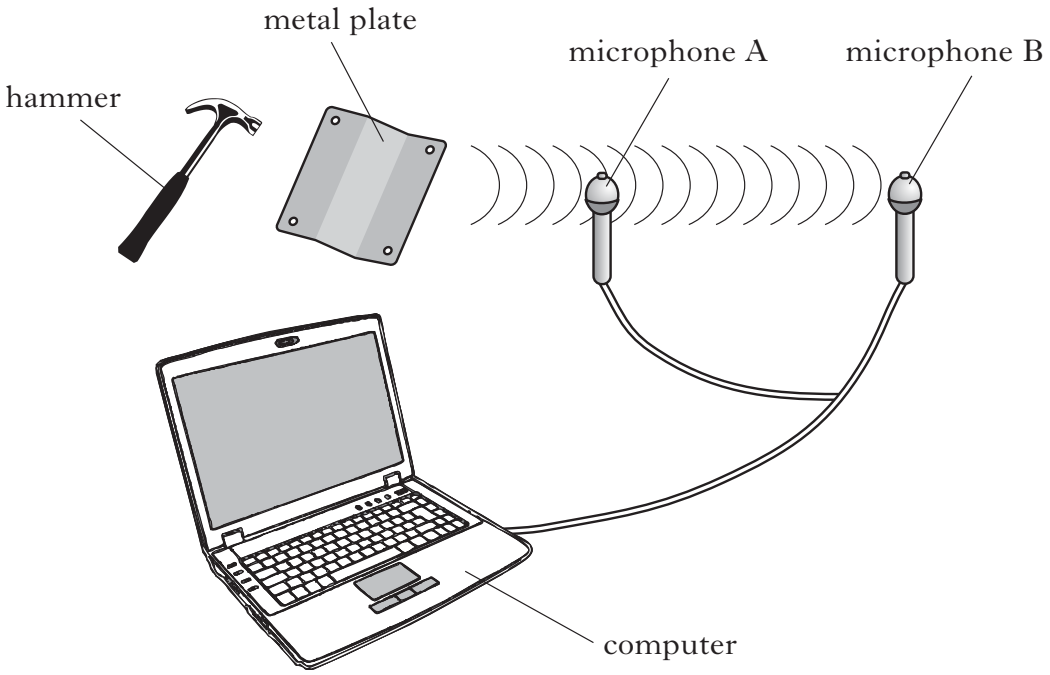
[Turn over

Marks

29. A student sets up the apparatus shown to measure the speed of sound in air.

A sound is produced by striking a metal plate with a hammer. Timing starts when the sound reaches microphone A. Timing stops when the sound reaches microphone B.

The student records times for different distances between the microphones.

