

FOR OFFICIAL USE

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Total
Marks

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X069/10/02

NATIONAL MONDAY, 28 MAY
QUALIFICATIONS 1.00 PM – 2.30 PM
2012

PHYSICS
INTERMEDIATE 1

Fill in these boxes and read what is printed below.

Full name of centre

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Town

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Forename(s)

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Surname

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Date of birth

Day Month Year

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Scottish candidate number

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Number of seat

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Reference may be made to the Physics Data Booklet.

Section A – Questions 1–20 (20 marks)

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

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

Section B (60 marks)

All questions should be attempted.

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

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

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

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



SECTION A

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

Sample Question

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

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

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



Changing an answer

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



SECTION A

Answer questions 1–20 on the answer sheet.

1. The unit of frequency is the
 - A ampere
 - B hertz
 - C newton
 - D second
 - E watt.

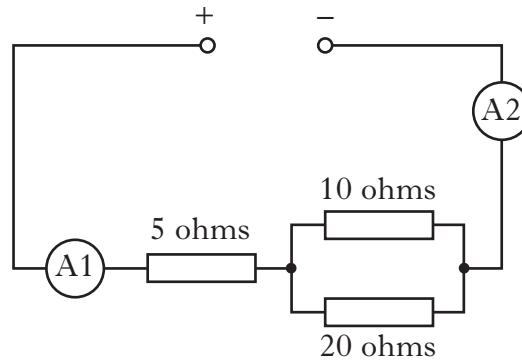
2. Which colours of light are mixed together to produce a yellow area on a TV screen?
 - A Red and blue
 - B Blue and green
 - C Red and green
 - D Blue and magenta
 - E Red, blue and green

3. The device used to change sound energy to electrical energy is a
 - A switch
 - B motor
 - C loudspeaker
 - D microphone
 - E buzzer.

4. Electric current is a flow of
 - A charge
 - B light
 - C power
 - D resistance
 - E voltage.

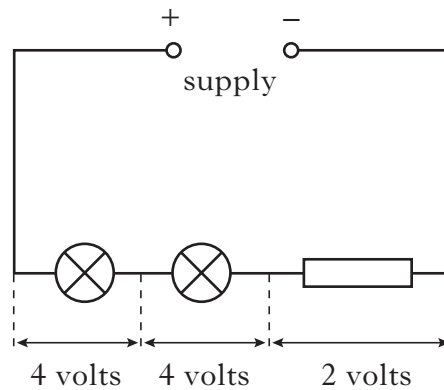
[Turn over

5. In the circuit below, the reading on ammeter A1 is 6 amperes.



The reading on ammeter A2 is

- A 2 amperes
 - B 3 amperes
 - C 6 amperes
 - D 12 amperes
 - E 18 amperes.
6. The voltage across each component in the circuit is shown.



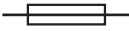
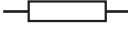
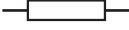

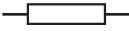





The voltage of the supply is

- A 2 volts
- B 4 volts
- C 6 volts
- D 8 volts
- E 10 volts.

7. The voltage across a lamp is 12 volts.
 The current in the lamp is 0.5 amperes.
 The resistance of the lamp is

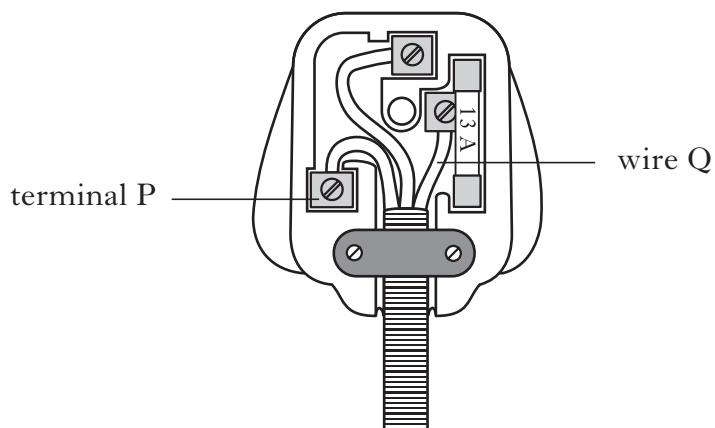
- A 2.4 ohms
- B 6.0 ohms
- C 11.5 ohms
- D 12.5 ohms
- E 24 ohms.

