LAHORE GRAMMAR SCHOOL
55 MAIN GULBERG, LAHORE

CANDIDATE NAME:.....

CLASS & SECTION .....

CLASS

PHYSICS	Mock Exams 2020	TIME: _____

Use a soft pencil (B or HB).

Instructions

Shade ONE letter only for each question.
Make sure you put your answer in line with the correct question number.

Example

For question 1,
if you think B is the right answer,
fill in your answer sheet like this.

1	A	**B**	C	D

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D

21	A	B	C	D
22	A	B	C	D
23	A	B	C	D
24	A	B	C	D
25	A	B	C	D
26	A	B	C	D
27	A	B	C	D
28	A	B	C	D
29	A	B	C	D
30	A	B	C	D
31	A	B	C	D
32	A	B	C	D
33	A	B	C	D
34	A	B	C	D
35	A	B	C	D
36	A	B	C	D
37	A	B	C	D
38	A	B	C	D
39	A	B	C	D
40	A	B	C	D

LAHORE GRAMMAR SCHOOL 55-MAIN GULBERG

11 - Mock Examination 2020

Physics **5054/01**

Paper 1 Multiple Choice Questions March 2020

1 hour

No Additional Materials are required.

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, Centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.

Read very carefully the instructions on the answer sheet.

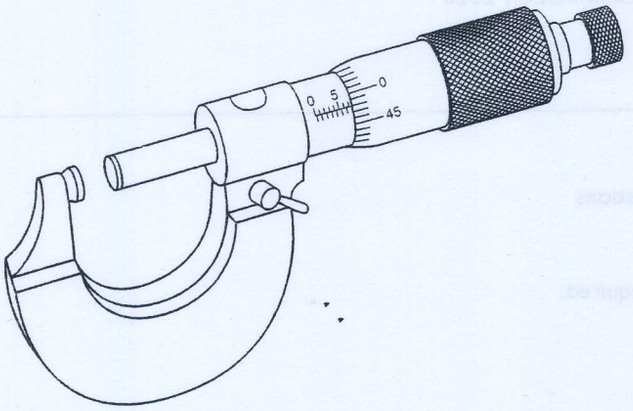
INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

This question paper consists of 14 printed pages.

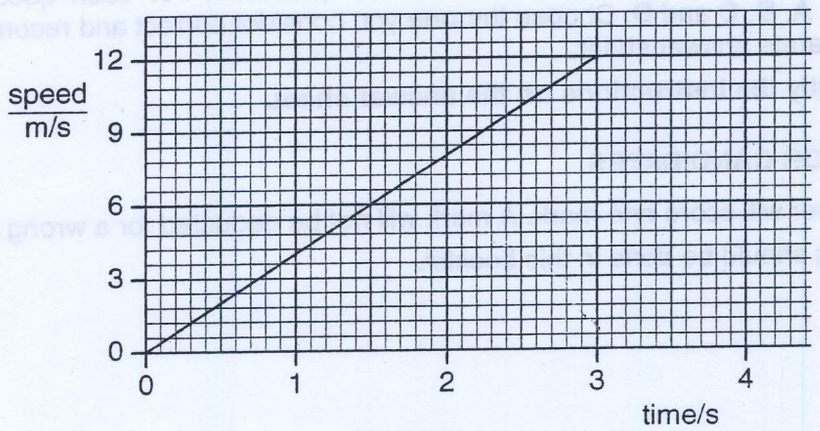
1 The diagram shows a micrometer screw gauge.



What is the reading shown?

A 5.25 mm **B** 5.48 mm **C** 7.02 mm **D** 7.48 mm

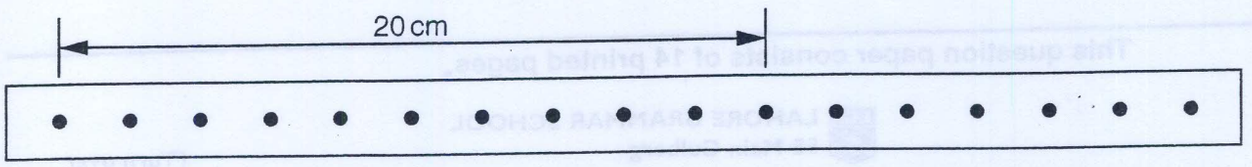
2 The graph shows the speed of a car as it moves from rest.



What is the average speed of the car during the first 3 s?

A 4 m/s **B** 6 m/s **C** 18 m/s **D** 36 m/s

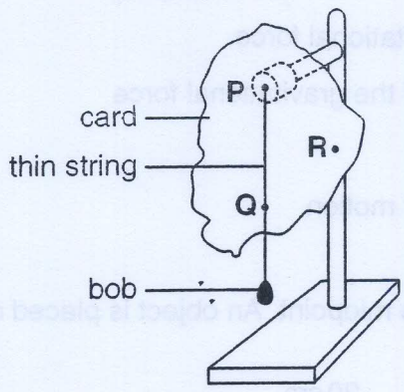
3 The diagram shows a strip of paper tape that has been pulled under a vibrating arm by an object moving at constant speed. The arm is vibrating regularly, making 50 dots per second.



What was the speed of the object?

A 2.0 cm/s **B** 5.0 cm/s **C** 100 cm/s **D** 200 cm/s

4 The diagram shows the first step in an experiment to determine the position of the centre of mass of a thin card.



What is the next step in this experiment?

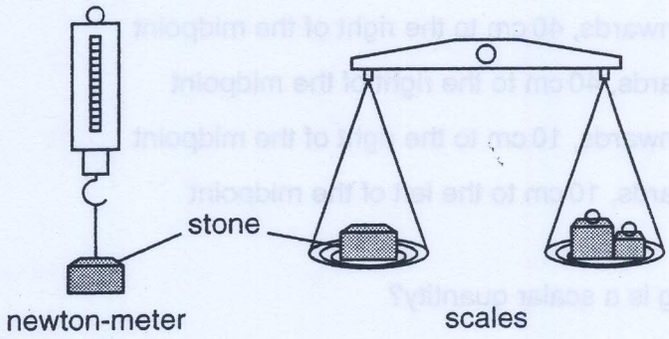
A Find the mid-point of **PQ**.

B Hang the card from point **R**.

C Measure the mass of the card.

D Measure the thickness of the card.

5 A lump of stone is weighed using a newton-meter (spring balance) and a pair of scales (pan balance).



This experiment is repeated on the Moon.

Are the readings for each balance the same or different when taken on Earth and on the Moon?

	on newton-meter	on scales
A	different	different
B	different	same
C	same	different
D	same	same

6 In which direction does the frictional force always act on an object moving across a horizontal surface?

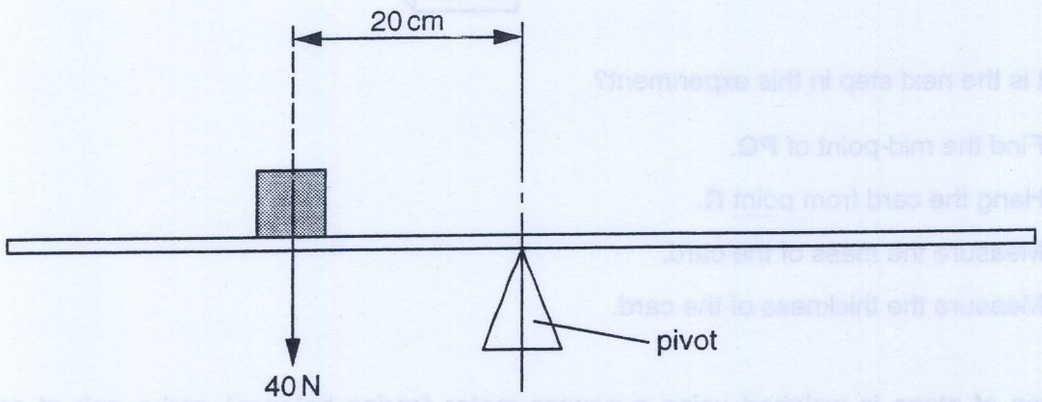
A in the direction of the gravitational force

B opposite to the direction of the gravitational force

C in the direction of motion

D opposite to the direction of motion

7 A uniform beam is pivoted at its midpoint. An object is placed on the beam as shown.



Which force will re-balance the system?

A 20 N acting downwards, 40 cm to the right of the midpoint

B 20 N acting upwards, 40 cm to the right of the midpoint

C 50 N acting downwards, 10 cm to the right of the midpoint

D 50 N acting upwards, 10 cm to the left of the midpoint

8 Which of the following is a scalar quantity?

A the braking force needed to stop a car

B the effort needed to hammer a nail into wood

C the heat needed to boil some water

D the thrust needed to lift a rocket off the ground

9 The power output of a lamp is 6 W.

How much energy does the lamp give out in 2 minutes?

A 3 J **B** 12 J **C** 120 J **D** 720 J

10 A barometer is carried from the 1st floor to the 20th floor of a building.

Why does the reading on the barometer fall?