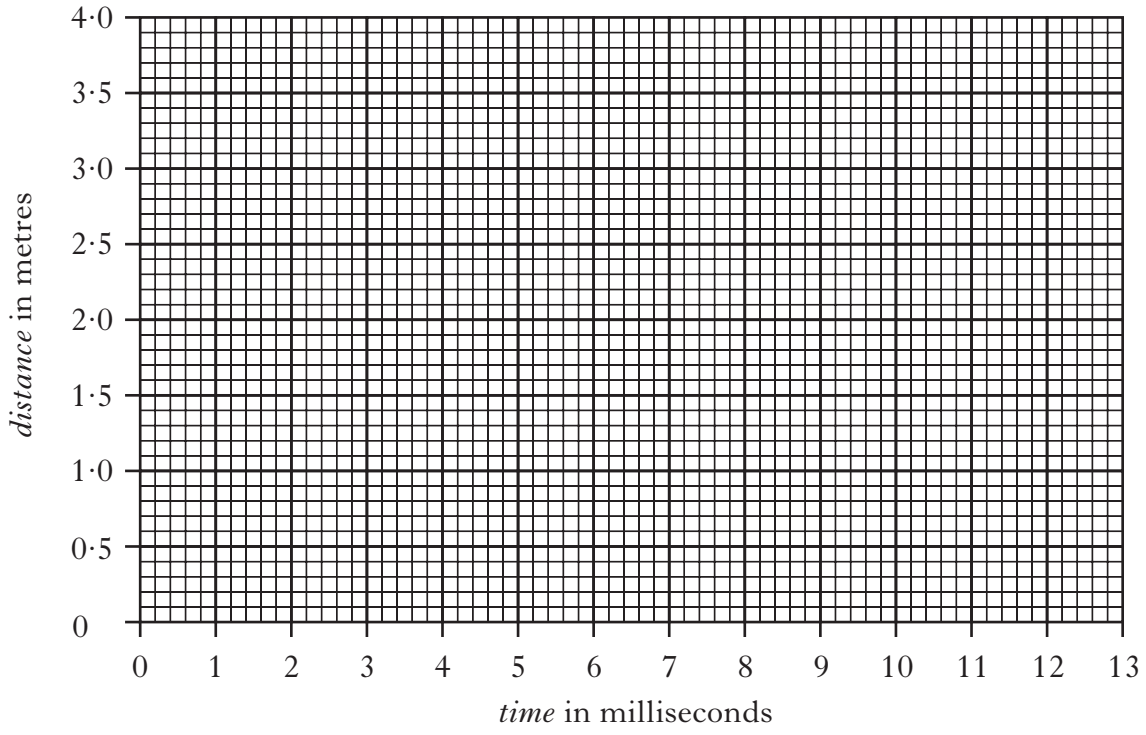


Distance between microphones in metres	*Time for the sound to travel between the two microphones* in milliseconds
0·8	2·5
1·6	5·0
2·4	7·5
3·2	10·0
4·0	12·5

Marks

29. (continued)

(*a*) Using the data in the table, plot a **line graph** on the grid provided.



2

(*b*) Why is this method of measuring the speed of sound in air more accurate than a method that uses a stopwatch?

1

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

30. An unmanned spacecraft is on a mission to Mars.

The engines of the spacecraft are turned off once it has travelled far into space.

(*a*) The spacecraft now travels at a constant speed.

Explain why this happens.

1

The table below gives some information on the planets.

Planet	*Gravitational pull* in newtons per kilogram
Earth	10
Mars	4
Jupiter	26
Saturn	11

(*b*) The spacecraft has a mass of 900 kg.

(i) What is the weight of the spacecraft on Earth?

2

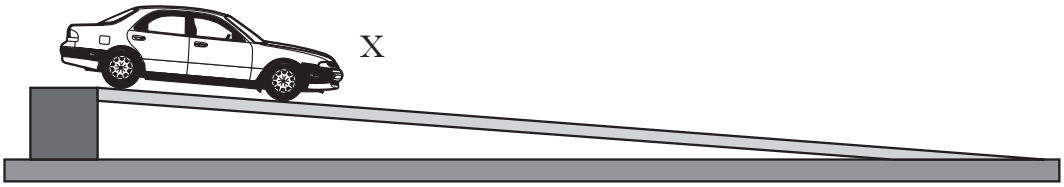
(ii) Complete the following sentence by **circling** the correct word or phrase.

The mass of the spacecraft on Mars is { the same as its mass on Earth. / zero. / different from its mass on Earth. } **1**

Marks

31. A student measures the average speed of a car travelling down the full length of a ramp.

The car, of length 0·15 metres, is released at point X.



Describe a method for measuring the average speed of the car.

Your description should include:

Additional equipment the student would require.

The measurements the student would make.

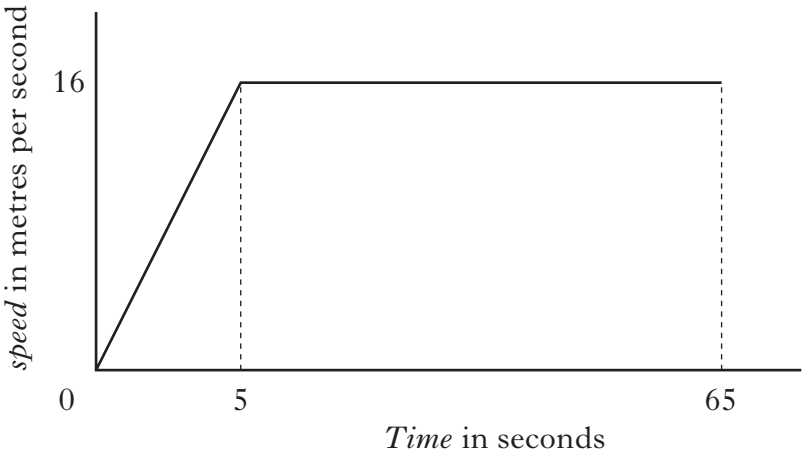
How the student would calculate the average speed of the car.