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

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

[Turn over

9. The diagram shows a plug wired correctly.



Which row in the table identifies terminal P and the colour of the insulation on wire Q?

	<i>Terminal P</i>	<i>Colour of insulation on wire Q</i>
A	Neutral	Brown
B	Neutral	Blue
C	Live	Blue
D	Live	Yellow and Green
E	Earth	Brown

10. A student makes the following statements about light and sight.

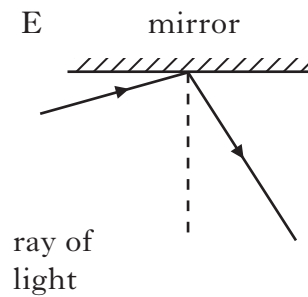
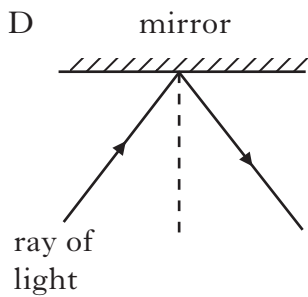
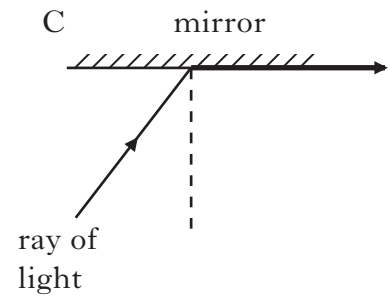
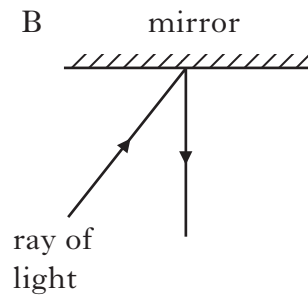
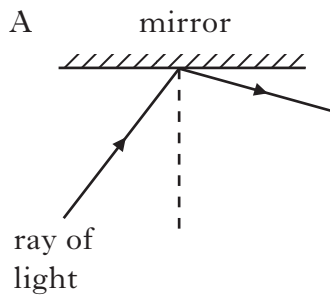
- I Laser light is a concentrated beam of light.
- II All visible objects emit or reflect light.
- III Laser light is white light.

Which of the 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

11. A ray of light is reflected from a mirror.

Which diagram shows the ray before and after reflection?



12. A loudspeaker produces a sound.

The frequency of this sound is the number of

- A sound waves produced by the loudspeaker
- B sound waves produced by the loudspeaker in 1 second
- C decibels produced by the loudspeaker
- D decibels produced by the loudspeaker in 1 second
- E metres the sound travels in 1 second.

[Turn over

13. A student makes the following statements about sound.

- I Sound cannot pass through a vacuum.
- II Sound levels are measured in decibels.
- III Loud sounds can damage hearing.

Which of the 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

14. A signal of frequency 250 hertz is input to an amplifier.

The voltage gain of the amplifier is 10.

The frequency of the output signal is

- A 0.04 hertz
- B 25 hertz
- C 250 hertz
- D 260 hertz
- E 2500 hertz.

15. A Newton balance is used to measure

- A acceleration
- B distance
- C speed
- D time
- E weight.

16. A ball is dropped onto a surface and rebounds.

A student makes the following statements about the rebound height of the ball.

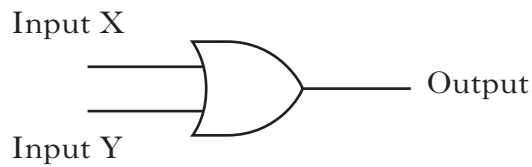
- I The rebound height depends on the material of the ball.
- II The rebound height depends on the material of the surface.
- III The rebound height depends on the speed of the ball as it hits the surface.

Which of the statements is/are correct?

