Name: _____ ( ) Class: _____

WHITLEY SECONDARY SCHOOL

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PRELIMINARY EXAMINATION 2019

SUBJECT : **PHYSICS Paper 1 (6091/01)**

LEVEL : **Sec 4 Express**

DATE : **2 Sep 2019 (Mon)**

DURATION : **1 hr**

TOTAL MARKS: **40**

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, index number and class in the spaces on the Multiple Choice Answer Sheet and at the top of this cover page.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

There are **forty** questions in this section. 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 provided.

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.
The use of an approved scientific calculator is expected, where appropriate.

Take the value of the acceleration due to free fall on earth to be 10 m/s^2.

Answer **all** questions.

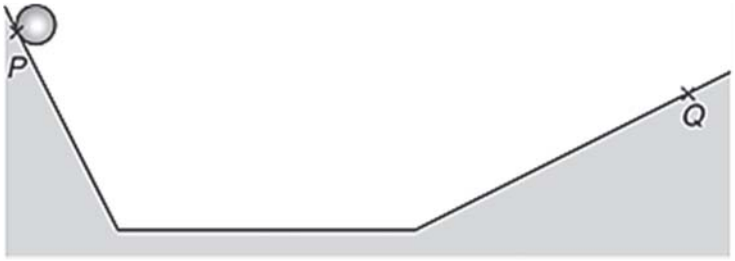
1 Three groups of quantities are shown below.

I mass, force, weight
II weight, work done, acceleration
III weight, force, displacement

Which group of quantities consists of only vectors?

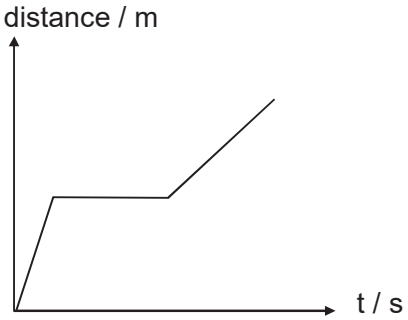
A I only **B** I and II only **C** III only **D** All of them

2 A sphere runs along a smooth rail from P to Q as shown.

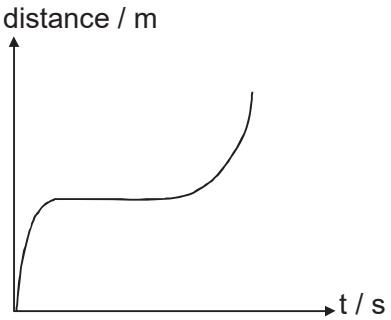


Which of the following graphs best represents the variation of the distance *d* travelled by the sphere with time *t*?

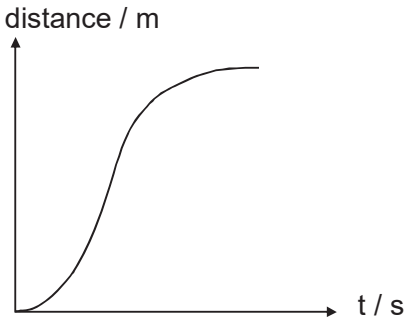
A



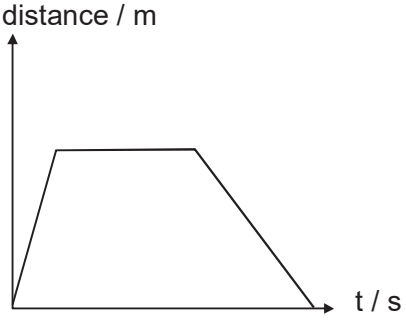
B



C



D



3 A car, which was travelling due east at a speed of 3.6 m/s initially, changes direction and travels due west at a speed of 6.2 m/s.

Taking the direction to the east as positive, determine the change in speed and velocity.

	change in speed (m/s)	change in velocity (m/s)
A	2.6	– 2.6
B	9.8	2.6
C	2.6	9.8
D	2.6	– 9.8

4 A wooden block that is pushed along a horizontal flat surface moves at constant speed.

Which statement is correct?

A The frictional force is greater than the pushing force.
B The frictional force is equal and opposite to the pushing force.
C The frictional force is less than the pushing force.
D The frictional force increases as the block moves at constant speed.

5 A magician pulled a tablecloth swiftly off a table top. An empty glass which was set on the tablecloth remained on the table top when the table cloth was removed.

Which of the following modifications would make this performance easier?

A use a rough table cloth
B use a glass of a lighter mass
C wet the table cloth
D fill the empty glass with water

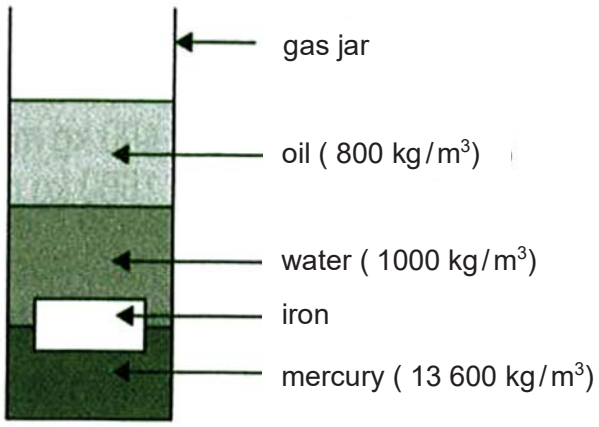
6 Suppose some aliens landed on several planets.

alien	mass / kg	weight / N
P	40	80
Q	20	200
R	10	200
S	20	400

From the information given, which two aliens are likely to have landed on the same planet?

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

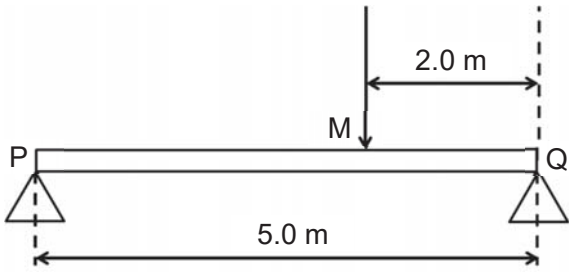
7 The following density experiment was set up.



Which of the following is a possible density for iron?

A 600 kg / m^3 **B** 1000 kg / m^3 **C** 8000 kg / m^3 **D** 14 000 kg / m^3

8 The diagram below shows a uniform 5.0 m beam. The beam is supported at P and Q. A man of weight 800 N stands at M such that QM = 2.0 m. Assume that the mass of beam is negligible.

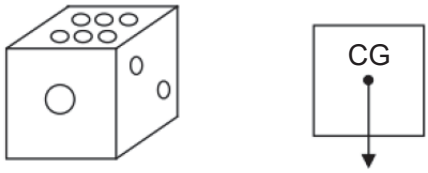


What are the reaction forces at P and Q due to the weight of the man?

	reaction force at P	reaction force at Q
A	300 N	500 N
B	320 N	480 N
C	400 N	400 N
D	480 N	320 N

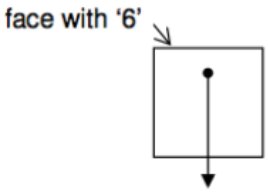
9 A die is unbiased when its centre of gravity (CG) is at its geometrical centre whereas a biased die has its centre of gravity nearer to one of its six faces.