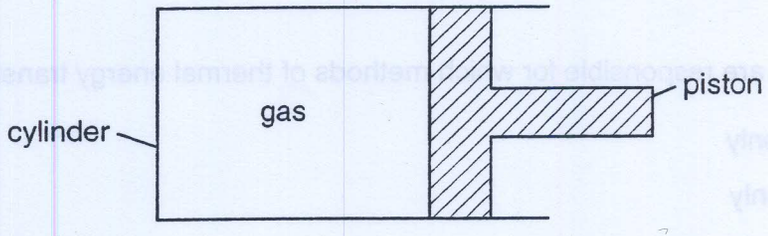
A Air pressure has increased.

B Gravity has decreased.

C Temperature has increased.

D There is less air above the barometer.

11 The cylinder shown contains gas. The piston is held fixed and the cylinder is heated.



Why does the pressure of the gas increase?

A The gas molecules expand.

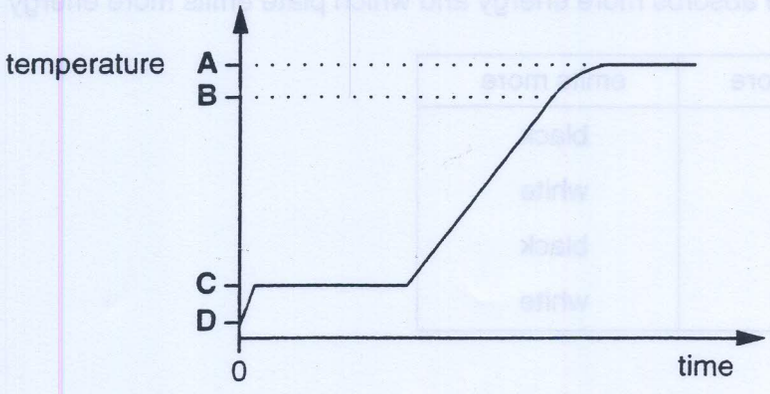
B The molecules move at the same speed, but hit the walls more often.

C The molecules move faster and hit the walls more often.

D The number of molecules of gas increases.

12 Some ice cubes are taken from a deep-freeze and placed in a metal container. The container is heated at a steady rate and temperature/time readings are taken. The results are recorded on a graph.

Which temperature corresponds to 0 °C?



13 The sensitivity of a liquid-in-glass thermometer depends on the volume of liquid used and the diameter of the bore of the thermometer.

Which changes will produce the greatest increase in sensitivity?

	volume of liquid	bore diameter
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

14 Density changes are responsible for which methods of thermal energy transfer?

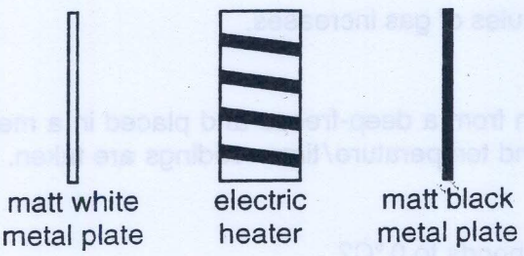
A conduction only

B convection only

C radiation only

D conduction, convection and radiation

15 Two identical metal plates are painted, one matt white and the other matt black. These are placed at equal distances from a radiant heater as shown. The heater is turned on for five minutes.



Which metal plate absorbs more energy and which plate emits more energy in this time?

	absorbs more	emits more
A	black	black
B	black	white
C	white	black
D	white	white

16 What happens to light as it passes from glass into air?

A Its frequency decreases because its speed decreases.

B Its frequency increases because its speed increases.

C Its wavelength decreases because its speed decreases.

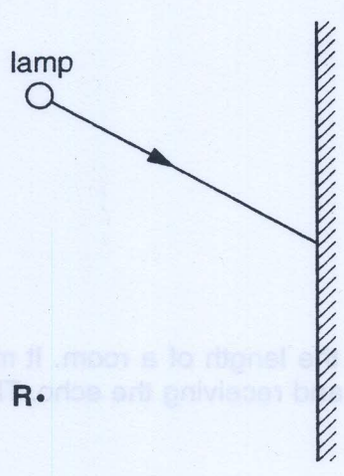
D Its wavelength increases because its speed increases.

17 X-rays, visible light and radio waves are all part of the electromagnetic spectrum.

What is the correct order of increasing wavelength?

	shortest ⟶ longest		
A	radio waves	X-rays	visible light
B	radio waves	visible light	X-rays
C	X-rays	radio waves	visible light
D	X-rays	visible light	radio waves

18 The diagram shows a ray of light from a small lamp striking a plane mirror.



The image of the lamp formed by the mirror is

A at **P** and is real.

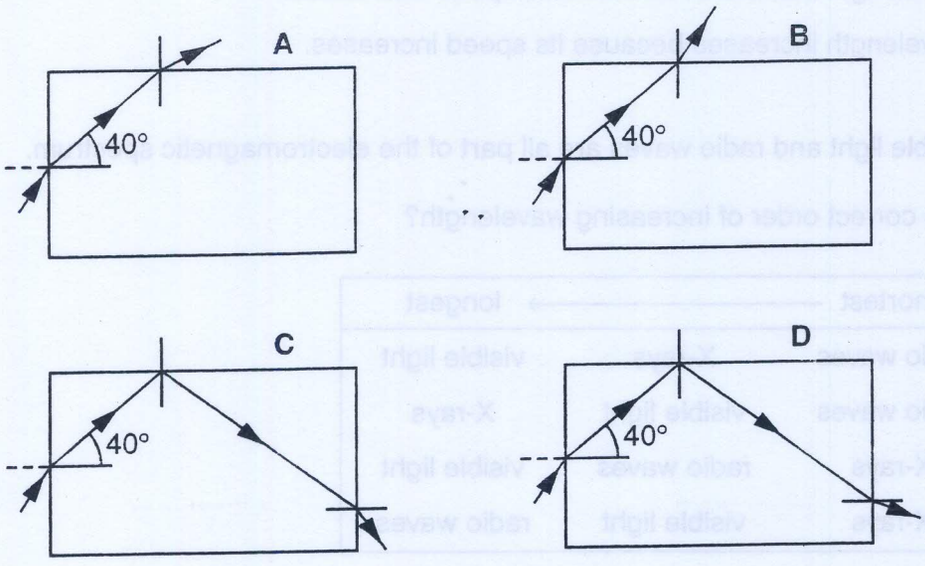
B at **P** and is virtual.

C at **R** and is real.

D at **R** and is virtual.

19 A ray of light is incident on one side of a rectangular glass block, so that the angle of refraction is 40° in the glass.

Which diagram correctly shows a possible path of this ray? [The critical angle for glass is 42°.]



20 What is the correct order for the speed of sound in air, steel and water?

	slowest ⟶		fastest
A	air	steel	water
B	air	water	steel
C	water	air	steel
D	water	steel	air

21 A sonic 'tape measure' is used to measure the length of a room. It measures a time interval of 0.060 s between transmitting a sound pulse and receiving the echo. The speed of sound in air is 330 m/s.

How far is the reflecting wall from the 'tape measure'?

A 5.5 m **B** 9.9 m **C** 11 m **D** 20 m

22 The answer to which question will distinguish between a magnetic material and a non-magnetic material?

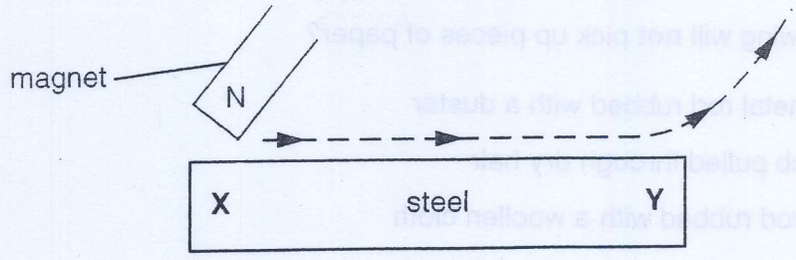
A Is it a metal or a non-metal?

B Is it a conductor or an insulator?

C Can it be given an electric charge?

D Does it affect the direction in which a compass needle points?

23 A piece of steel can be magnetised by stroking it with a magnet.

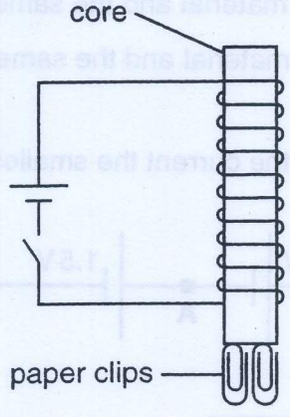


When the magnet is moved in the direction shown, which poles are produced at **X** and at **Y**?

	X	Y
A	north	north
B	north	south
C	south	north
D	south	south

24 Four different substances are tested by using each as the core of an electromagnet to find the most suitable one for use as the core of a transformer.