- A I only
 - B III only
 - C I and II only
 - D II and III only
 - E I, II and III
17. Which of the following lists of electronic devices contains two output devices and one input device?
- A LDR, microphone, thermistor
 - B Buzzer, LED, switch
 - C Electric motor, thermistor, LDR
 - D Lamp, loudspeaker, LED
 - E Switch, electric motor, LDR
18. The resistance of an LDR decreases when the
- A light level increases
 - B light level decreases
 - C sound level decreases
 - D temperature increases
 - E temperature decreases.
19. Which of the following is the energy change in an LED?
- A Light energy to electrical energy
 - B Heat energy to electrical energy
 - C Electrical energy to heat energy
 - D Electrical energy to light energy
 - E Light energy to heat energy

[Turn over

20. The symbol for a digital logic gate is shown.



The inputs X and Y can be high (1) or low (0).

Which table describes the logic states for this gate?

A

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

B

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

C

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

D

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

E

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

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

Marks

Answer questions 21–30 in the spaces provided.

21. An outside broadcast van is transmitting live television from an athletics stadium.



- (a) In the statement below **circle one** word from the boxes to make the statement correct.

TV broadcasts are signals with a

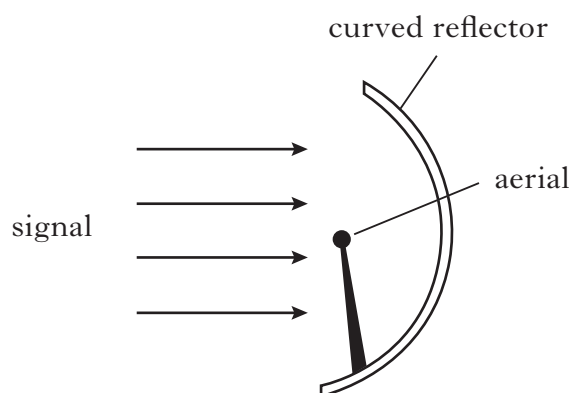
frequency than radio broadcasts.

2

- (b) (i) The TV signals are sent from the van to the TV centre.

A dish aerial with a curved reflector is used by the TV centre to receive the signals.

Complete the diagram below to show how the curved reflector affects the signals.



1

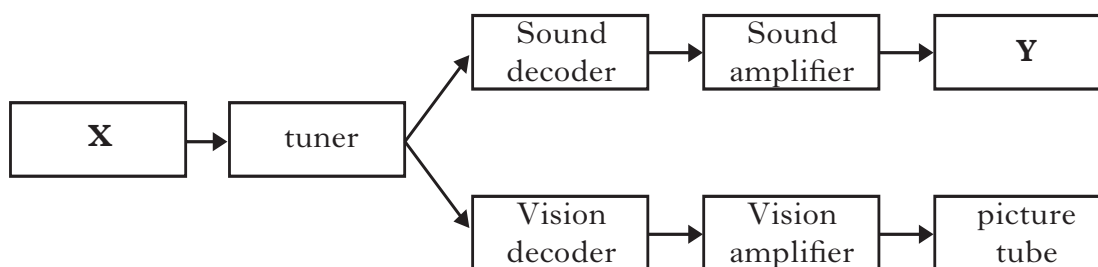
21. (b) (continued)

Marks

- (ii) Explain why a curved reflector on a receiving aerial makes the received signal stronger.

1

- (c) The TV signals are relayed from the TV centre to the TV sets in people's homes. A block diagram of a TV set is shown. Two parts have not been named.



Name parts **X** and **Y** on the block diagram.

X

Y

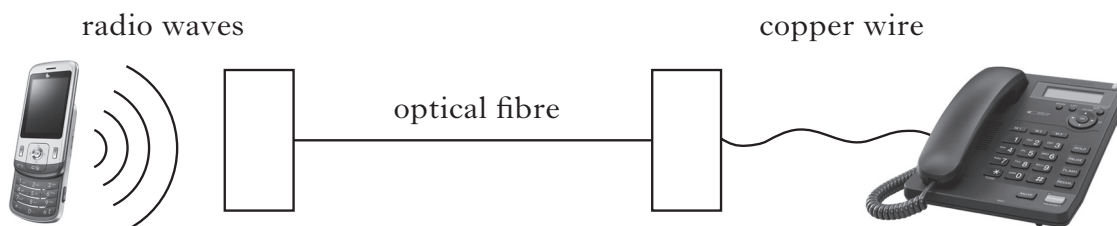
2

[Turn over

Marks

22. A student uses a mobile phone to call a friend on a landline.

The signal from the phone travels through air, optical fibres and copper wires.