The diagram below shows an unbiased dice.

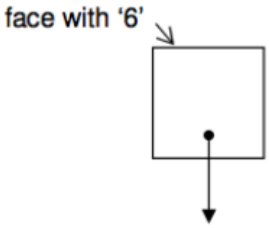


Which one of the following **biased** dice has a higher chance of getting a '6' on top after it is rolled?

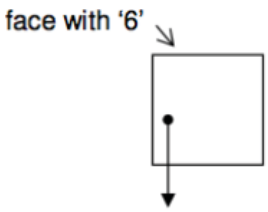
A



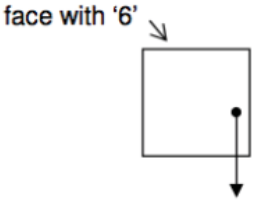
B



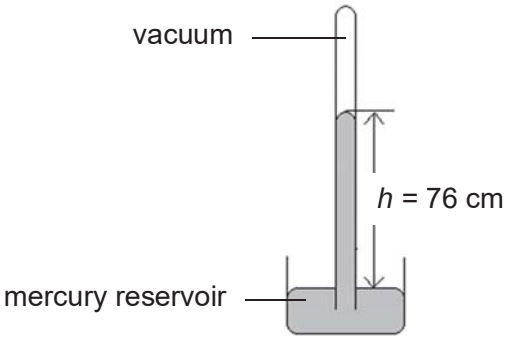
C



D



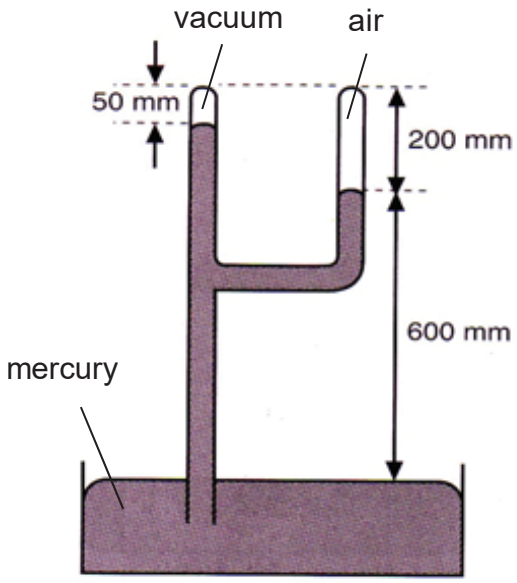
10 The diagram shows a simple mercury barometer. The height of mercury, *h*, was recorded as 76 cm.



Which of the changes will result in a smaller *h* being observed?

A conduct the experiment under a shelter
B conduct the experiment below sea level
C tilt the mercury barometer
D replace the mercury with a liquid of a greater density

11 The diagram shows a forked tube containing mercury, air in one branch and a vacuum in the other.



What is the pressure exerted by the air?

A 50 mm Hg **B** 150 mm Hg **C** 600 mm Hg **D** 750 mm Hg

12 A ball of mass 0.50 kg is released from rest at a height of 3.0 m above the ground.

Assuming that air resistance is negligible, what is the kinetic energy of the ball when it is 2.0 m above the ground? Take the acceleration due to gravity to be 10 m/s^2.

A 5.0 J **B** 10.0 J **C** 15.0 J **D** 25.0 J

13 When a liquid evaporates, its temperature is lowered.

Which of the following is the most appropriate explanation for this observation?

A The liquid lost transferred heat to the surroundings.
B The average internal kinetic energy of the molecules in the liquid decreased.
C The total internal energy of the liquid decreased.
D The total internal kinetic energy of the molecules in the liquid decreased.

14 A match would ignite if held 10 cm above a Bunsen flame but not if held 10 cm away to one side of the flame.

This is because the match above the Bunsen flame gains more thermal energy through

A convection.
B conduction.
C radiation.
D diffusion.

15 The diagrams show the scale of a voltmeter connected to a thermocouple thermometer.

ice point | steam point | unknown temperature

What is the temperature of the liquid?

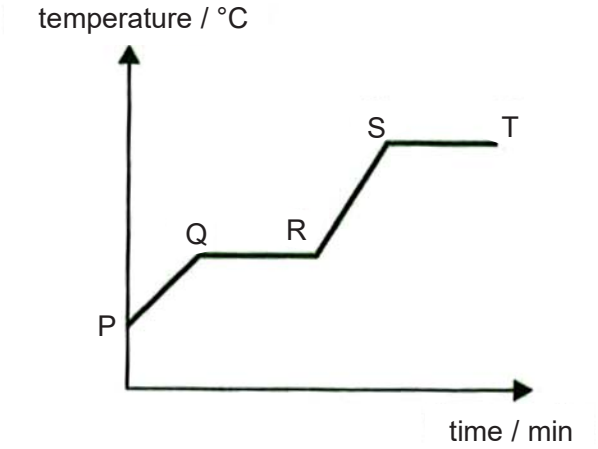
A 12.5 °C **B** 100 °C **C** 125 °C **D** 150 °C

16 18 000 J of energy is required to increase the temperature of 2 kg of liquid by 4 °C.

What is the heat capacity of the liquid?

A 2250 J/K **B** 4500 J/K **C** 9000 J/K **D** 12 000 J/K

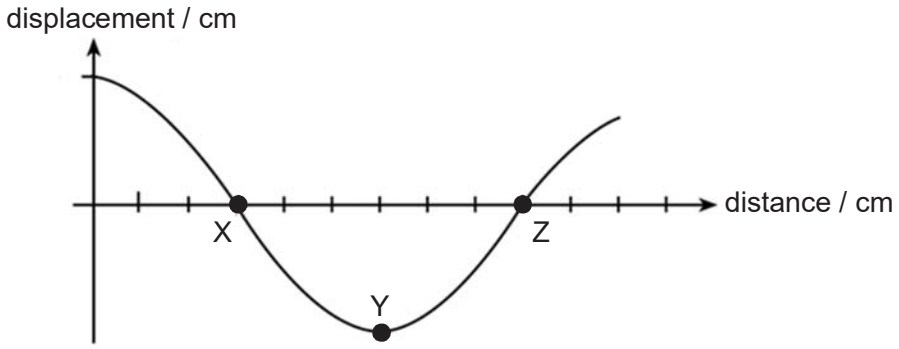
17 A solid substance is placed in a boiling tube and heated steadily. The temperature-time graph of the substance is shown below.



At which portion(s) do the substance gain internal potential energy?

A PQ and QR only
B PQ and RS only
C RS and ST only
D QR and ST only

18 The graph shows the displacement-distance graph of a sound wave. The sound wave is travelling to the right. Three of the particles X, Y and Z in the sound wave are marked below.



