

FOR OFFICIAL USE

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Total Marks

**X069/101**

NATIONAL MONDAY, 4 JUNE  
QUALIFICATIONS 9.00 AM – 10.30 AM  
2001

**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

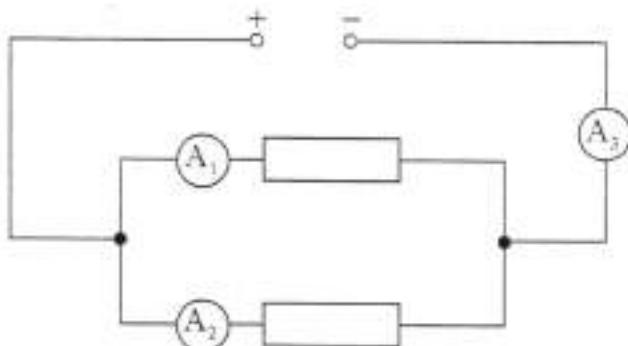
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Number of seat

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- 1 All questions should be answered.
- 2 The questions may be answered in any order but all answers must be written clearly and legibly in this book.
- 3 For questions 1–6, write down, in the space provided, the letter corresponding to the answer you think is correct. There is only **one** correct answer.
- 4 For questions 7–20 write your answer where indicated by the question or in the space provided at the end of the answer book.
- 5 If you change your mind about your answer you may score it out and rewrite it in the space provided at the end of the answer book.
- 6 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.

1. The circuit shown below contains three ammeters, two resistors and a power supply. Marks

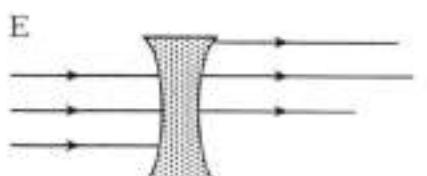
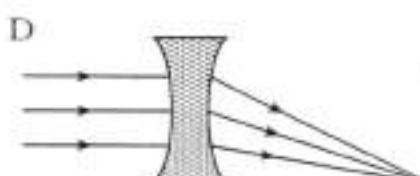
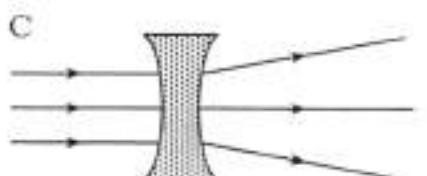
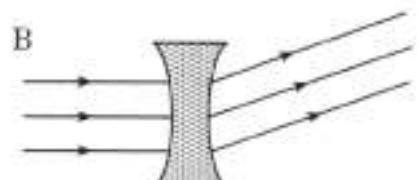
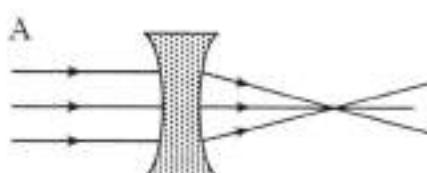


Which row in the table gives possible values for the readings on  $A_1$ ,  $A_2$  and  $A_3$ ?

	Reading on $A_1$ (amperes)	Reading on $A_2$ (amperes)	Reading on $A_3$ (amperes)
A	1	1	1
B	1	1	2
C	1	2	1
D	2	1	1
E	2	2	1

Answer   1

2. Which diagram correctly shows parallel light rays passing through a diverging lens?



Answer   1

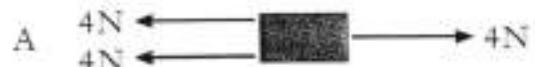
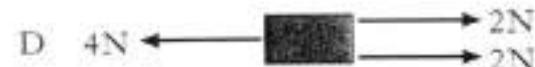
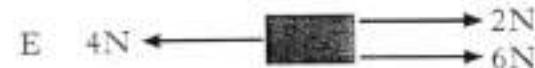
3. Gamma radiation is used to sterilise hospital instruments because the gamma radiation

- A heats the instruments to a high temperature
- B removes any poisonous liquids from the instruments
- C kills any living cells on the instruments
- D makes the instruments highly radioactive
- E cools the instruments to a very low temperature.

Answer

1

4. Which of the diagrams below shows balanced forces acting on a block?

- A 
- B 
- C 
- D 
- E 

Answer

1

5. A solar cell is an input device.

The main energy change in a solar cell is

- A electrical energy to light energy
- B heat energy to light energy
- C electrical energy to heat energy
- D light energy to electrical energy
- E light energy to heat energy.