(a) State **one advantage** of using a mobile phone for a telephone conversation.

1

(b) (i) Complete the diagram below to show how a light signal travels along an optical fibre.



1

(ii) State **one disadvantage** of using optical fibres rather than copper wires in a telephone communication system.

1

(c) The signal travels at different speeds in air, optical fibre and copper wire. In which of these does it travel at the **slowest** speed?

air optical fibre copper wire

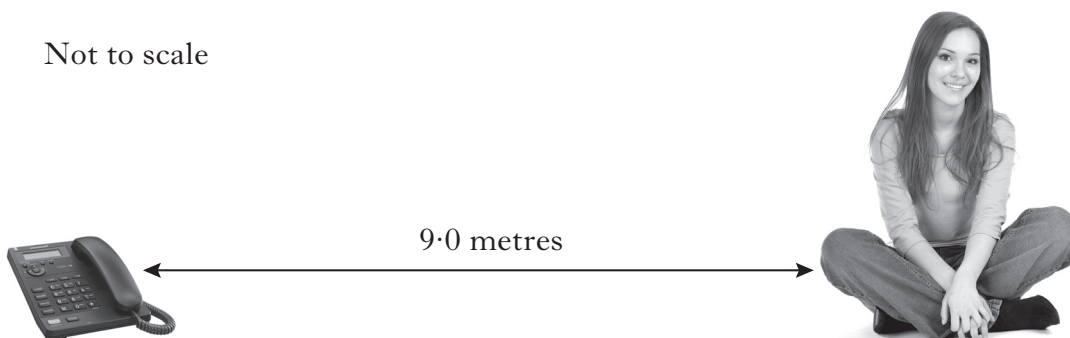
1

22. (continued)

Marks

- (d) The friend is sitting 9.0 metres from the phone when it starts to ring.
The sound takes 0.025 seconds to travel from the phone.

Not to scale



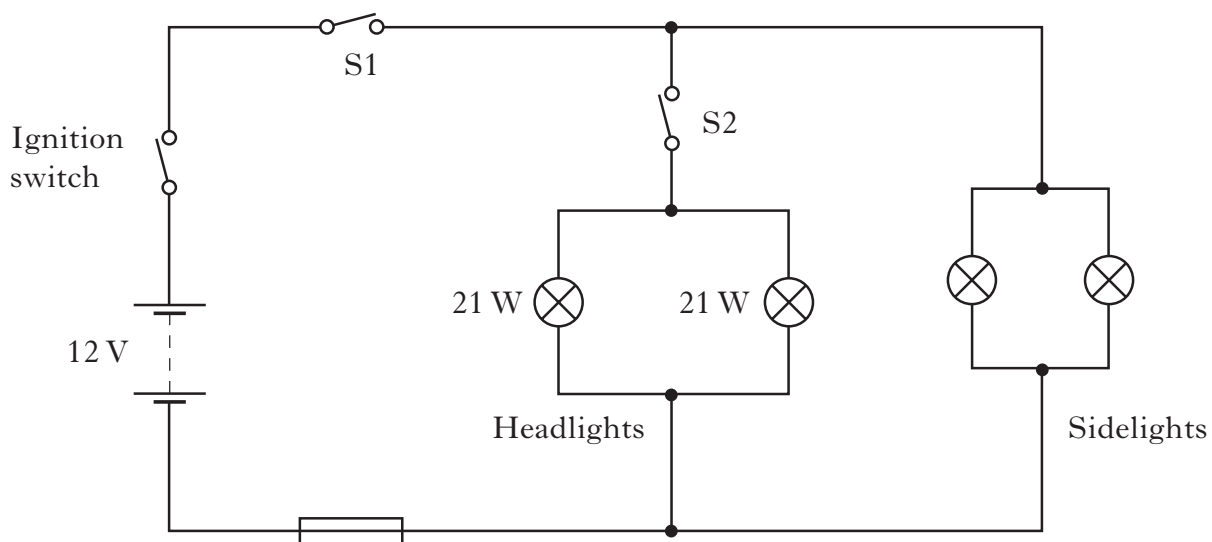
Calculate the speed of this sound.