3

[Turn over

Marks

32. The graph below shows the speed of a cyclist during a 1000 metre sprint race.



(*a*) State the maximum speed of the cyclist during the race.

1

(*b*) Calculate the average speed of the cyclist during the race.
Give your answer to 2 decimal places.

2

[Turn over for Question 33 on *Page twenty-eight*

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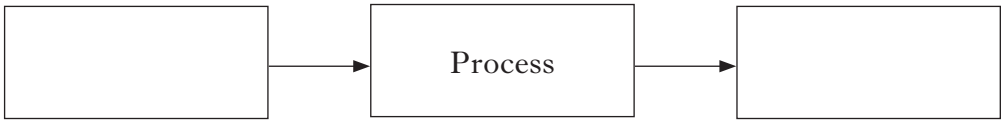
Marks

33. (*a*) An electronic system can be represented by a block diagram as shown.

Complete the block diagram by filling in the missing labels.



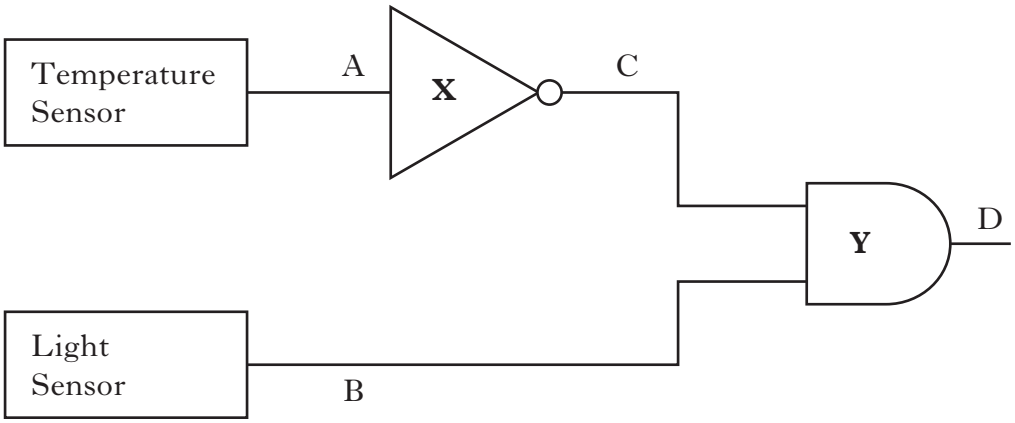
1

(*b*) A circuit is set up to open a window in a greenhouse when the daytime temperature inside becomes too warm.

The diagram shows part of the circuit.

Temperature sensor when warm gives logic 0.

Temperature sensor when cold gives logic 1.



Light sensor in darkness gives logic 0.

Light sensor in light gives logic 1.

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Marks

33. (*b*) (continued)

(i) Name logic gate **X**.

1

(ii) Name logic gate **Y**.