Answer

1

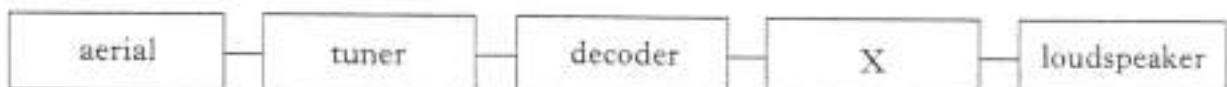
6. Which of the following is an output device?

- A Amplifier
- B Buzzer
- C NOT gate
- D Switch
- E Thermistor

Answer

1

7. (a) The main parts of a radio receiver are represented by the block diagram shown below.



- (i) Name part X.

1

- (ii) What is the main energy change in the loudspeaker?

1

- (b) The aerial of a radio receiver detects the signals of many radio stations.



Explain how **one** radio station is selected by the radio receiver.

1

7. (continued)

*Marks*

- (c) The aerial shown below is used to detect signals from a satellite.



Explain why an aerial of this shape is used. You may use a diagram as part of your answer.

2

[Turn over

8. (a) The person shown below is using a mobile telephone.

Marks



Complete the passage below by choosing from the list of words given.

**microphone**  
**sound**  
**radio**  
**loudspeaker**

**300 million metres per second**  
**buzzer**  
**light**  
**the speed of sound**

The mouthpiece of the mobile telephone contains a

A  wave is transmitted by the mobile telephone.

The speed at which the wave travels is

3

*Marks*

8. (continued)

- (b) A student telephones a friend to discuss her design for a lamp.



- (i) Name **one** method of telephone communication that could be used by the student to send a copy of the design to her friend.

1

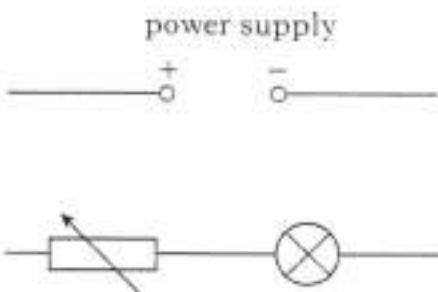
- (ii) Describe **one** advantage of using this method of telephone communication.

1

[Turn over

9. A student is asked to measure the current through a lamp and the voltage across the lamp. The student is provided with an incomplete circuit diagram as shown.

Marks



- (a) Complete the diagram to show how an ammeter and a voltmeter should be connected to enable the current and voltage to be measured.
- (b) The student completes the circuit correctly and obtains the following readings.

2

Reading on voltmeter (volts)	Reading on ammeter (amperes)	Resistance ( )
0.3	0.5	0.6
1.0	1.0	1.0
2.7	1.5	1.8
5.8	2.0	

- (i) The student has left the unit of resistance out of the table.  
State the unit of resistance.

1

- (ii) The resistance of the lamp has been calculated for the first three rows of the table.  
Calculate the resistance for the fourth row of the table.  
You **must** show your working.

2

*Marks*

9. (b) (continued)

- (iii) What happens to the **resistance** of the lamp as the **current** increases?

1

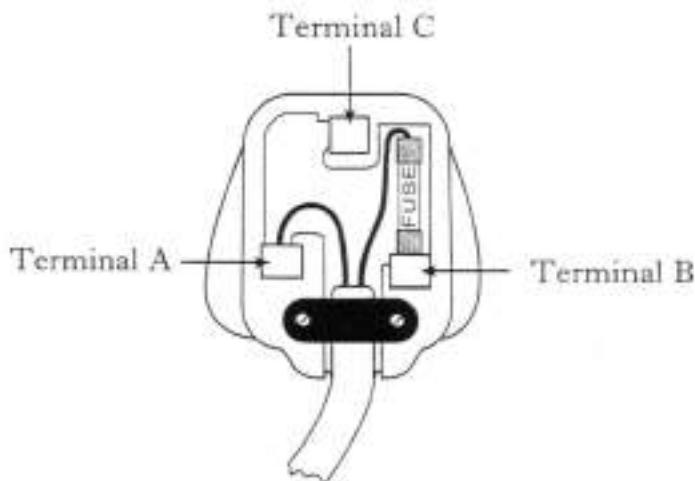
- (c) The student now changes the resistance of the variable resistor until the lamp no longer lights. The ammeter shows there is still a current through the lamp.

Explain why the lamp no longer lights.

2

[Turn over

10. (a) The diagram shows a correctly wired plug.



- (i) Name the terminals A and B.

Terminal	Name
A	
B	

1

- (ii) The appliance connected to this plug does not need to have a wire connected to terminal C.