2

[Turn over

Marks

23. The circuit shows how the headlights and front sidelights are wired in a car.



(a) Are the headlights connected in series or parallel with each other?

1

(b) Which switch or switches should be closed so that only the sidelights are on?

1

23. (continued)

Marks

- (c) (i) Calculate the current in a headlight that is operating at its rated value of 21 watts and 12 volts.

	2
--	---

- (ii) The current in each sidelight is 0.8 amperes.
Calculate the total current from the battery when both sidelights and both headlights are on.

	2
--	---

- (iii) From the list of fuses below, **circle** the most appropriate fuse needed to protect the car lighting circuit.

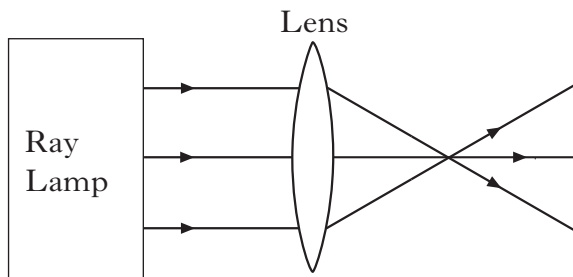
3 amperes **5 amperes** **10 amperes** **15 amperes** **1**

[Turn over

Marks

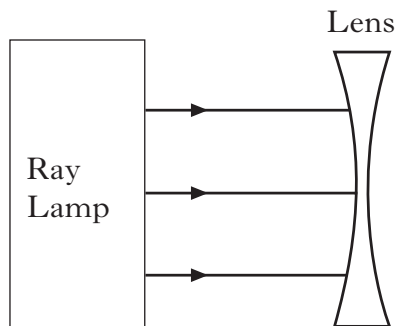
24. (a) A student sets up the apparatus shown using a lens.

The diagram shows the effect of the lens on the light rays.



The lens is now removed and replaced by a different lens.

Complete the diagram to show the effect of this lens on the light rays.



1

(b) The student reads a magazine and notices that the words on the page appear blurred.

(i) The student has an eye defect.

Name this eye defect.

1

(ii) The student puts on glasses to see the words clearly.

Name the type of lens used to correct this eye defect.

1

25. A hospital technician is preparing medical equipment.

Marks

(a) One of the instruments to be used is a digital thermometer.

The digital thermometer detects heat radiation.

(i) State the other name for “heat radiation”.

1

(ii) The digital thermometer contains a temperature sensor.

Which of the following devices could be used as a temperature sensor?

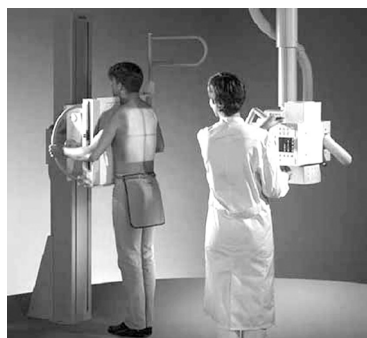
microphone

thermistor

LDR

1

(b) The technician takes an X-ray of a patient’s chest.



(i) What can be used to detect X-rays?

1

(ii) Explain why the technician has to limit the time that the patient is exposed to the X-rays.

1

25. (continued)

- (c) The technician injects a source of gamma radiation into the patient, as a tracer, to diagnose a medical condition inside the patient. The tracer emits gamma radiation. A gamma camera scans and detects the gamma radiation.

Marks

Gamma
camera

- (i) Why is gamma radiation used as a tracer?

1

- (ii) The half-life of a radioactive source is the time taken for its strength or activity to reduce by half. The table gives information on the half-life of different sources of gamma radiation.

<i>Source of gamma radiation</i>	<i>Half life</i>
Krypton 81	13 seconds
Technetium 99	6 hours
Iodine 125	60 days
Cobalt 57	270 days

- (A) Which of the sources of gamma radiation would be best for use as a tracer in this case?

1

- (B) Explain your answer.