Which particle(s) in the graph above is/ are centre(s) of compression?

(Assume that a displacement to the right is positive displacement and a displacement to the left is negative displacement.)

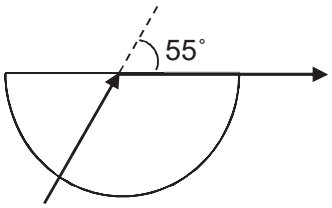
A particle X
B particle Y
C particle Z
D particles X and Z

19 In a ripple tank experiment, a dipper is connected to a motor to generate water waves.

If the motor rotates with higher speed, what is the effect on frequency, wavelength and speed of the water waves generated?

	frequency	wavelength	speed
A	decreases	increases	decreases
B	decreases	increases	no change
C	increases	decreases	increases
D	increases	decreases	no change

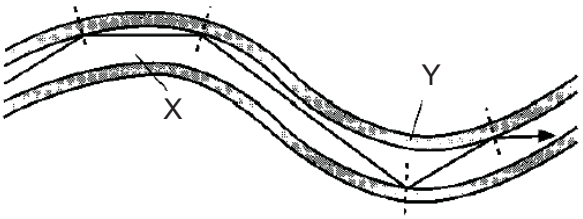
20 A ray of light is incident normally at the curved surface of a semicircular transparent block. It is found that the light deviates by 55˚ from its original path and emerges as shown below.



What is the refractive index of the material of the block?

A 1.00 **B** 1.22 **C** 1.74 **D** 2.00

21 The diagram shows how light travels through the optical fiber of an endoscope used to look into stomach of ulcer patients. X represents the inner material of the optical fiber while Y represents the outer material.



Which of the following statements is false?

A No light is lost through the optical fiber.

B The refractive index of X is greater than the refractive index of Y.

C The refractive index of Y is greater than the refractive index of X.

D The light in the optical fiber obeys the Laws of reflection.

22 The table shows the properties of some waves.

Which of the following correctly describes the properties of the waves?

	waves	types of waves	speed of wave in vacuum
A	gamma rays	longitudinal	3.0×10^8 m/s
B	X-rays	transverse	3.0×10^8 m/s
C	radio waves	transverse	340 m/s
D	sound waves	longitudinal	340 m/s

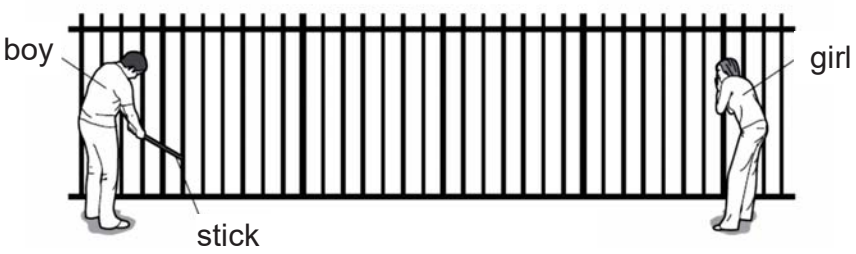
23 The statements below describes the property of a kind of electromagnetic wave.

I It causes chemical reactions and causes many substances to glow or fluoresce.
II It causes human skin to have sunburn due to prolonged exposure to the Sun.
III It has a wavelength shorter than that of visible light.

Which electromagnetic wave is best described by the statements?

A ultraviolet ray
B infra-red radiation
C microwave
D gamma rays

24 A boy strikes a rigid metal fence with a stick to create a sound along the fence. A girl listens with her ear against the fence. One second after the fence is struck, the girl hears a sound through the air.

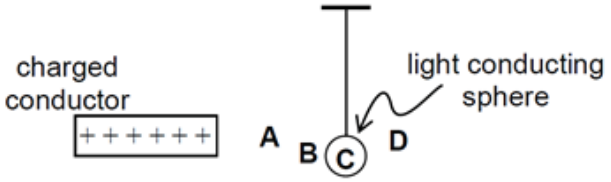


How long will it take for the sound to reach the girl through the fence?

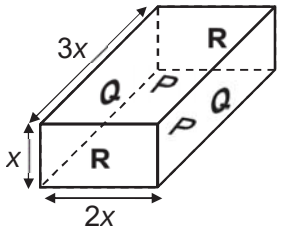
A 0.0 s
B less than 1.0 sec
C 1.0 s
D more than 1.0 sec

25 The figure below shows a light and neutral conducting sphere suspended vertically by an insulated thread near a charged conductor. The sphere moves towards and touches the charged conductor.

In which position will the light conducting sphere come to rest?



26 The diagram shows a rectangular block with dimensions x, $2x$ and $3x$.



P, Q and R mark the opposite faces on the block across which a potential difference is applied.

Across which two faces would there be **maximum** electrical resistance?

A the faces labelled **P**

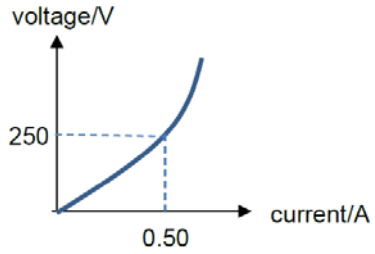
B the faces labelled **Q**

C the faces labelled **R**

D the resistance is the same, whichever pair of faces is used

27 A handphone battery requires 900 C of charge before it is 100% charged.

The following diagram shows the characteristic voltage-current graph of the charging circuit. It initially displays ohmic behaviour at low voltages but its gradient increases as the circuit heats up.

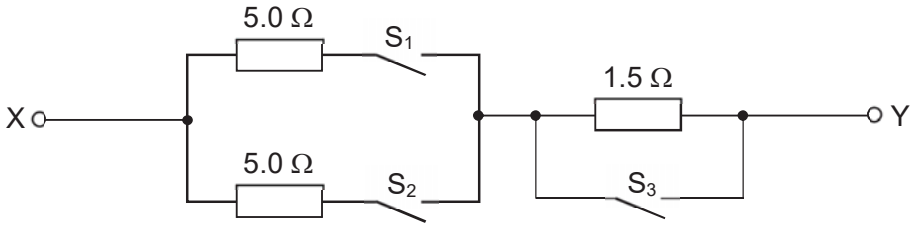


The phone is plugged into a 255 V supply.

Which of the following shows the time required to charge the phone to 100%?

A 1800 s
B 1.8 hours
C slightly more than 1800 s
D slightly less than 1800 s

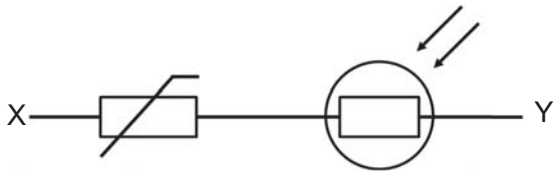
28 The diagram shows a circuit in which all the switches are open.



Which switch positions give a resistance of 4.0 Ω between X and Y?