The number of paper clips each will hold is recorded when there is a current in the electromagnet and when the current is switched off.



Which substance will be the best for making a core for a transformer?

substance	number of paper clips held with a current	number of paper clips held when current is switched off
A	8	4
B	6	0
C	5	1
D	4	0

25 An electrostatically charged object will pick up small pieces of paper.

Which of the following will **not** pick up pieces of paper?

A an earthed metal rod rubbed with a duster

B a plastic comb pulled through dry hair

C a polythene rod rubbed with a woollen cloth

D a rubber balloon rubbed on a nylon shirt

26 Why can birds stand on an overhead transmission line without suffering any harm?

A Their bodies have a very high resistance.

B Their feet are very good insulators.

C There is no potential difference between their feet.

D The spaces between their feathers act as insulators.

27 The terminals of a battery are joined by a length of resistance wire.

Which change, on its own, will increase the current through the battery?

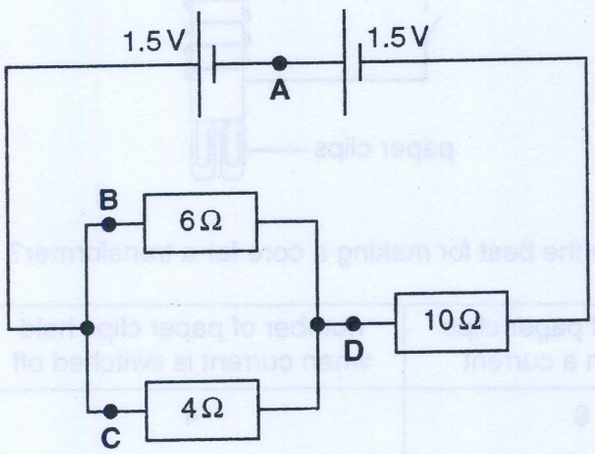
A connecting an identical wire in series with the first one

B covering the wire with plastic insulation

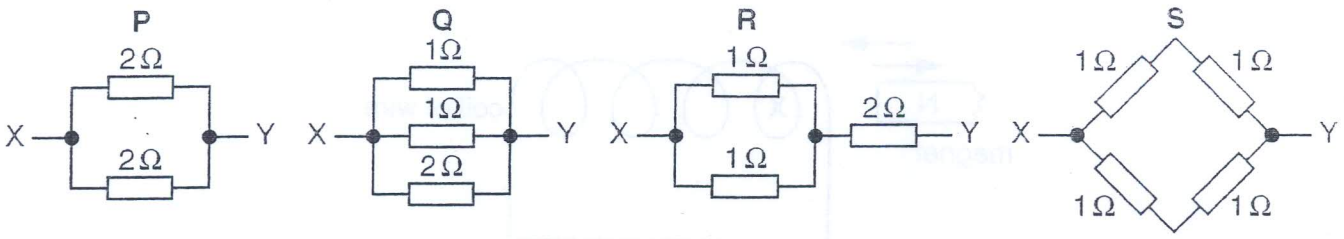
C using a shorter wire of the same material and the same thickness

D using a thinner wire of the same material and the same length

28 In the circuit shown, at which point is the current the smallest?



29 Which two resistor combinations have the same effective resistance between X and Y?



A P and Q **B** P and S **C** Q and R **D** R and S

30 The earth wire of an electric appliance should be connected to the

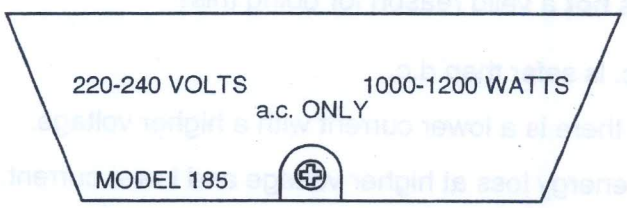
A fuse.

B metal case.

C ON/OFF switch.

D plastic handle.

31 The diagram shows the information given on an electric iron.

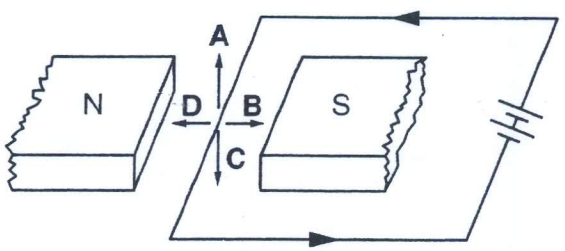


If electricity costs 7 p per unit, what is the cost of using this iron at maximum power for 10 hours?

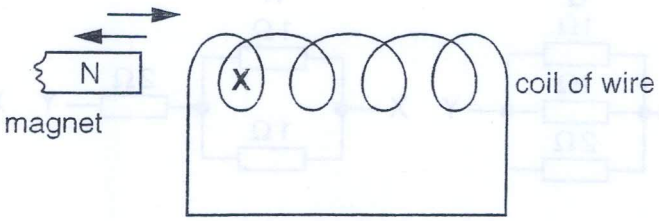
A 17 p **B** 70 p **C** 84 p **D** 220 p

32 A current-carrying wire is placed between the poles of a magnet.

In which direction will the force due to the current try to move the wire?



33 The diagram shows a magnet moved into, and out of, a coil of wire.



What describes the poles produced in the coil at **X** by the movement of the magnet?

	north pole in	north pole out
A	N	N
B	N	S
C	S	N
D	S	S

34 Electrical energy is transmitted at high alternating voltages.

Which of the following is **not** a valid reason for doing this?

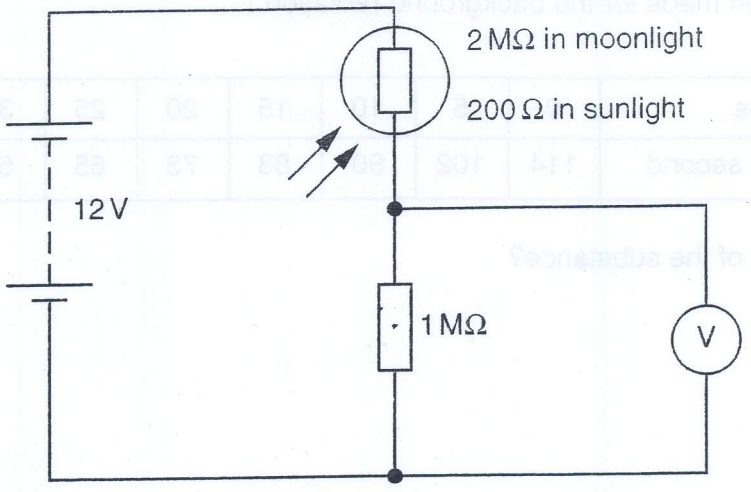
A At high voltage, a.c. is safer than d.c.

B For a given power, there is a lower current with a higher voltage.

C There is a smaller energy loss at higher voltage and lower current.

D The transmission lines can be thinner with a lower current.

35 A circuit with a light-dependent resistor is used to detect changes in light levels.



What are the approximate voltmeter readings in moonlight and in sunlight?

	reading in moonlight / V	reading in sunlight / V
A	4	0
B	4	12
C	8	0
D	8	4

36 Which action will most increase a person's exposure to radioactivity?

A eating food that has been sterilised by exposure to gamma rays

B going for a flight in a high-flying aircraft

C opening the windows of a house

D using a Geiger-Müller tube and counter

37 Which nuclear reaction shows nuclear fission?

A $^{2}_{1}H + {}^{2}_{1}H \longrightarrow {}^{4}_{2}He$

B $^{14}_{7}N + \text{neutron} \longrightarrow {}^{15}_{7}N$

C $^{241}_{94}Pu \longrightarrow {}^{237}_{92}U + \alpha\text{-particle}$

D $^{239}_{92}U \longrightarrow {}^{95}_{38}Sr + {}^{141}_{54}Xe + 3 \text{ neutrons}$

38 The table shows how the activity of a radioactive substance changes over a period of time. (Allowance has been made for the background radiation.)

time / minutes	0	5	10	15	20	25	30	35	40
activity / counts per second	114	102	90	83	73	65	57	51	45

What is the half-life of the substance?

A 73 minutes

B 57 minutes

C 30 minutes

D 20 minutes

39 What can be used as the unit of energy?

A newton per metre

B volt ampere

C volt per coulomb

D watt second

40 A 12 V electric motor is used to lift a load of 60 N through a height of 2 m in 4 seconds.

Assuming the motor to be 100% efficient, what is the average current in the motor?

A $\frac{4}{60 \times 2 \times 12}$ A **B** $\frac{12 \times 4}{60 \times 2}$ A **C** $\frac{60 \times 2}{12 \times 4}$ A **D** $\frac{60 \times 2 \times 4}{12}$ A

LAHORE GRAMMAR SCHOOL 55-MAIN GULBERG
11 - Mock Examination 2020

Physics **5054/02**

Paper 2 Theory March 2020

1 hour 45 minutes

No Additional Materials are required.