1

25. (continued)

Marks

(d) Another medical instrument uses ultrasound.

Which of the following frequencies of sound would this machine use?

200 hertz

2000 hertz

200 000 hertz

--

1

[Turn over

26. (a) Two students carry out an experiment to measure the speed of sound using the apparatus shown.

Marks



balloon



trundle wheel



timer

One student stands with a balloon and a pin to burst the balloon, while the second student stands 100 m away with a timer.

- (i) Explain why the second student saw the balloon burst **before** hearing it.

1

- (ii) Describe how the students use this apparatus to determine the speed of sound in air. Your answer should include:

how the measurements are made;

how they would calculate the speed of sound.

3

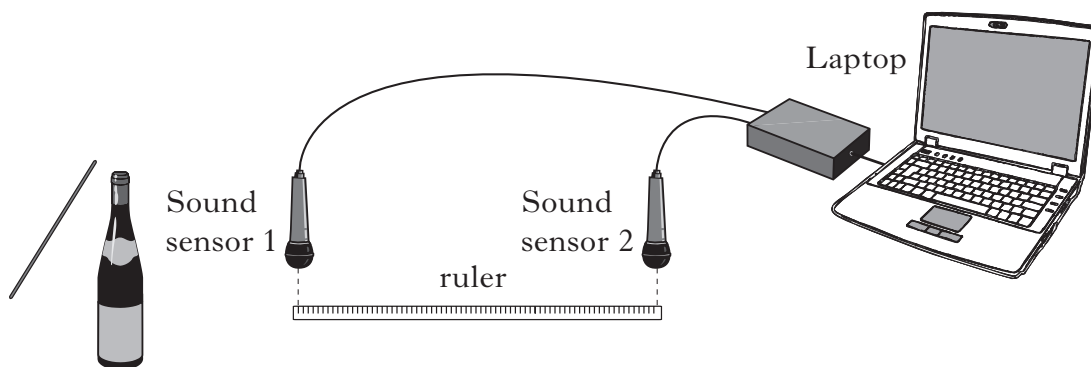
- (iii) Suggest why this method of measuring the speed of sound in air may not give an accurate answer.

1

26. (continued)

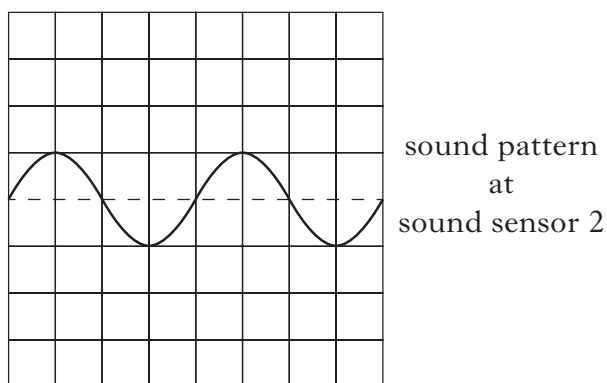
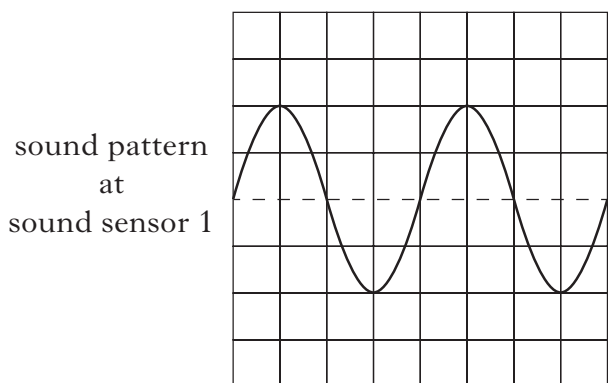
Marks

(b) The students then set up another experiment.



A bottle is tapped with a stick and sound waves travel from the bottle past the two sound sensors.

The laptop displays the sound pattern detected by each sound sensor.



(i) What must be happening to the bottle for a sound to be produced?

1

(ii) (A) State how the sound wave reaching sound sensor 2 is different from the sound wave at sound sensor 1.

1

(B) Explain your answer.