	S_1	S_2	S_3
A	closed	closed	closed
B	closed	closed	open
C	closed	open	closed
D	closed	open	open

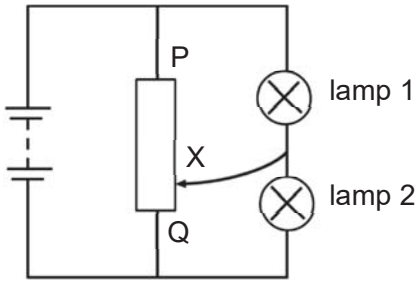
29 The diagram shows a thermistor and a light-dependent resistor connected in series.



Which of these conditions will result in the maximum resistance between X and Y?

	temperature	lighting
A	warm	bright
B	warm	dim
C	cool	bright
D	cool	dim

30 The diagram below shows a potential divider circuit.



What happen to the brightness of the lamps as the contact X moves from Q to P?

	lamp 1	lamp 2
A	dimmer	brighter
B	brighter	brighter
C	brighter	remains the same
D	brighter	dimmer

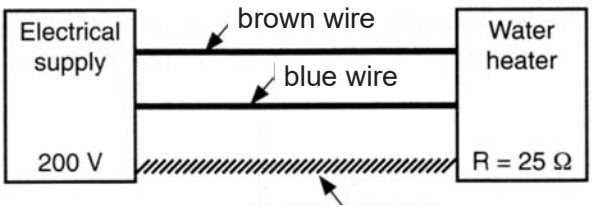
31 The cost of a unit of electricity is $0.10.

appliance	power rating	time used (hours)
lamp	100 W	5
heater	1.5 kW	3
cooker	3 kW	0.5

What is the total cost when all these appliances are used for the durations shown above?

A $0.065 **B** $0.65 **C** $2.65 **D** $50.60

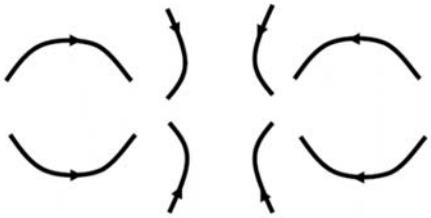
32 The diagram shows the three wires of an electrical supply connected to a water heater.



What is the amount of current that flows through each of the wires when the water heater is switched on?

	brown wire	blue wire	yellow and green striped wire
A	8 A	8 A	8 A
B	8 A	0 A	0 A
C	8 A	0 A	8 A
D	8 A	8 A	0 A

33 The diagram shows a magnetic field lines pattern.



Which pair of bar magnets will produce the magnetic field as shown above?

A

B

C

D

34 Which one of these statements best describes magnetic induction?

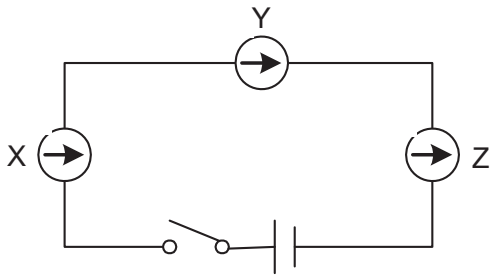
A Magnetic induction is the reason why unmagnetised material may be attracted by a magnet.

B Induced magnetism is always permanent.

C Magnetic induction is the same as electromagnetic induction.

D The material to be induced must be in physical contact with the magnet.

35 Three identical compasses are placed over a wire loop as shown in the diagram below.

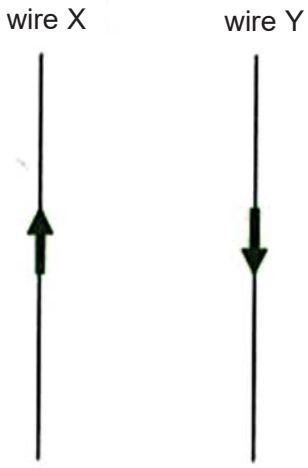


The switch is now closed.

Which row shows the correct orientation of each compass after some time?

	compass X	compass Y	compass Z
A	no change	down	left
B	no change	up	right
C	left	down	left
D	left	up	right

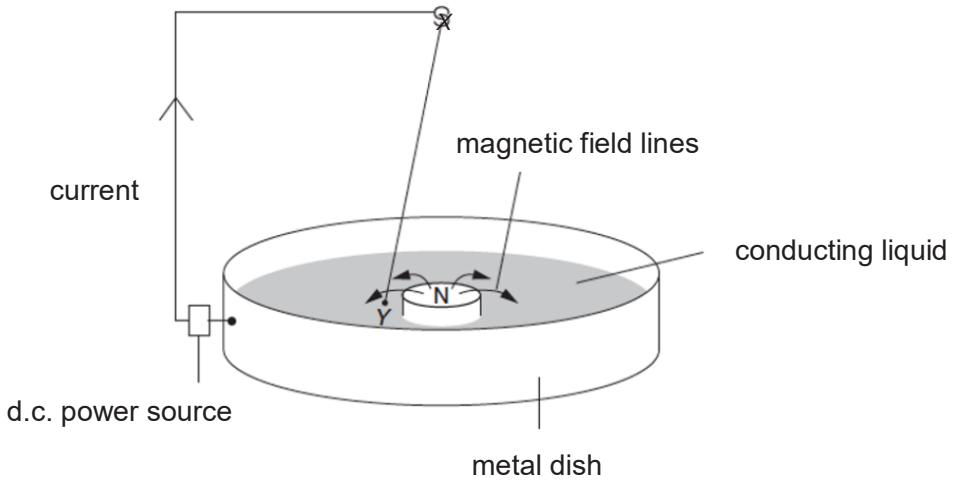
36 Two current-carrying wires X and Y are arranged in parallel as shown below.



What is the direction of the electromagnetic force on each wire?

	wire X	wire Y
A	to the left	to the left
B	to the left	to the right
C	to the right	to the left
D	to the right	to the right

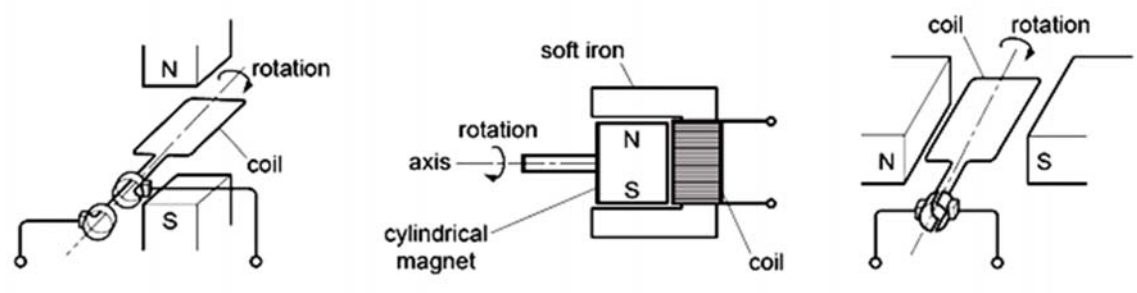
37 One end of a wire **Y** is immersed in a conducting liquid while the other end **X** is connected to a battery and is free to rotate. The direction of the current in the circuit is indicated. A cylindrical magnet is placed in the centre of the conducting liquid with the North Pole facing upwards.