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on any separate answer paper used.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers on the lined pages provided and, if necessary, continue on the separate answer paper provided.

At the end of the examination, fasten any separate answer paper used securely to the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

Candidates are reminded that **all** quantitative answers should include appropriate units.

Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of physics than for correct answers.

This question paper consists of 16 printed pages,

For Examiner's Use

Section A

Answer **all** the questions in this section.

1 Fig. 1.1 shows a spring. Masses are added to the spring and the extension is measured. The results are shown in Fig. 1.2.

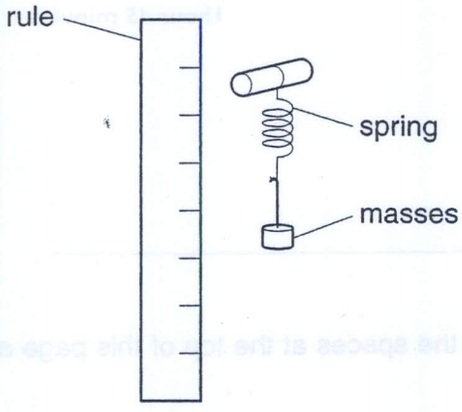


Fig. 1.1

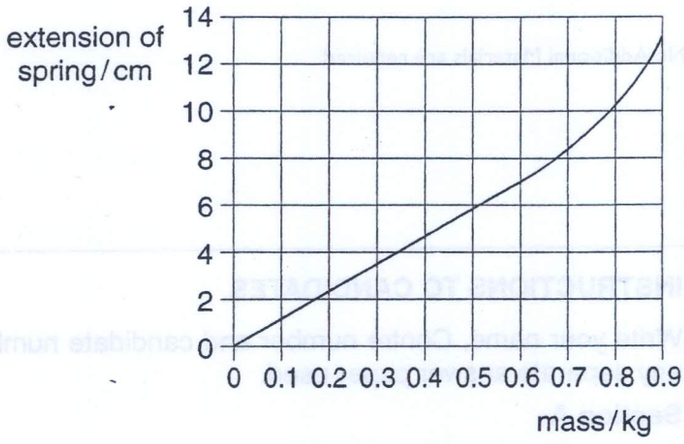


Fig. 1.2

(a) Explain how the extension of the spring is determined with the rule.

.....

.....

..... [1]

(b) **(i)** State the mass that stretches the spring to the limit of proportionality.

mass = ... kg

(ii) Calculate the weight of this mass.

Take the gravitational force on a mass of 1 kg to be 10 N.

weight = ... N
[2]

(c) State and explain how the graph drawn in Fig. 1.2 is different when the experiment is performed at a place where the gravitational field is weaker.

.....

.....

..... [2]

2 Fig. 2.1 shows how the speed of a cyclist varies during a journey.

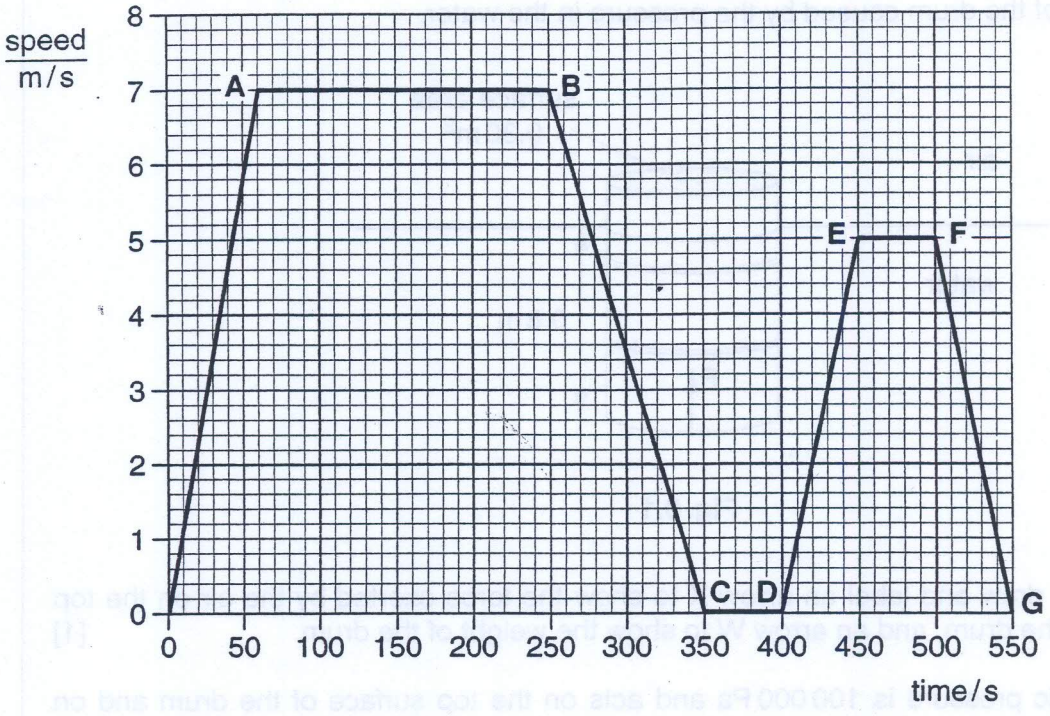


Fig. 2.1

(a) Describe the motion of the cyclist between points **B** and **C**.

.....

..... [2]

(b) State which parts of the graph show the cyclist **moving** with constant speed.

..... [1]

(c) Calculate the distance travelled by the cyclist in the first 250 s of the journey.

distance = ... [3]

3 Fig. 3.1 shows an oil drum floating in water. Force F is the force acting upwards on the bottom surface of the drum caused by the pressure in the water.

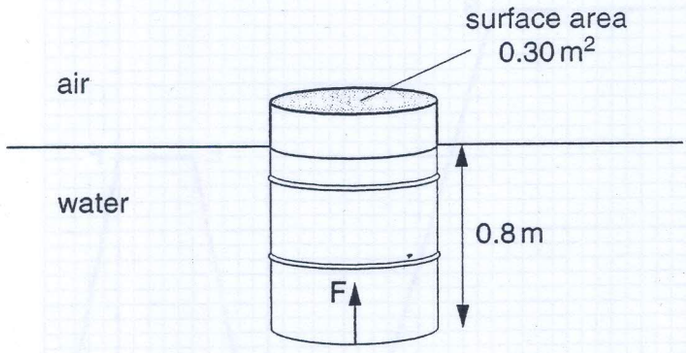


Fig. 3.1

(a) On Fig. 3.1 draw and label an arrow X to show the force exerted by the air on the top surface of the drum, and an arrow W to show the weight of the drum. [1]

(b) Atmospheric pressure is 100 000 Pa and acts on the top surface of the drum and on the water surface.

(i) State the formula that relates pressure, force and area.

.....

(ii) The drum has a top surface of area 0.30 m^2.

Calculate the force that the air exerts on this surface.

force = ...

(iii) The pressure in water increases by 10 000 Pa for each metre increase in depth below the surface.

The bottom surface of the drum is 0.8 m below the water surface.

Calculate the total pressure in the water at this depth.

pressure = ...

[5]

4 **(a)** State what is meant by the boiling point of a liquid.

.....

.....

..... [2]

(b) A thermocouple thermometer is calibrated at 0 °C and 100 °C. The results are shown in the table.

temperature / °C	0	100
thermocouple output / mV	0	22

(i) Calculate the recorded temperature when the output of the thermocouple is 18 mV.

temperature = ...

(ii) State **one** advantage of using a thermocouple thermometer rather than a liquid-in-glass laboratory thermometer.

.....

.....

.....

[3]

5 Fig. 5.1 shows a transformer connected to an alternating current supply. The primary coil has 50 turns and the secondary coil 100 turns. Both coils are made of insulated copper wire and are wound on a soft-iron core.

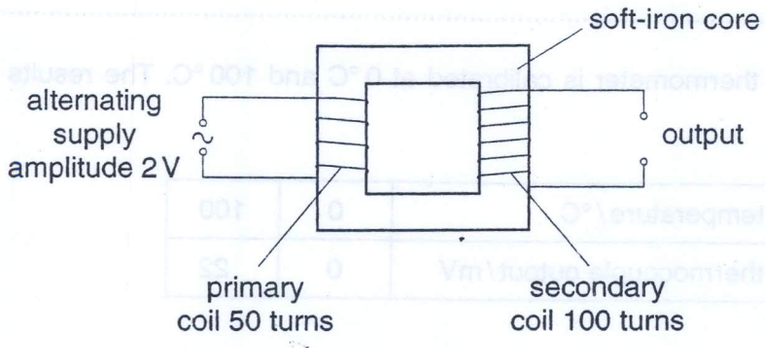


Fig. 5.1

(a) State

(i) why the coils are made of copper,

.....

.....

(ii) why the core is made of soft iron,

.....

.....