What name is given to this type of appliance?

1

10. (continued)

- (b) A vacuum cleaner has a power rating of 1035 watts. The mains voltage is 230 volts.



- (i) Calculate the current when the vacuum cleaner is operating normally.

2

- (ii) A student suggests that a 3 ampere fuse should be fitted in the plug for this vacuum cleaner.

Is the student correct? You **must** explain your answer.

2

[Turn over

Marks

11. The statements below are related to light.

1	2	3
produced by mixing red, green and blue light	contains light of only one colour	a concentrated beam of light
4	5	6
travels faster than the light produced by a lamp	spreads out in many directions	produced by passing light through a diverging lens

- (a) Which **two** statements describe the light produced by a laser?

Statements  and

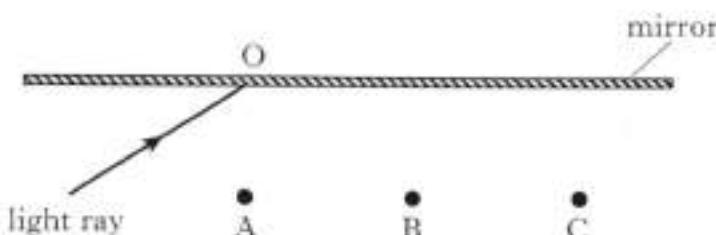
2

- (b) Which **two** statements describe the light produced by a colour television screen?

Statements  and

2

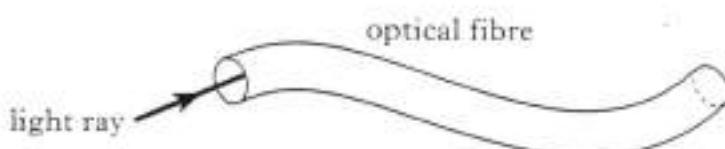
12. (a) The diagram shows a light ray directed at a plane mirror.



From O, draw a line to point A or point B or point C to show the correct path of the reflected ray.

1

- (b) Light can be transmitted along an optical fibre.



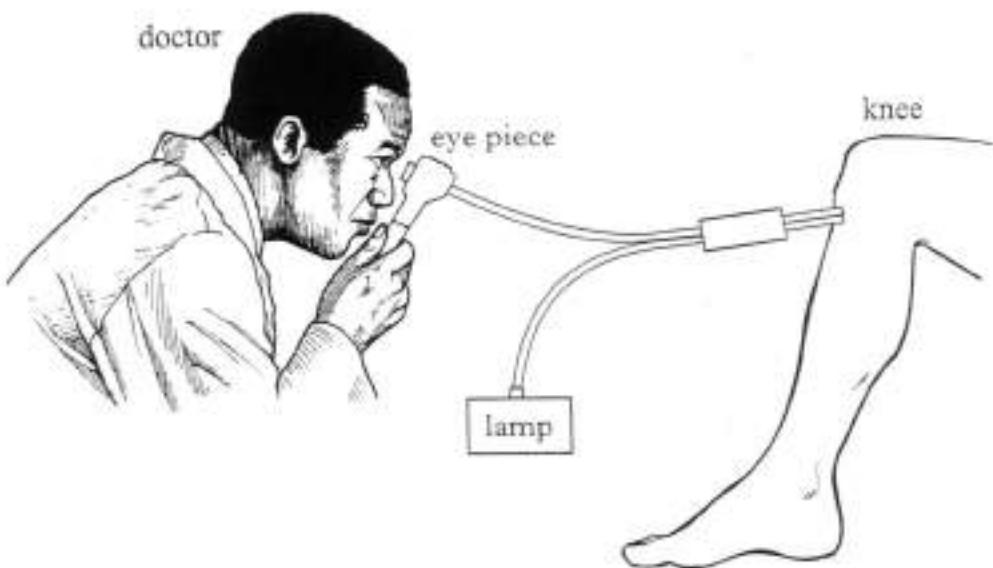
Complete the above diagram to show the path taken by the light ray until it leaves the optical fibre.

2

Marks

## 12. (continued)

- (c) The diagram below shows how a doctor is able to examine the inside of a patient's knee.



In this examination the doctor uses a device which has two bundles of optical fibres. One bundle is connected to a lamp and the other is connected to an eye piece.

- (i) Why are **two** bundles of optical fibres needed in this device?

2

- (ii) Why does the doctor **not** use infrared radiation for this examination?

1

[Turn over

13. (a) An infrared detector is used to detect infrared radiation given off by human bodies.

Give another name for infrared radiation.