When viewed from the top, which direction will the wire **XY** move?

A clockwise
B anti-clockwise
C towards the magnet
D away from the magnet

38 The following diagram shows three electrical generators.

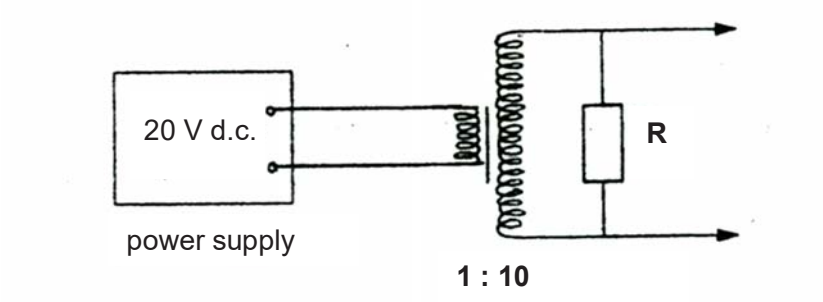


X Y Z

Which generator(s) provide an alternating voltage?

A X only **B** Y only **C** X and Y only **D** X and Z only

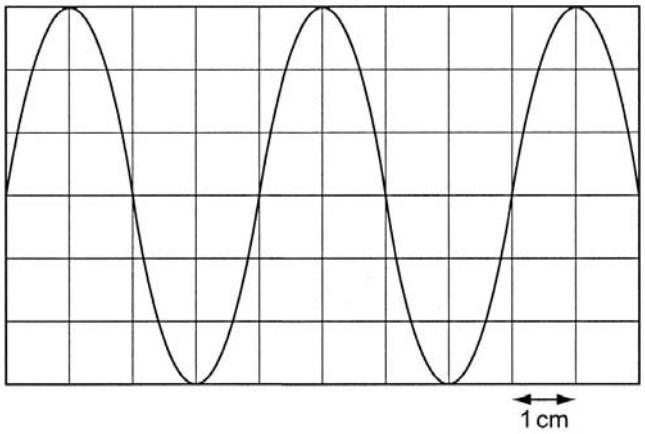
39 The circuit below shows a resistor R connected to a 20 V d.c. power supply through a transformer of turns ratio 1 : 10.



What is the voltage across **R** after some time?

A zero **B** 20 V a.c **C** 200 V d.c **D** 200 V a.c

40 An alternating supply with a period of 0.040 s is connected to a cathode-ray oscilloscope (c.r.o).



What is the time-base setting of the c.r.o?

A 0.4 ms / cm **B** 1 ms / cm **C** 4 ms / cm **D** 10 ms / cm

— End of paper —

Name: _____ ( ) Class: _____

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*Discipline * Integrity * Respect * Responsibility*

PRELIMINARY EXAMINATION 2019

SUBJECT : **PHYSICS Paper 2 (6091/02)**

LEVEL : **Sec 4 Express**

DATE : **29 Aug 2019 (Thur)**

DURATION : **1 hr 45 mins**

TOTAL MARKS: **80**

INSTRUCTION TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, class and index number in the spaces at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A [50 marks]
Answer **all** questions. Write your answers in the spaces provided on the question paper.

Section B [30 marks]
Answer **all** questions. Question 10 has a choice of parts to answer.
Write your answers in the spaces on the question paper.

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.

At the end of the examination, fasten separate writing papers (if any) securely to the Question Paper.
The number of marks is given in brackets [ ] at the end of each question or part question.

Take acceleration due to gravity, g as 10 m/s^2.

For Examiner's Use	
Section A	**/ 50**
Section B	**/ 30**
Total	**/ 80**

Section A [50 marks]

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

1 A ball is given a push to start it rolling freely up a slope. The velocity-time graph in Fig. 1.1 shows the change in the velocity of the ball with time.

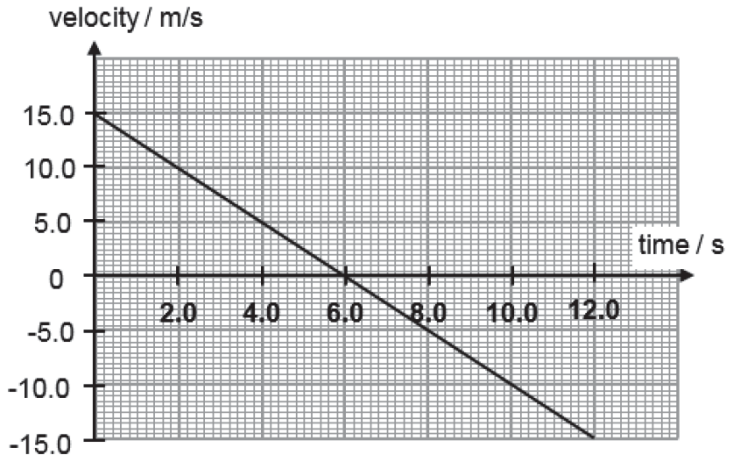


Fig. 1.1

(a) State the time when the ball reaches the highest point on the slope.

time = …….. [1]

(b) Determine the acceleration of the ball at the highest point on the slope.

acceleration = …….. [2]

(c) Determine the average speed of the ball between 2.0 and 12.0 s.

average speed = …….. [2]

(d) On Fig. 1.2, sketch the displacement-time graph of the ball between 0.0 s to 12.0 s. [2]

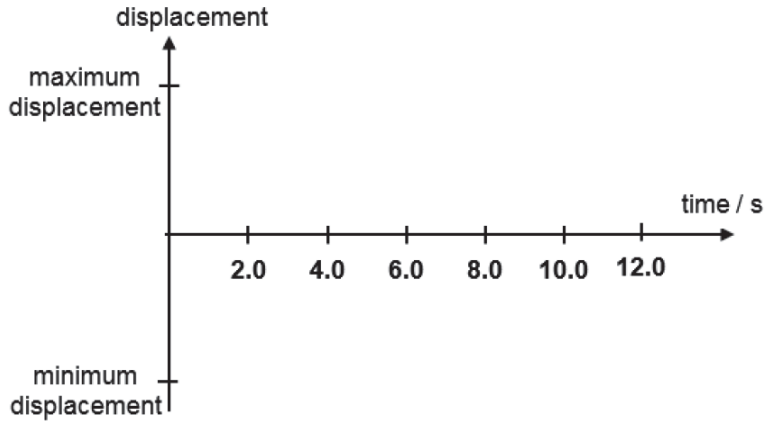


Fig. 1.2

2 A manhole cover is a plate to cover the opening of a manhole or a hole on the ground leading to a sewer. A manhole cover is typically round in shape as shown in Fig. 2.1.

Fig. 2.1

Fig. 2.2 shows the side view of a manhole cover hinged at **X** and with a handle at **Y**.