(iii) the cause of the magnetic field in the soft-iron core.

.....

.....

[4]

(b) Fig. 5.2 shows the variation of the output voltage of the transformer with time.

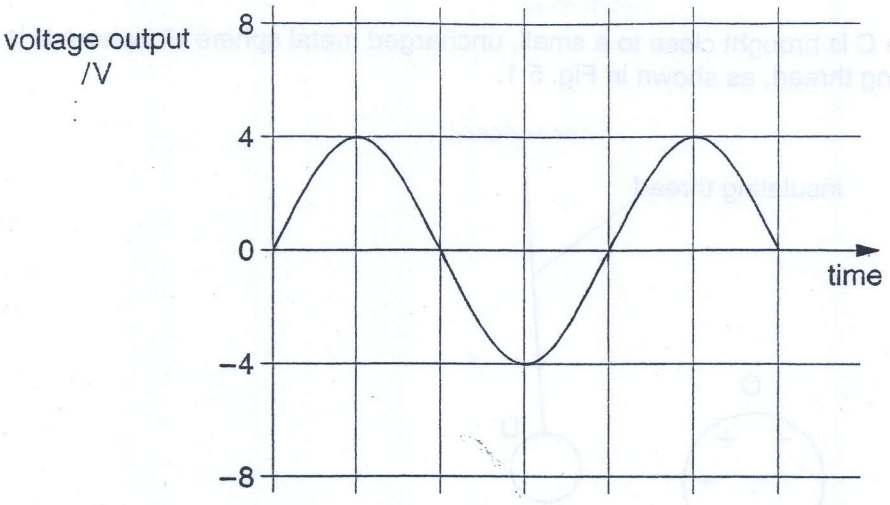


Fig. 5.2

The number of turns on the secondary coil is increased to 150, but the number of turns on the primary coil and the input voltage are unchanged.

On Fig. 5.2, draw the variation with time of the output voltage after this increase. [2]

6 A positively charged sphere C is brought close to a small, uncharged metal sphere U. Sphere U is suspended from an insulating thread, as shown in Fig. 5.1.

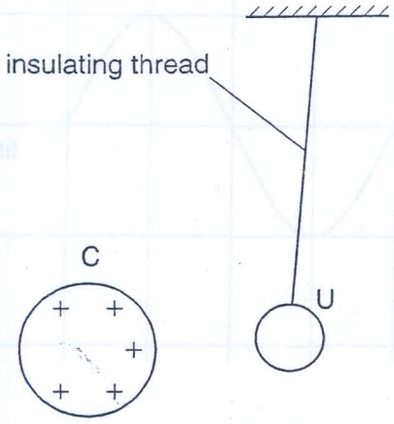


Fig. 5.1

(a) On Fig. 5.1, draw the induced charges on sphere U. [1]

(b) Sphere C is moved towards sphere U until the spheres touch. Sphere U is then repelled by sphere C, as shown in Fig. 5.2. The charges on C and U are not shown.

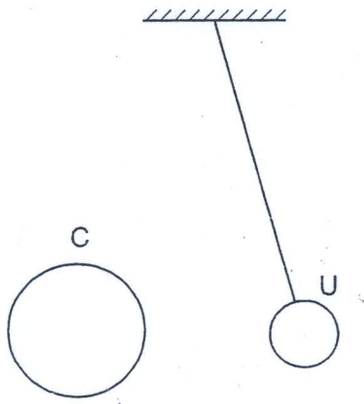


Fig. 5.2

(i) State and explain what happens to the charge on the two spheres as they touch.

charge on C: .....

.....

charge on U: .....

.....

[3]

(ii) Explain why U is repelled by C.

.....

..... [1]

7 Using a microscope, smoke particles can be seen moving inside a glass tube. They appear as tiny spots of light that move in various directions. The air molecules inside the glass tube cannot be seen with the aid of the microscope. The apparatus is illustrated in Fig. 7.1.

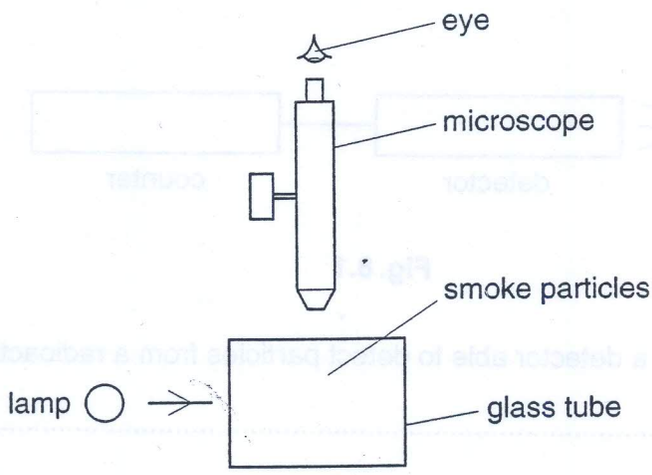


Fig. 7.1

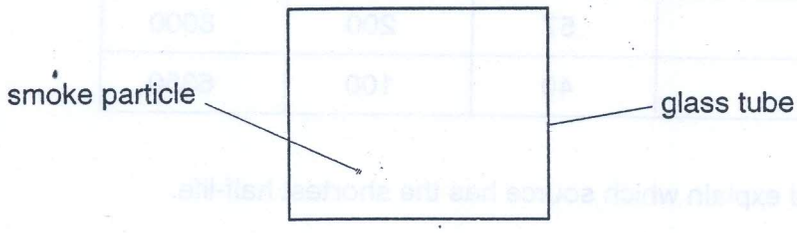
(a) State why a microscope is needed to see the smoke particles.

.....[1]

(b) Explain why the smoke particles appear as spots of light.

.....[1]

(c) On the diagram below draw a path taken by one smoke particle over a period of time.



[1]

(d) **(i)** State what makes the smoke particles move in this way.

.....

(ii) Explain what the movement of the smoke particles tells us about the movement of the air molecules that cannot be seen.

.....

.....

[3]

8 A teacher counts the number of particles emitted from a radioactive source, as shown in Fig. 8.1.

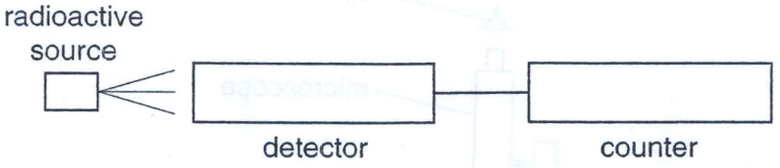


Fig. 8.1

(a) State the name of a detector able to detect particles from a radioactive source.

..... [1]

(b) The teacher measures the number of particles emitted in 1 minute from three different sources. The measurements are repeated each hour for four hours.

The results are shown in the table.

time / hours	number of particles emitted in 1 minute		
	source A	source B	source C
0	160	1600	16000
1	113	800	12700
2	80	400	10000
3	57	200	8000
4	40	100	6350

(i) State and explain which source has the shortest half-life.

source with shortest half-life .....

reason .....

.....

.....

(ii) The experiment continues until the time is 6 hours.

For this time of 6 hours, calculate the number of particles emitted in 1 minute from

1. source A,

number = ...

2. source B.

number = ...

[5]

Section B

For Examiner's Use

Answer **two** questions from this section. Answer in the spaces provided.

9 Fig. 9.1 shows a skydiver, of mass 70 kg, falling towards the Earth at constant speed, a long time after jumping from an aeroplane.

Fig. 9.1

At time $t = 0$, he receives a radio signal. He opens his parachute 12 s later. Fig. 9.2 is the speed-time graph for the skydiver.

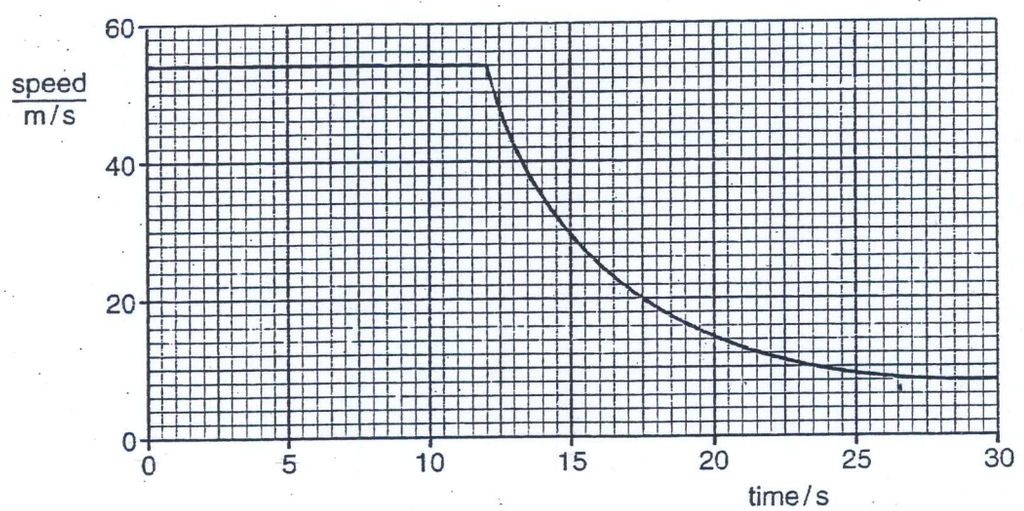


Fig. 9.2

(a) State the difference between *speed* and *velocity*.