Marks

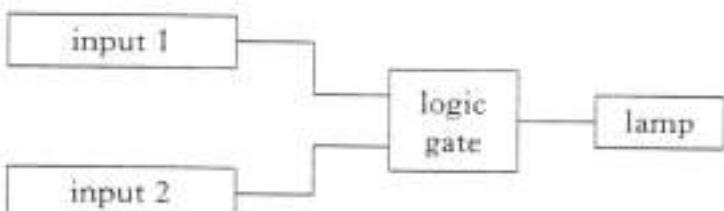
1

- (b) A house has a security light system fitted to the outside wall.



The security light only comes on when it is dark and there is a person close by.

The block diagram for this system is shown below.



- (i) Name suitable input devices.

Input	Device
1	
2	

2

- (ii) Name the logic gate.

1

13. (continued)

*Marks*

(c) During a physics lesson students are discussing the effects of ultraviolet radiation on the human body.

(i) Give **one** example of a medical application of ultraviolet radiation.

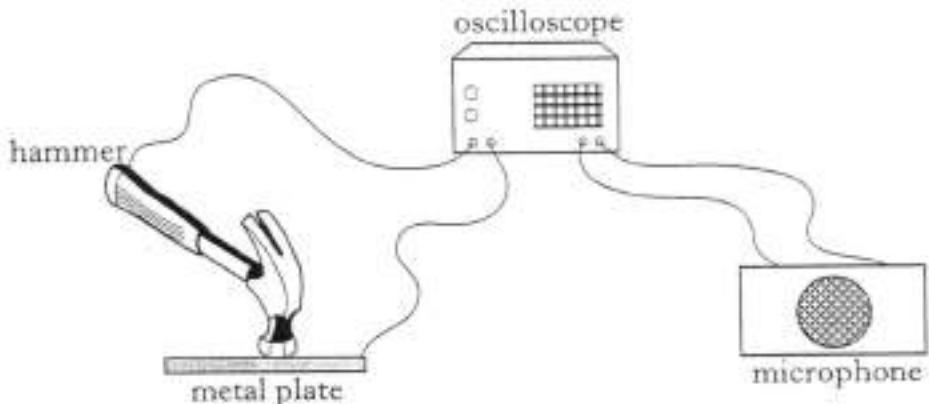
1

(ii) Give **one** example of ultraviolet radiation harming the human body.

1

[Turn over

14. The speed of sound in air is measured using the apparatus shown below.



- (a) In an experiment, the distance between the metal plate and the microphone is measured as 0.80 metres.

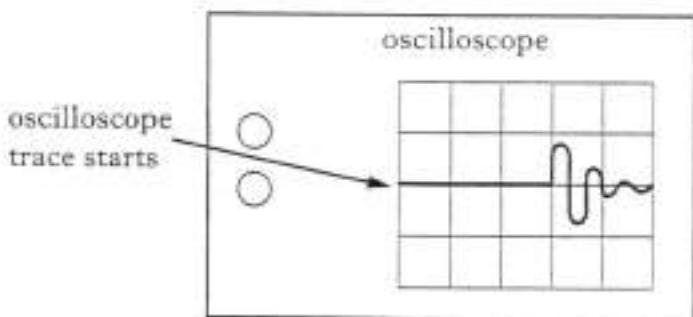
The time for the sound to travel from the metal plate to the microphone is measured as 0.0025 seconds.

Using these measurements, calculate the speed of sound in air.

## 14. (continued)

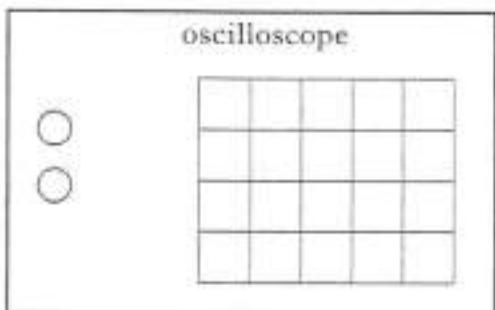
Marks

- (b) When the hammer hits the metal plate, the oscilloscope trace starts. Some time later the sound reaches the microphone and the trace changes. The trace obtained is shown below.



In a second experiment, the hammer hits the metal plate harder. The settings on the oscilloscope, and the distance between the metal plate and the microphone are not changed.

On the diagram below, sketch the trace which would be shown on the oscilloscope when the hammer hits the metal plate harder.