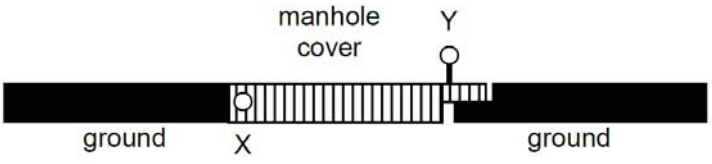


Fig. 2.2

(a) On Fig. 2.2, draw and identify all the forces acting on the manhole cover. [2]

(b) The manhole cover has a weight of 45.0 N and the centre of gravity is 30.0 cm from the hinge at **X**. The handle is 55.0 cm from **X**.

(i) Explain the term the *moment* of a force about a point.

……

…… [1]

(ii) A pulling force is applied at **Y** to lift the manhole cover.

Explain why it is easier to lift the manhole cover if the pulling force at **Y** is normal to the manhole cover.

……

……

…… [2]

(iii) Calculate the minimum pulling force applied at **Y** to lift manhole cover.

minimum pulling force = …….. [2]

3 Fig. 3.1 shows a set of traffic lights supported by two cables, **A** and **B**, which hang from a pole. The set of traffic lights is in equilibrium.

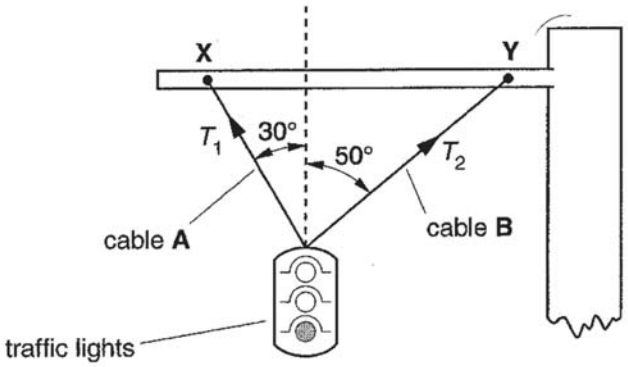


Fig. 3.1

The weight of the set of traffic lights is 350 N. The weight of the cables and pole is negligible. The tensions in the cables **A** and **B** are T_1 and T_2 respectively.

In the space below, draw a labelled vector diagram to show the resultant of the two tensions. State the scale used and determine the magnitudes of T_1 and T_2. [2]

scale = ... [1]

T_1 = ... [1]

T_2 = ... [1]

4 Fig. 4.1 shows the plan of a bedroom and part of the main room of a house and their respective temperatures. Other rooms are not shown.

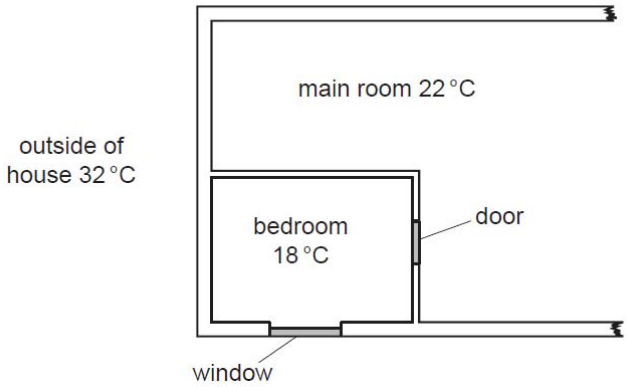


Fig. 4.1

Fig. 4.2 shows all the thermal energy inputs to the bedroom in one hour.

thermal energy input to bedroom	**energy / J**
through the door and walls from main room	4.5×10^4
through the walls from outside of house	2.3×10^6
through the window	1.1×10^6
from the person sleeping in bedroom	2.0×10^5

Fig. 4.2

(a) Explain why more thermal energy enters the bedroom from the outside of the house than from the main room.

……

…… [1]

(b) An air conditioner keeps the temperature constant in the bedroom by removing thermal energy.

(i) Identify a suitable location of the air conditioner in the bedroom for maximum efficiency.

…… [1]

(ii) Explain how the location in **(b)(i)** cools the bedroom efficiently.

……

……

……

……

…… [3]

(iii) A person sleeping in the bedroom.

Calculate the power of the air conditioner required to keep the temperature in the bedroom constant.

power = …….. [2]

(iv) State an assumption made in the calculation for **(b)(iii)**.

…….

……. [1]

5 An experiment is conducted to determine the specific latent heat of fusion of ice.

Fig. 5.1 shows two set-ups in the same room. The immersion heater in setup 1 is connected to a 12 V power supply and the current is 10.0 A. The heater in setup 2, which serves as a control in the experiment, is not connected to any power supply.

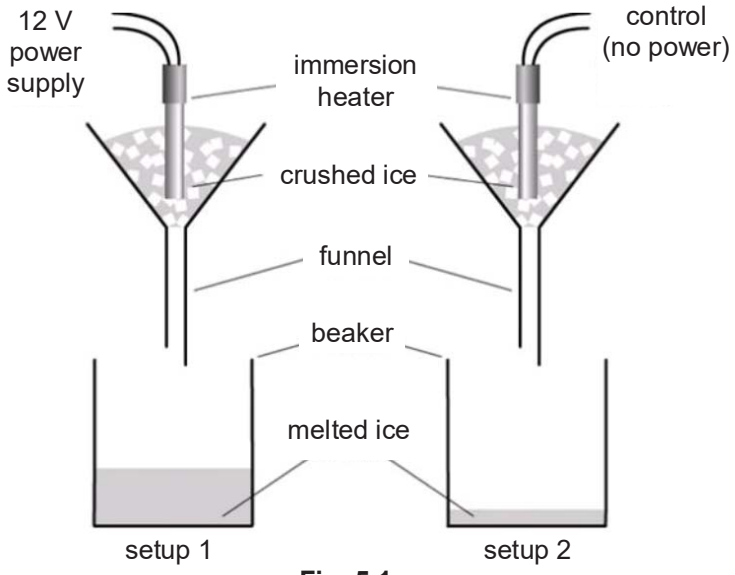


Fig. 5.1

The immersion heater in setup 1 is switched on until water flows at a steady rate from the funnel, for a duration of 5.0 minutes.

Fig. 5.2 shows the data collected from the experiment after 5.0 minutes.

	setup 1	setup 2
mass of empty beaker / g	60	60
mass of beaker with melted ice / g	192	85
mass of melted ice / g		

Fig. 5.2

(a) Define *specific latent heat of fusion*.

……

…… [1]

(b) Fill in the blanks for Fig. 5.2. [1]

(c) Setup 2 is known as a control set.

Explain the purpose of having a control set in this experiment.

……

…… [1]

(d) Calculate the heat energy provided by the immersion heater for 5.0 minutes.

heat energy = ……..…….….. [2]

(e) Calculate the value of the specific latent heat of fusion of ice.

specific latent heat of fusion = ……..…….. [3]

(f) The actual value of specific latent head of fusion of ice is smaller than that calculated in **(e)**.

Suggest and explain why.

……..……..……...…...…….…….……..