.....

.....[1]

(b) The gravitational field strength g is 10 N/kg.

(i) Calculate the weight of the skydiver.

weight = ...[1]

(ii) State the size of the air resistance acting on the skydiver between $t = 0$ and $t = 12$ s.

For Examiner's Use

air resistance = ...[1]

(c) For the period between $t = 0$ and $t = 12$ s, determine

(i) the speed of the skydiver,

speed = ...[1]

(ii) the distance fallen by the skydiver,

distance = ...[2]

(iii) the change in the gravitational potential energy of the skydiver.

change in energy = ...[2]

(d) As he falls at constant speed, his gravitational potential energy changes into another form. State the name of this other form of energy.

.....[1]

(e) (i) State and explain what happens to the air resistance as the skydiver opens his parachute.

.....

.....

.....[2]

(ii) State and explain the effect on the motion of the skydiver of opening the parachute.

.....

.....

.....[2]

(f) By $t = 15$ s, his parachute is fully open.

State and explain what happens to the air resistance after $t = 15$ s.

.....

.....

.....[2]

10 A student goes for a walk in the mountains. During a storm, she sees lightning strike a hillside in the distance. Several seconds later, she hears the thunder caused by the lightning.

For Examiner's Use

(a) (i) Explain why she hears the thunder several seconds after she sees the lightning.

.....

.....[1]

(ii) The student knows the distance to the hillside. She waits for lightning to strike the hillside again. Describe how she can determine a value for the speed of sound in air.

.....

.....

.....

.....[2]

(b) After the storm, the student sees a rainbow.

(i) State the speed of light in air.

speed = ...[1]

(ii) Calculate the wavelength in air of light of frequency 7.5×10^{14} Hz.

wavelength = ...[2]

(iii) State the colours of the spectrum in order of increasing wavelength.

.....

.....[2]

For Examiner's Use

(c) In the laboratory, the student sends blue light into a glass prism placed on a sheet of paper. The arrangement is shown in Fig. 10.1.

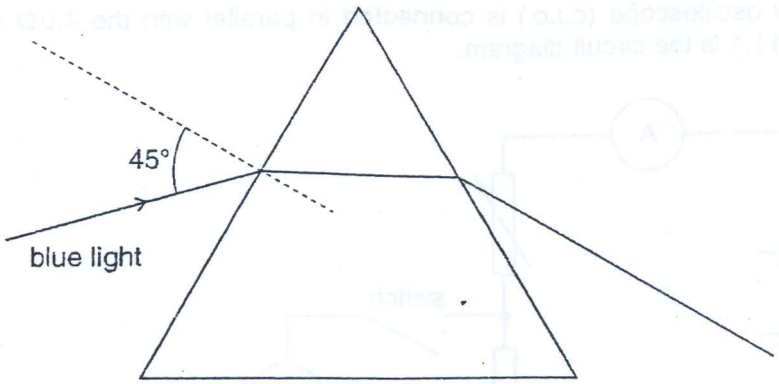


Fig. 10.1

The blue light enters the prism with an angle of incidence of 45°.

(i) On Fig. 10.1, mark the angle of refraction in the glass and label it *r*. [1]

(ii) The student wishes to determine the angle of refraction. On the sheet of paper, she draws the path the ray takes in the glass. Describe how she could do this.

.....

.....

.....[2]

(iii) 1. State the formula that relates the angle of incidence *i*, the angle of refraction *r* and the refractive index *n*.

.....

.....[1]

2. The angle of refraction in the glass is 28°.

Calculate the refractive index of the glass.

refractive index = ...[1]

(iv) The student sends a ray of red light to the glass prism along the same path as the blue light.

On Fig. 10.1, mark the path taken by the red light after it enters the prism. [2]

11 An ammeter, a variable resistor and a 4.0Ω resistor are connected in series with a 6.0V battery. A cathode-ray oscilloscope (c.r.o.) is connected in parallel with the 4.0Ω resistor through a switch. Fig. 11.1 is the circuit diagram.

For Examiner's Use

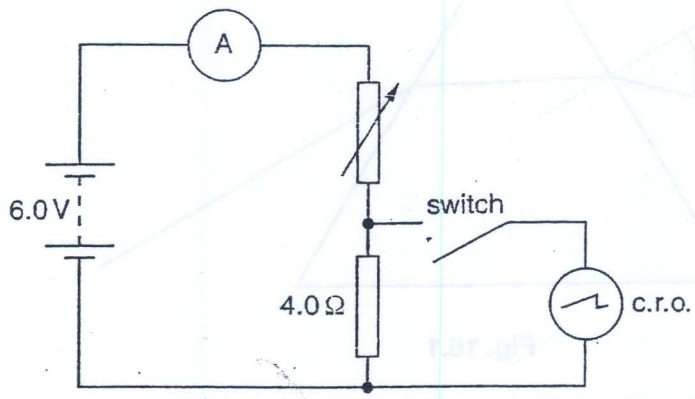


Fig. 11.1

The switch is open.

(a) The variable resistor is adjusted so that it has a resistance of 8.0Ω.

Calculate

(i) the current measured by the ammeter,

current = ...[2]

(ii) the potential difference (p.d.) across the 4.0Ω resistor.

p.d. = ...[1]

(b) The resistance of the variable resistor is adjusted until the p.d. across the 4.0Ω resistor is 5.0V.

State the effect that this adjustment has on

(i) the current measured by the ammeter,

.....[1]

(ii) the resistance of the variable resistor.

.....[1]

For Examiner's Use

(c) The trace on the c.r.o. is a horizontal line across the middle of the screen and the p.d. across the 4.0Ω resistor is still 5.0V.

The Y-gain control is set at 2.0V/cm and the switch is closed.

State the effect on the trace of closing the switch.

.....

.....

.....[2]

(d) Fig. 11.2 shows, in outline, the basic structure of a c.r.o. viewed from the side.

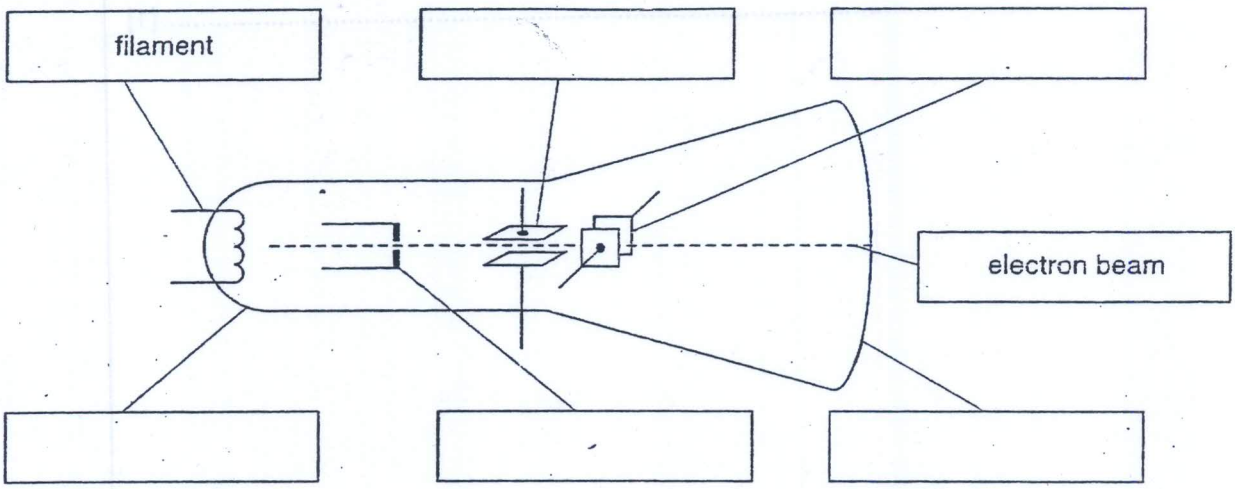


Fig. 11.2

(i) On Fig. 11.2 write, in the **five** empty boxes, the names of the parts of the c.r.o. indicated. [3]

(ii) Explain how the electron beam is produced.

.....

.....

.....[2]

(iii) Explain why the tube of the c.r.o. must be evacuated.

.....

.....[1]

Question 11 continues on page 16.

(iv) In the c.r.o. shown in Fig. 11.2, the electrons travel from left to right.

For Examiner's Use

1. Explain why the flow of electrons is an electric current.

.....

.....[1]

2. State the direction of the conventional current due to the electrons.

.....