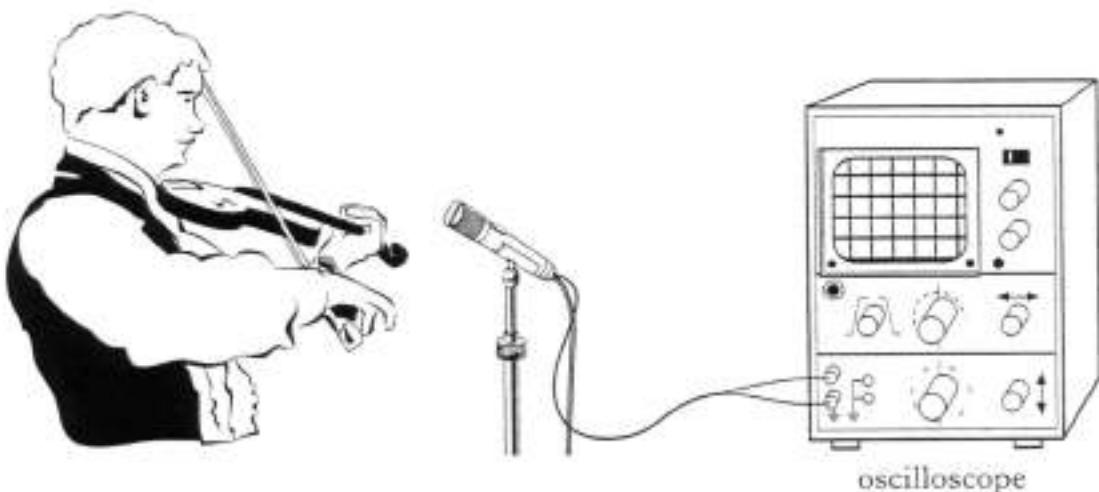


2

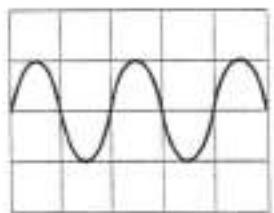
[Turn over

15. (a) A violinist stands beside a microphone which is connected to an oscilloscope.

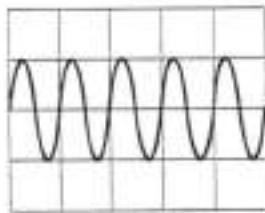
Marks



The violinist plays one note followed by a different note. The two traces displayed on the oscilloscope are shown below.



Trace 1



Trace 2

- (i) Which trace represents the note with the higher frequency?

1

- (ii) What **two** changes could be made to the violin string to produce a note of **higher** frequency?

2

Marks

## 15. (a) (continued)

- (iii) The signal from the microphone is passed through an amplifier. The amplified signal is used to operate a loudspeaker.

The table below lists the voltage measured across the microphone and the voltage measured across the loudspeaker.

Voltage measured across the microphone	0.2 volts
Voltage measured across the loudspeaker	2 volts

Calculate the voltage gain of the amplifier.

2

- (b) A musician is playing a trombone.



The slide of the trombone is pushed out so that the length of the vibrating air column is increased.

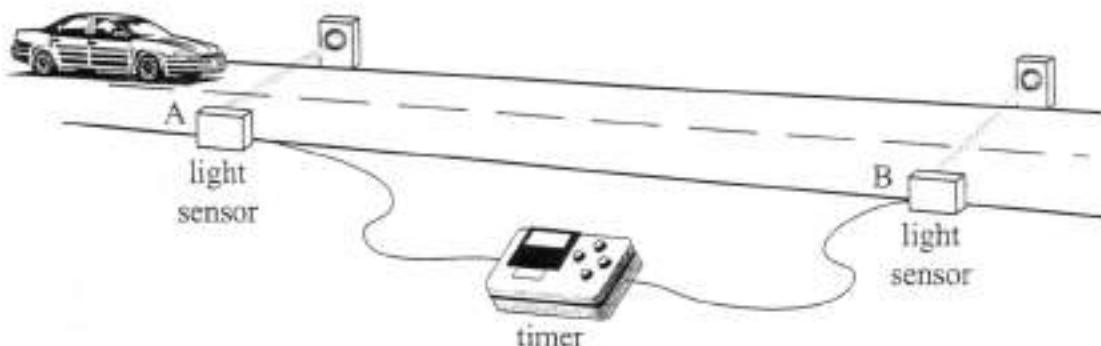
What happens to the frequency of the sound produced?

1

[Turn over

16. The equipment shown below is used to measure the average speed of a car.

Marks



A light sensor is placed at A and another light sensor is placed at B.

When the car passes the light sensor at A the timer starts.

When the car passes the light sensor at B the timer stops.