……..……..……...…...…….…….. [1]

6 A plastic rod is initially electrically neutral. It is rubbed with a cloth and becomes positively charged. After charging, the rod is held close to a suspended table-tennis ball shown in Fig. 6.1. The table-tennis ball is covered with metal paint and is initially uncharged.

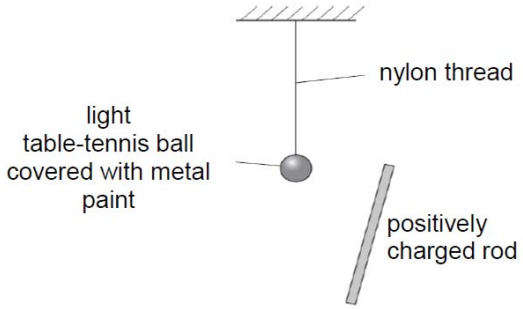


Fig. 6.1

(a) Describe what happens to the charges on the electrically neutral plastic rod when it is rubbed with a cloth.

……

…… [1]

(b) Describe what happens to the charges on the metal-painted table-tennis ball as the positively-charged rod is brought close to the ball.

……

…… [1]

(c) The ball swings towards the positively charged rod.

Explain why this happens.

……

……

…… [2]

(d) When it is a few centimetres away from the rod, the ball is briefly touched by a wire connected to earth.

In terms of the movement of charges, describe what happens to the charge on the ball.

……

……

…… [2]

7 A 600 Ω resistor and a thermistor are connected in series with an ammeter and a power supply of 20 V d.c. (direct current). A voltmeter is in parallel with the resistor.

Fig. 7.1 shows the circuit diagram.

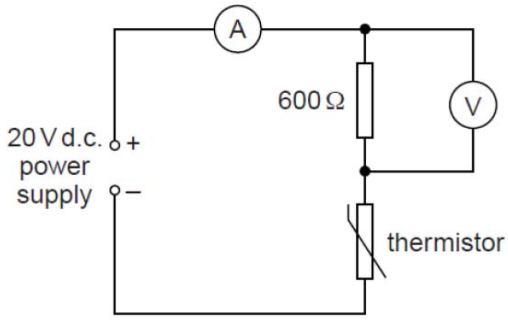


Fig. 7.1

The ammeter reads 0.025 A.

(a) Calculate the reading on the voltmeter.

voltmeter reading = …………………………… [2]

(b) Calculate the resistance of the thermistor.

resistance = …………………………… [2]

(c) Temperature of the thermistor increases.

(i) State and explain what happens to the ammeter reading.

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………………… [2]

(ii) State and explain any change to the voltmeter reading.

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………………… [2]

Section B [30 marks]

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

Question 10 has a choice of parts to answer.

8 Fig. 8.1 shows a cylindrical tank with two taps at **P** and **Q**. The tank, which contains oil, is resting on a horizontal surface. An empty horizontal tube is attached to tap **P** and an empty U-tube is attached to the tap **Q**. The other ends of the tubes are open. Both taps are initially turned off. Taps **P** and **Q** may be replaced with steel, copper or aluminium taps.

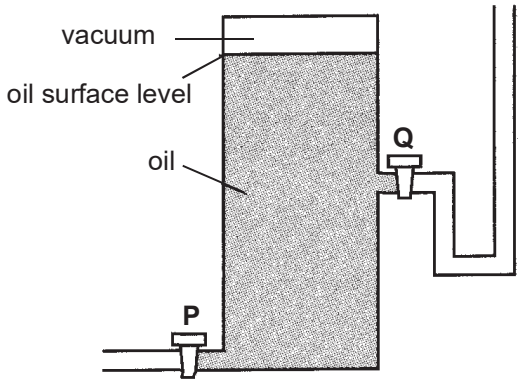


Fig. 8.1

Fig. 8.2 consists of information related to the operation of the taps.

atmospheric pressure	1×10^5 Pa
density of oil	800 kg/m^3
gravitational field strength	10 N/kg
height difference between tap **P** and tap **Q**	20 m
height difference between oil surface level and tap **Q**	15 m
base area of tank	18 m^2
cross-sectional area of horizontal tube	0.05 m^2
cross-sectional area of U-tube	0.03 m^2
cross-sectional area of steel tap replacement	0.02 m^2
cross-sectional area of copper tap replacement	0.03 m^2
cross-sectional area of aluminium tap replacement	0.04 m^2

Fig. 8.2

(a) Calculate the oil pressure acting on tap **Q**.

oil pressure = ……..…….. [2]

(b) Tap **Q** is a copper tap.

Calculate the **net** force acting on tap **Q** when it is **turned on**.

net force = …….. [3]

(c) When only tap **P** is turned on, the oil starts to flow into the horizontal tube.

Suggest why the rate of flow of oil into the horizontal tube is **not** constant as the level of oil falls in the tank.

……..……..……..……..……..……..

……..……..……..……..……..……..

……..……..……..……..……..……..

……..……..……..……..……..……..

……..……..……..……..……..…….. [3]

(d) State whether steel tap, copper tap or aluminium tap should be installed at **P** for greater rate of flow of oil. Explain your answer.

……..……..……..……..……..……..

……..……..……..……..……..……..

……..……..……..……..……..…….. [2]

9 Fig. 9.1 shows a ray of light incident on an interface of air and corn oil at an angle, *i* equals to 35°. The ray is transmitted through parallel layers of corn oil and glycerol and is then reflected at the surface of a plane mirror, located below and parallel to the glycerol layer. The ray then emerges from the corn oil back into the air. The refractive index of corn oil is 1.48.

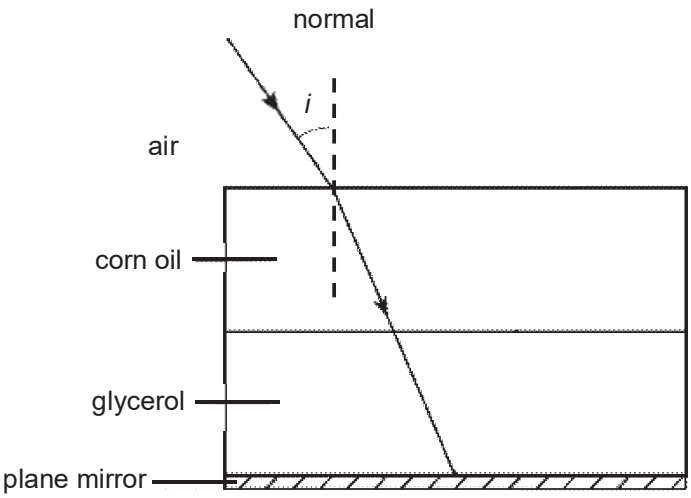


Fig. 9.1

(a) Calculate the angle of refraction of the light ray when it travels from air to corn oil.

angle of refraction = ……..…….. [2]

(b) Explain why the light ray did **not** bend at the corn oil and glycerol interface.

……..……..……..……..……..……..……..……..……..……..

……..……..……..……..……..……..……..……..……..……..