.....[1]

LAHORE GRAMMAR SCHOOL 55-MAIN GULBERG

11 - Mock Examination 2020

Physics 5054/04

Paper 4 Alternative to Practical March 2020

1 hour

No Additional Materials are required.

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

This question paper consists of 11 printed pages .

1 A small bird lands and stays on a thin horizontal branch of a tree as shown in Fig. 1.1.

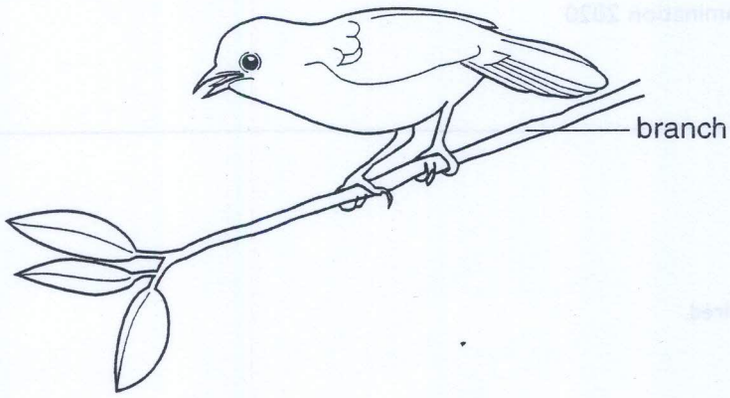


Fig. 1.1

This produces up and down oscillations of the branch. A student counts and times the oscillations, and finds that the time for 10 oscillations is 7.7 s. The bird then flies away.

The student has 12 similar coins. Some of them are attached to the spot where the bird had landed as shown in Fig. 1.2.

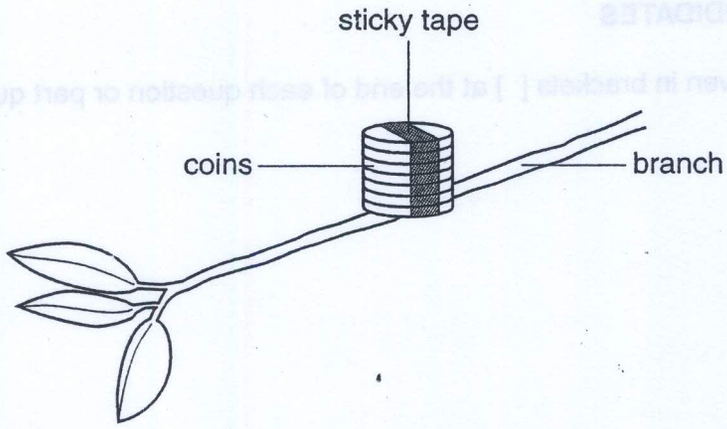


Fig. 1.2

The branch is then made to oscillate. The time for 10 oscillations is obtained with different numbers of coins attached to the branch.

The student's results are shown in the table.

object on the branch	number of oscillations	time/s	mass of object / g
nothing	10	4.5	0
2 coins	10	6.4	
4 coins	10	7.3	
bird	10	7.7	*X*
6 coins	10	8.0	
8 coins	10	8.5	

Using a balance, the student finds that the mass of 12 coins is 90 g.

(a) Complete the table by giving the missing information in the mass column. [2]

(b) By using the values given in the table, complete the following statement about the mass *X* of the bird.

'*X* is greater than ..... g but less than ..... g'.

[1]

(c) **(i)** State the graph that you would plot to help you determine the value of *X*.

.....

(ii) Explain how you would obtain the value for *X* from your graph.

.....

.....

.....

.....[3]

2 When you blow into a bottle, as shown in Fig. 2.1, a loud sound may be heard.

Fig. 2.1

You can also make a loud sound using the apparatus shown in Fig. 2.2.

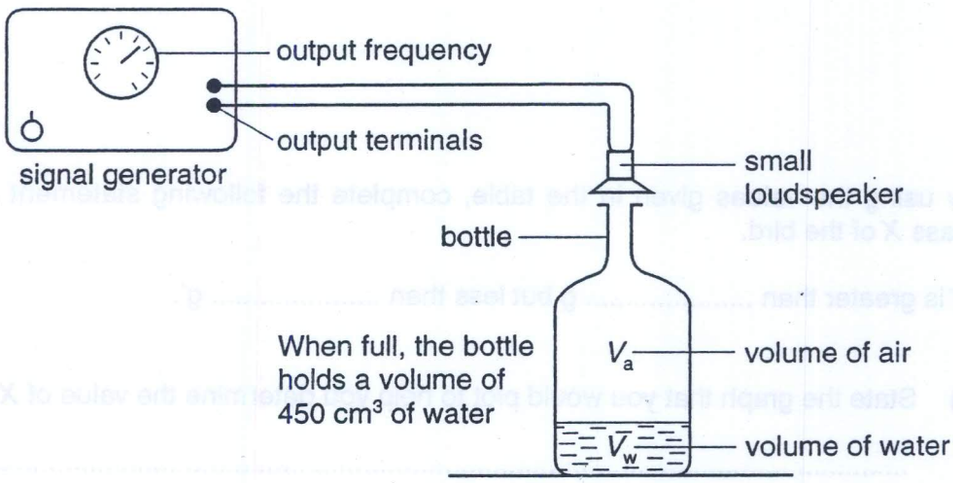


Fig. 2.2

The output frequency of the signal generator can be changed. For a given volume V_a of air, the sound is loud for only one value of frequency *f*. Your teacher asks you to find out how the value of the volume V_a of air in the bottle affects the frequency at which a loud sound is heard. You pour a known volume V_w of water into the bottle and then determine V_a. The loudspeaker is placed over the open top of the bottle and the frequency of the signal generator is adjusted until a loud sound is heard coming from the bottle. All the readings are recorded, including the volume V_b of water that fills the bottle. V_b is found to be 450 cm³.

(a) How can you change the volume of air inside the bottle?

.....[1]

(b) What does the volume V_a of air, plus the volume V_w of water always equal?

$V_a + V_w =$ .....[1]

For Examiner's Use

(c) In the experiment, you determine different values of frequency and different volumes of water and air. In the space below, draw up a table in which you could record **all** the observations you need to make.

[4]

For Examiner's Use

3 A student makes an electromagnet by wrapping wire around an iron nail. In one experiment the length of wire used makes a coil of 40 turns. The coil is connected in a series circuit as shown in Fig. 3.1.

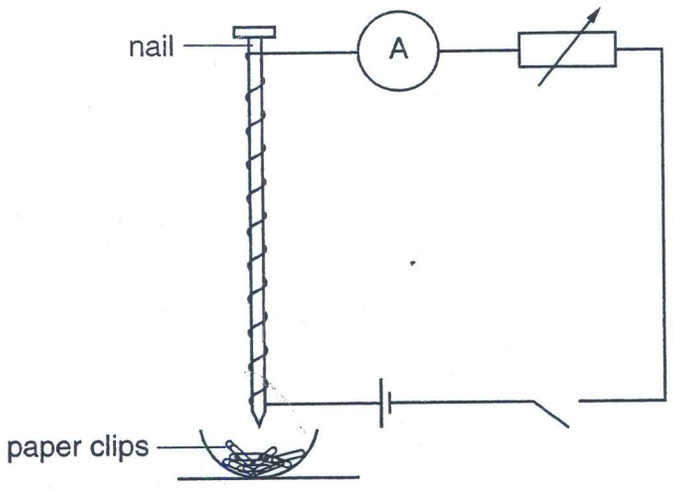


Fig. 3.1

The student uses the variable resistor to obtain six different values of current through the coil. For each value of current, the strength of the electromagnet is measured by the number *N* of paper clips that the nail can pick up. Three trials are performed and the average number of clips picked up is determined.

The student's values are given in the Table 1 below.

number of turns 40				
current / A	number *N* of paper clips trial 1	trial 2	trial 3	average number of paper clips
0.5	1	0	0	0.3
1.0	6	9	6	7.0
1.5	12	15	13	13.3
2.0	24	26	23	24.3
2.5	36	37	34	35.7
3.0	37	53	41	43.7

Table 1

(a) Explain why you think that it was a good experimental procedure to take an average of the values obtained for *N* in the three trials.

.....

.....

.....[1]

(b) (i) Complete Table 2 below.

change in current through the coil	change in average number of paper clips picked up
from 0 to 1.0 A	7.0
from 1.0 A to 2.0 A	
from 2.0 A to 3.0 A	

Table 2

[2]

(ii) With reference to Table 2 explain how you know that the strength of the electromagnet is not directly proportional to the magnitude of the current through the coil.

.....

.....

.....

.....[2]

(c) Table 1 shows that for a current of 3.0 A the first two values for *N* are 37 and 53. The number 53 is 43% larger than 37. Suggest one reason why there is such a large difference between the number of clips.

.....

.....