- (a) The distance between A and B is 400 metres.

The timer records that the car takes 25 seconds to travel from A to B.

Calculate the average speed of the car between A and B.

2

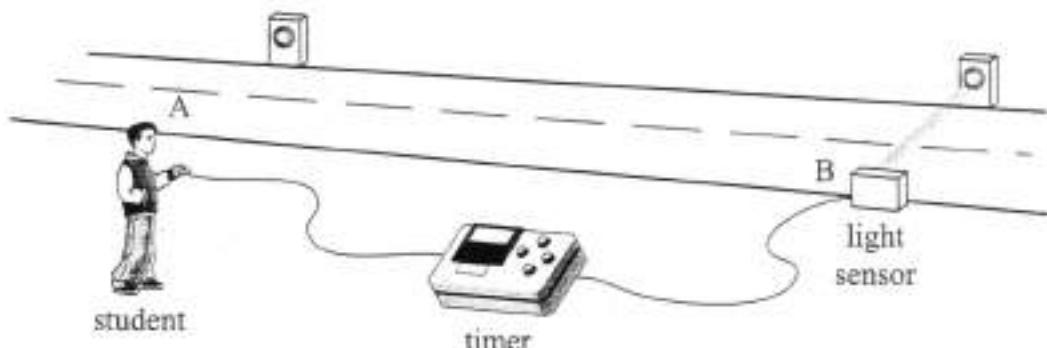
- (b) The car is accelerating as it moves from A to B.

Will the time taken for the car to travel the second 200 metres be more or less than the time for the car to travel the first 200 metres? Explain your answer.

2

## 16. (continued)

- (c) The light sensor at A is replaced by a student holding a switch.



When the car passes A the student presses the switch and the timer starts.

When the car passes the light sensor at B the timer stops.

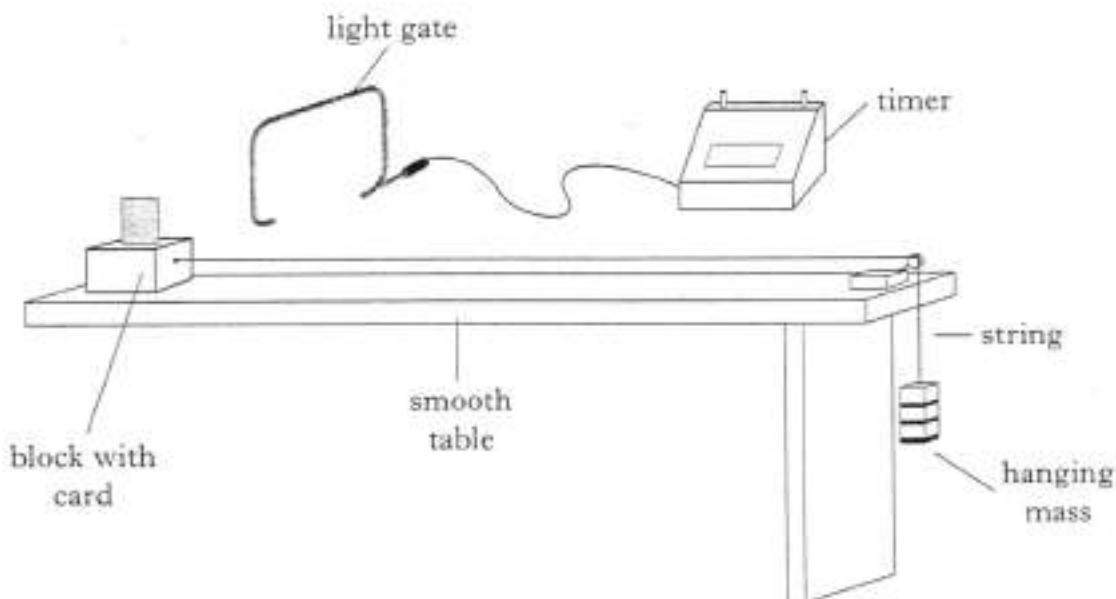
Why does this arrangement result in a less accurate measurement of time?

1

[Turn over

Marks

17. A block is attached to a hanging mass using string as shown below.



When the hanging mass is released the block starts to move. As the block passes the light gate the card interrupts the light beam.

- (a) Describe how you could find the instantaneous speed of the block as it passes the light gate.

In your description you should

- list all the measurements you would take
- state clearly how you would use these measurements to calculate the instantaneous speed.