1

Marks

27. A vehicle called Thrust SSC broke the land speed record in 1997 in the Nevada Desert, USA.



- (a) The mass of Thrust SSC is 10 500 kg.
Calculate the weight of Thrust SSC.

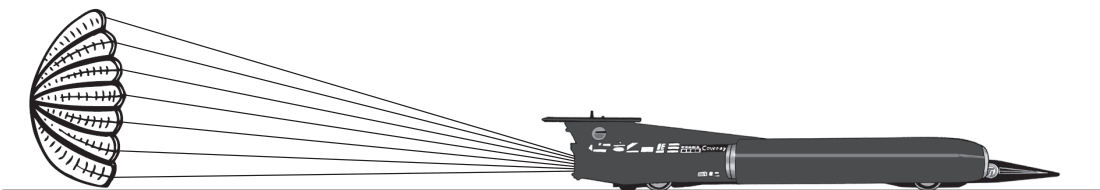
2

- (b) The diagram below shows Thrust SSC travelling at a constant speed.
Label the horizontal forces acting on the vehicle.



2

- (c) At the end of the run, Thrust SSC uses a parachute as shown.



- (i) What effect does the parachute have on the motion of the vehicle?

1

- (ii) Explain your answer.

1

27. (continued)

Marks

- (d) On one run Thrust SSC travelled 1710 metres in 5.0 seconds.
Calculate the average speed of Thrust SSC during this run.

2

[Turn over

Marks

28. A car manufacturer is carrying out safety tests on a new model of car.

During one test run an empty car collides with a wall.

The damage to the car is assessed by measuring how much the length of the front of the car has changed during the collision.



The test is carried out with identical cars at two different speeds, 10 metres per second and 20 metres per second.

(a) Which speed causes the biggest change in length of the front of the car?

1

(b) (i) The wall exerts a force on the car to make it stop.

Is this a balanced or an unbalanced force?

1

(ii) Explain your answer.

1

28. (continued)

Marks

- (c) The car manufacturer compares the new car's performance to an older model.

<i>Model</i>	<i>Mass</i> (kilograms)	<i>Time to accelerate from 0 to 60</i> <i>miles per hour (seconds)</i>
New	850	12.3
Old	850	11.6

- (i) Which model has the larger acceleration?

1

- (ii) Which car's engine exerts a bigger force when accelerating from 0 to 60 miles per hour?

1

- (iii) How could the body of the new model be changed to improve the acceleration?

1

[Turn over

29. A musician plays an electric guitar.

Marks



(a) A block diagram of the sound system is shown.



From the list of components below, **circle** the output device for this system.

- Lamp** **LED** **Loudspeaker** **Motor** **1**

(b) The input voltage to the amplifier is 0.01 volts.
The output voltage from the amplifier is 4.0 volts.
Calculate the voltage gain of the amplifier.

2

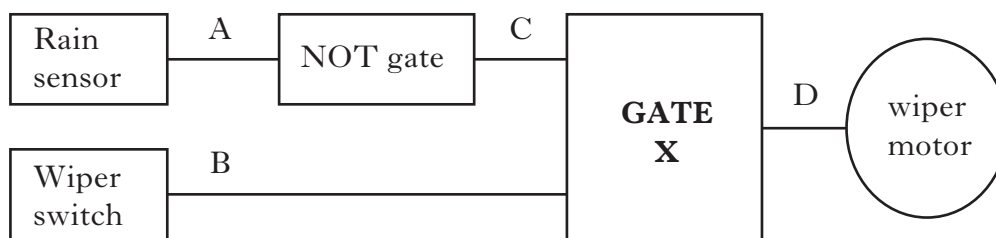
(c) The musician tightens a guitar string.
State what happens to the frequency of sound produced.

1

Marks

30. Some cars have “smart windscreen wipers” that operate whenever rain lands on the car windscreen.

An electronic system diagram for the “smart wipers” is shown.



The wiper switch must be on for the “smart wipers” to work.

The sensor outputs logic 1 when there is no rain and logic 0 when rain lands on the windscreen.

- (a) Draw the circuit symbol for a NOT gate

1

- (b) Identify Gate X

1

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

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

2

[END OF QUESTION PAPER]

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.

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