.....[1]

For Examiner's Use

4 The thermometer in Fig. 4.1 is a full-size diagram of a centigrade thermometer.

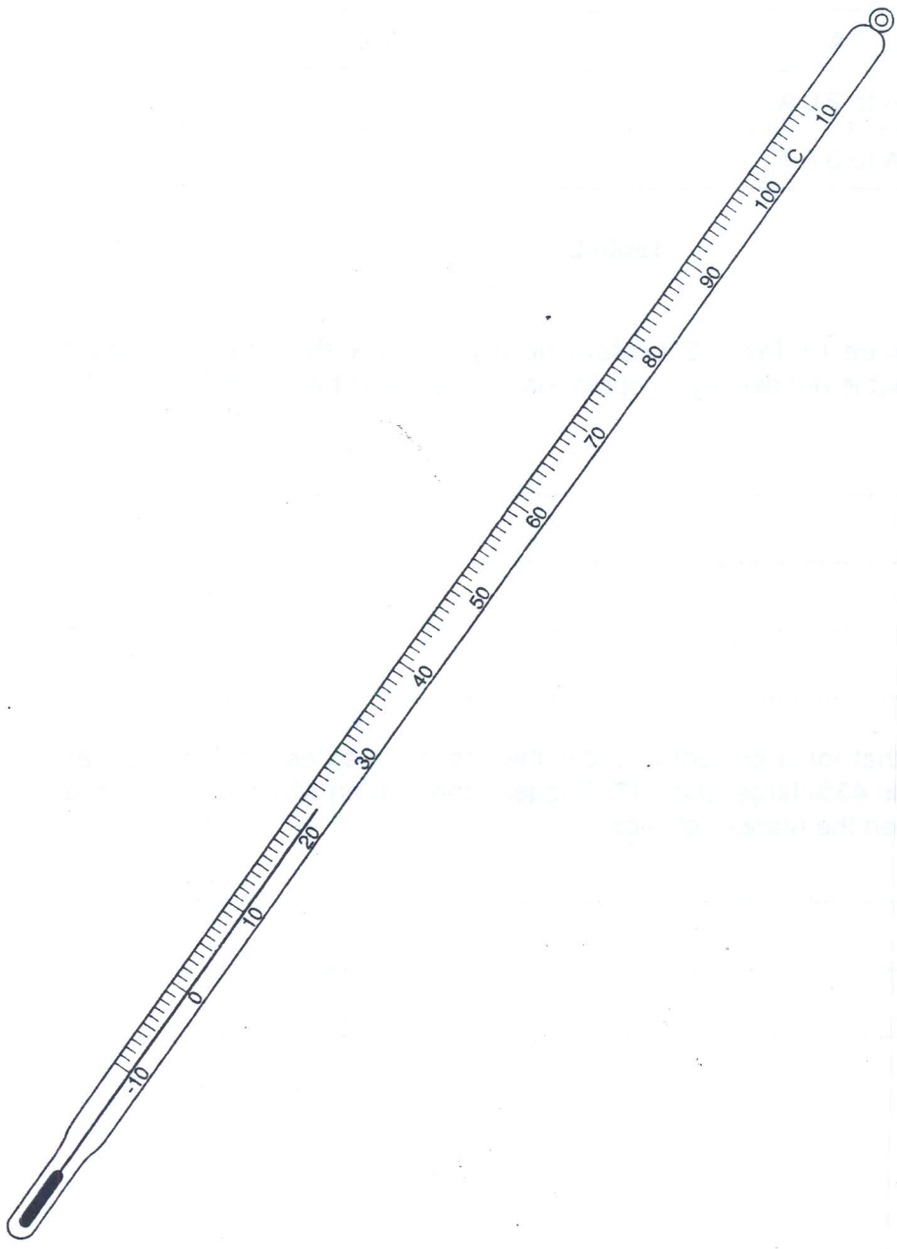


Fig. 4.1

(a) What range of temperatures may be measured using this thermometer?

temperature range = ...[1]

(b) On Fig. 4.1 mark the lower fixed point with the letter L and the upper fixed point with the letter U. [1]

(c) You dissolve 15 g of common salt in 200 cm^3 of water. The salt becomes what is known as a dissolved impurity. The solution is used to discover the effect of the dissolved impurity on the boiling point of water.

Further amounts of salt are added and the boiling point determined for each mass. The graph of Fig. 4.2 represents the results of the experiment.

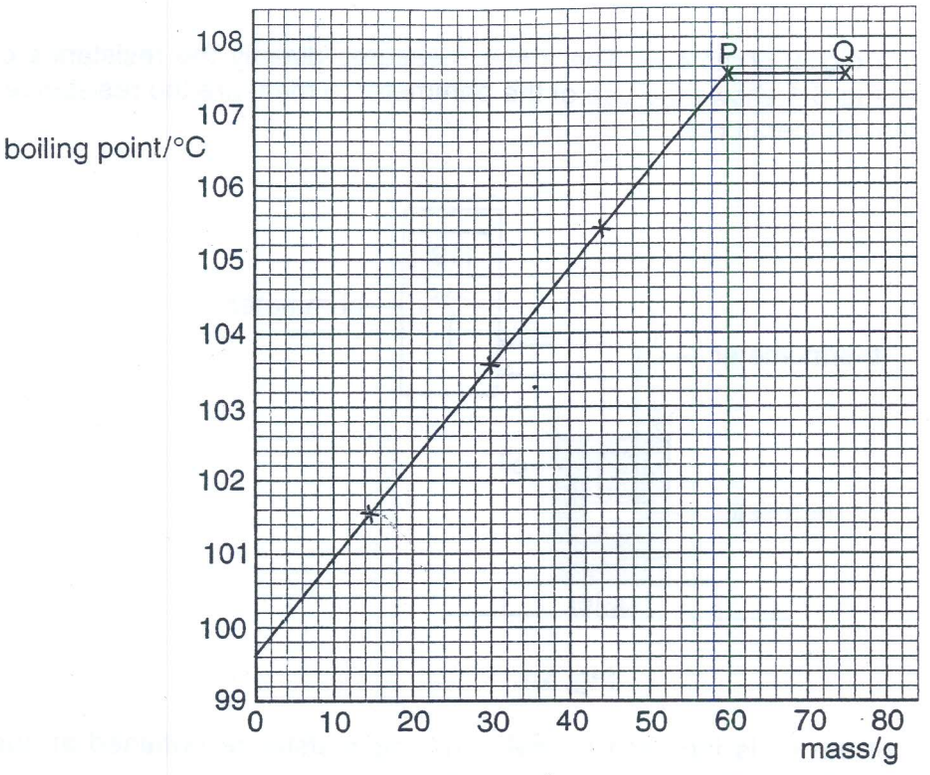


Fig. 4.2

At the beginning of the experiment the salt dissolves very quickly. It takes longer as more salt is added. At the point marked Q on the graph, not all the salt is dissolved.

Describe how the boiling point is changed by the presence of salt as a dissolved impurity. In your description, suggest what has happened at the points P and Q.

.....

.....

.....

.....

.....[3]

(d) When determining the upper fixed point of the thermometer it is held in steam. Suggest a reason for this.

.....

.....[1]

For Examiner's Use

5 A student is using a digital ohmmeter. The meter measures directly the resistance of an electric component. Fig. 5.1 shows the use of the ohmmeter to measure the resistance of a thermistor at different temperatures.

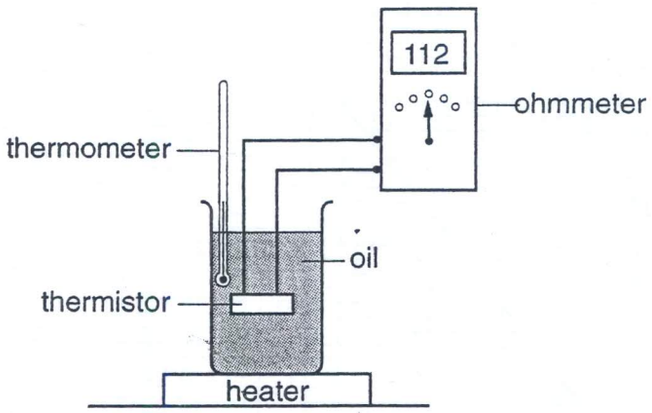


Fig. 5.1

The temperature of the oil is increased slowly and the resistance obtained at suitable temperatures. The readings are given in the table below.

temperature/°C	22	29	40	52	63	72	82	92	102
resistance/Ω	350	290	205	150	110	84	70	55	40

(a) On page 11 plot the graph of resistance/Ω (*y*-axis) against temperature/ °C (*x*-axis). (Please note the instruction about using the graph paper. This is given on the graph paper.)

Draw the best smooth curve for the points. [4]

(b) **(i)** The thermometer measures the temperature of the oil. How would you perform the experiment to ensure that the thermistor is at the same temperature as the oil?

.....

.....

(ii) How could you make a parallax error when taking the readings?

.....

.....[2]