2

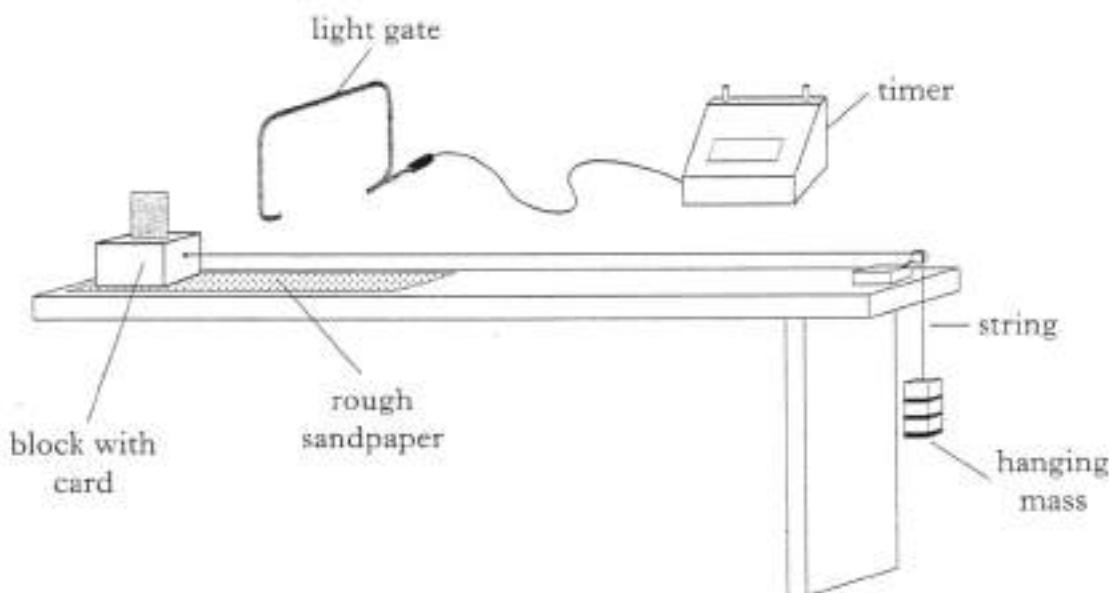
- (b) The hanging mass attached to the string is 0.5 kilograms.

Calculate the weight of this hanging mass.

2

## 17. (continued)

- (c) A large sheet of rough sandpaper is now placed on the table as shown below.



The hanging mass is again released and the instantaneous speed of the block is measured as it passes the light gate.

How will this instantaneous speed compare with the instantaneous speed measured in part (a)?

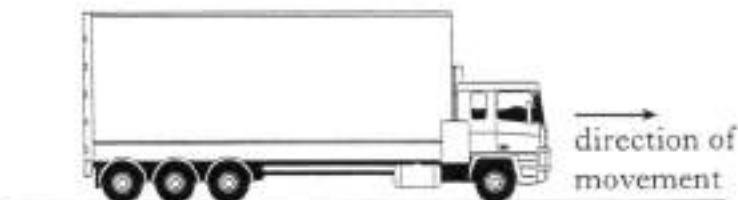
Explain your answer.

2

- (d) A group of students is asked to investigate whether changing the mass on the end of the string changes the speed of the block when it passes the light gate.
- List the factors which the students should change during the investigation.
  - List the factors which the students should keep constant during the investigation.

2

18. The diagram below shows a lorry moving to the right.



- (a) A force due to the friction of the air is acting on the lorry.  
In which direction is this force acting?

1

- (b) State the effect that streamlining has on the force caused by the friction of the air.

1

- (c) State **one** way in which the design of the lorry could be changed to make it more streamlined.

1

- (d) A pedestrian is standing 200 metres ahead of the lorry.  
The headlights and the horn of the lorry are switched on at the same time.  
Will the sound from the horn or the light from the headlights reach the pedestrian first? You **must** explain your answer.

2

Marks

19. Many shops have automatic doors.



- (a) From the list below, choose a suitable output device for an automatic door system.

bell      lamp      LED      motor

1

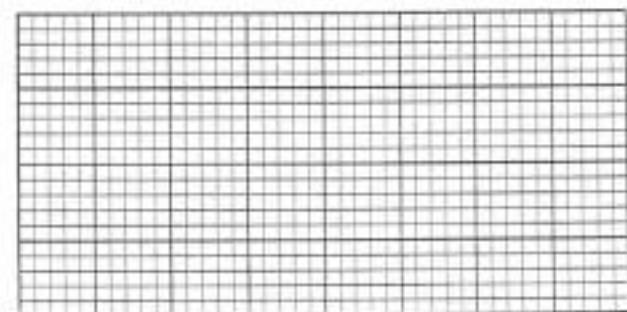
- (b) State the energy change in the output device chosen in part (a).