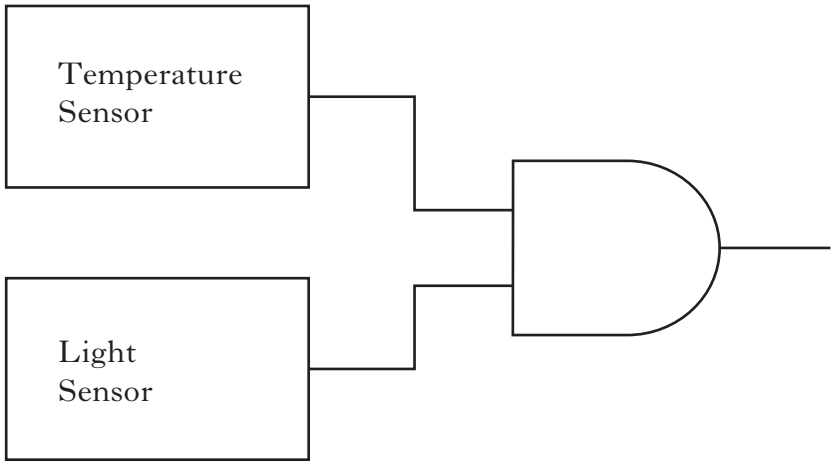
1

(*c*) Complete the table below to show the logic levels at C and D.

A	B	C	D
0	0		
0	1		
1	0		
1	1		

2

(*d*) Gate X is removed from the circuit as shown.

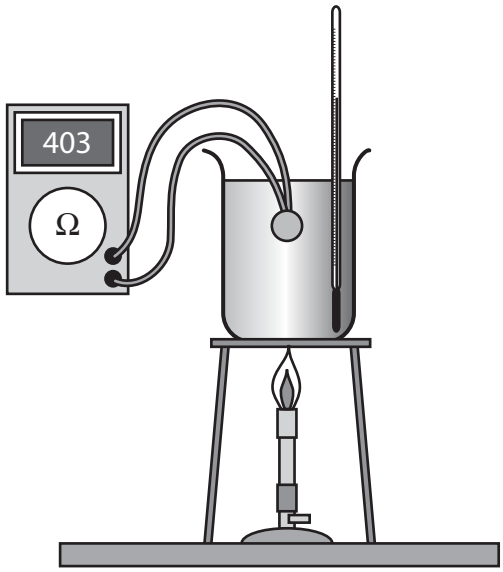


Describe how the circuit will now operate.

2

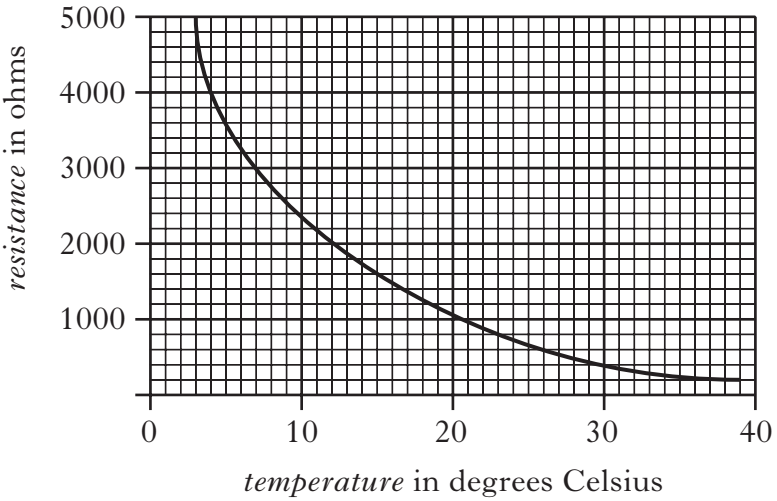
Marks

34. A student investigates how the resistance of a thermistor changes with temperature.



The student notes the resistance of the thermistor at different temperatures.

The graph of the student's results is shown below.



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Marks

34. (continued)

(*a*) What is the resistance of the thermistor at 15 degrees Celsius?

1

(*b*) The current in the thermistor at 15 degrees Celsius is 6·0 milliamperes.

(i) When the temperature is 10 degrees Celsius will the current now be **bigger**, **smaller** or **the same**?

1

(ii) Explain your answer to part (i).

1

[*END OF QUESTION PAPER*]

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Marks

YOU MAY USE THE SPACE ON THIS PAGE TO REWRITE ANY ANSWER YOU HAVE DECIDED TO CHANGE IN THE MAIN PART OF THE ANSWER BOOKLET. TAKE CARE TO WRITE IN CAREFULLY THE APPROPRIATE QUESTION NUMBER.