1

- (c) An input device used in some automatic door systems is a light dependent resistor (LDR).

Sketch a graph to show how the resistance of an LDR changes with the brightness of the light.

resistance of  
LDR



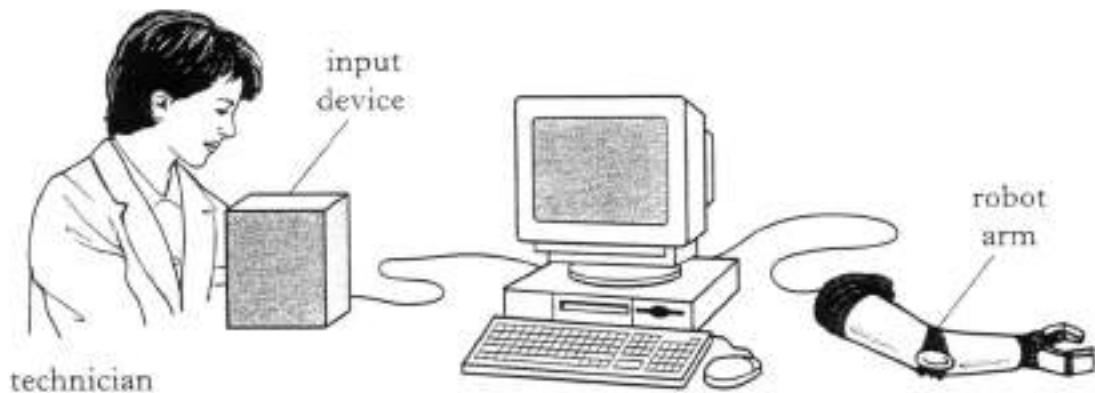
brightness of light

1

[Turn over

Marks

20. A robot arm is controlled by voice commands. In the system below the input device is connected to a computer which is linked to the robot arm.



- (a) Name the input device which detects the voice commands from the technician.

1

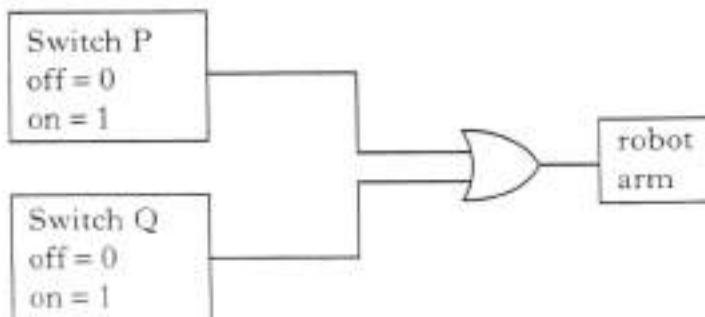
- (b) When this system is being tested a cassette recording is made of the technician speaking the commands. Later she listens to the cassette tape being played.

Explain why the technician does not think that the recording sounds like her own voice.

2

- (c) The robot arm is removed for testing.

The arm is tested using the system shown in the diagram below.



## 20. (c) (continued)

Marks

- (i) Identify the logic gate used in this system.

1

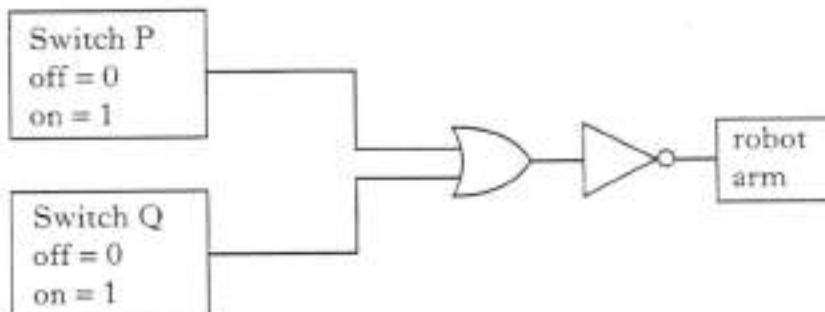
- (ii) The table shows the possible logic levels of the switches.

Complete the table to show the output logic levels of the gate.

Logic level of switch P	Logic level of switch Q	Output logic level of gate
0	0	
0	1	
1	0	
1	1	

1

- (iii) Another system used during the testing of the robot arm contains an extra logic gate.



Describe fully how this extra logic gate will change the operation of the system.

2

[END OF QUESTION PAPER]