……..……..……..……..……..……..……..……..……..…….. [2]

(c) Calculate the critical angle of light in the corn oil.

critical angle = ……..…….. [2]

(d) Explain why the reflected ray from the mirror will **not** undergo total internal reflection at the corn oil and air interface, regardless of the values of *i*.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………….. [2]

(e) Complete the ray diagram in Fig. 9.1 to show the path of the refracted light ray until it returns to air. [2]

EITHER

10 Fig. 10.1 shows a d.c. motor that is designed to rotate anti-clockwise. A rheostat is used in the circuit to adjust the motor speed.

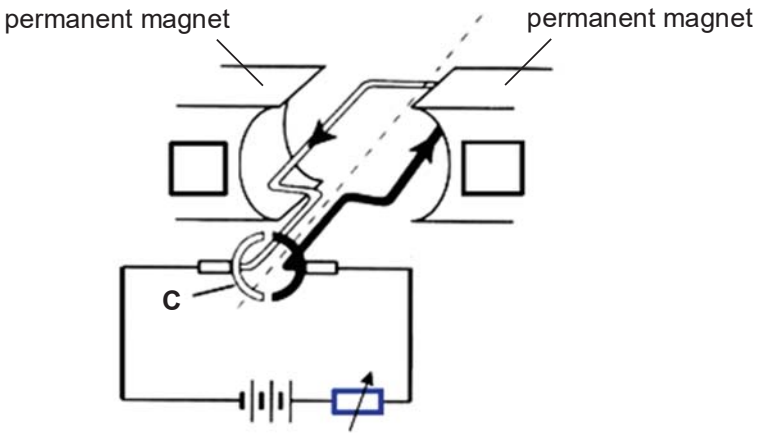


Fig. 10.1

(a) Label the polarities of the permanent magnet in the 2 boxes provided in Fig. 10.1. [1]

(b) Name the component **C** and states its function.

……

……

…… [2]

(c) Explain how the current causes the coil to rotate.

……

……

……

……

…… [3]

(d) Fig. 10.2 shows the rheostat that is connected to the d.c. motor.
The sliding contact is shifted to the right towards terminal **B**.

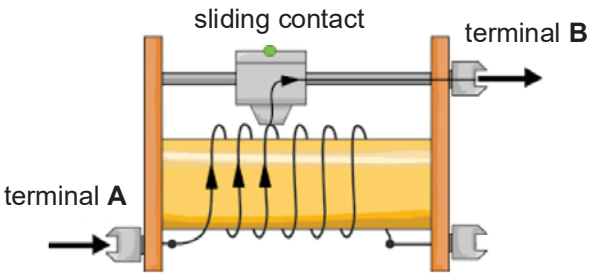


Fig. 10.2

State the effect of shifting the sliding contact to the right on the speed of the d.c. motor.
Explain your answer.

……

……

……

……

……

……

…… [4]

OR

10 Fig. 10.3 shows the compact cassette which is widely used to record and playback audio from the 1960s to the 1990s.

Fig. 10.3

When the cassette is inserted into the audio recorder, the recording head is positioned at the cassette opening.

During recording, as shown in Fig. 10.4, an audio signal is sent to the recording head in the form of an electric current which changes direction.

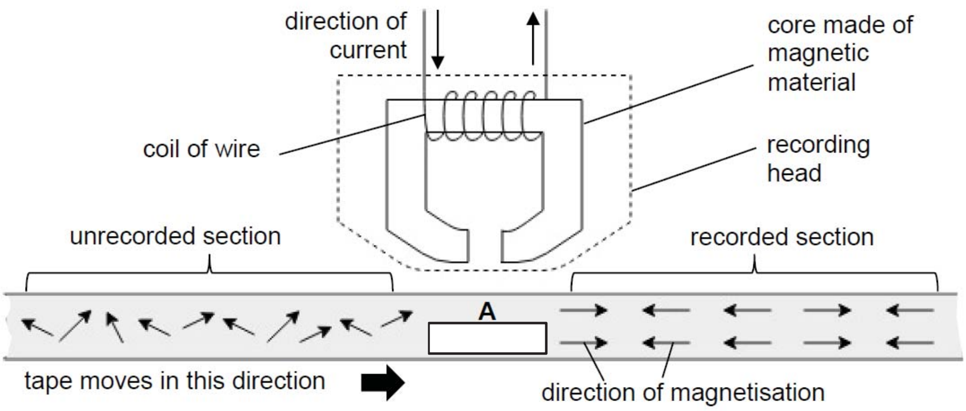


Fig. 10.4

The arrows on the tape represents the direction of magnetisation where the arrow head represents North Pole and the arrow tail represent South Pole.

(a) From the direction of current shown in Fig. 10.4, deduce the direction in which the tape at **A** will be magnetised.

Draw an arrow in the box given in Fig. 10.4 to represent this direction at **A**. [1]

(b) (i) State a difference between magnetic materials that form temporary magnets and permanent magnets.

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………………… [2]

(ii) Deduce the type of magnetic material used in the tape.

…………………………………………………………………………………………… [1]

(c) When playing back the tape, the same recording head is used to read the tape. As shown in Fig. 10.5, when the tape moves over the recording head, an *electrical signal* is produced in the coil of wire.

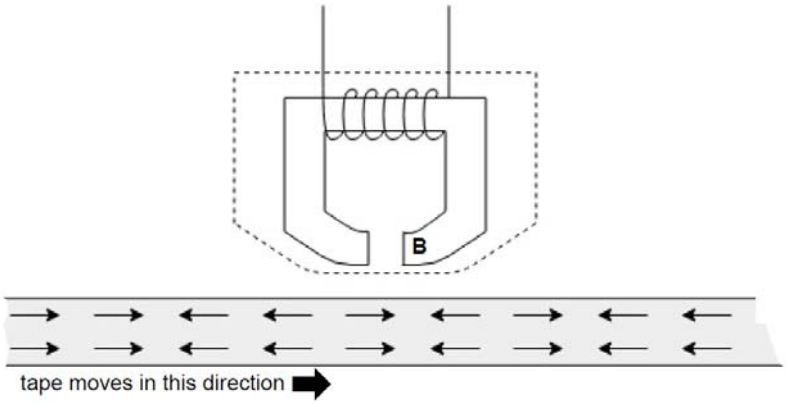


Fig. 10.5

An audio signal is then transmitted from the coil of wires to the speakers in the form of a current. This audio signal matches the audio signal initially used for recording.

Explain why there is an *electrical signal* being produced.

……

……

……

…… [2]

(d) The cassette player also comes with an erase function which activates the recording head to erase the recorded audio on the tape.

Suggest and explain how the recording head achieves this function.

……

……

……

…… [2]

(e) If a cassette is not properly stored, the recorded audio on the tape will gradually be lost over time.

State two reasons why this happens.

1 ……

……

2 ……

…… [2]

– End of Paper –

Whitley Secondary School
Marking Scheme

Assessment: 2019 Prelim
Level and Paper: 4E Pure Phy

Paper 1

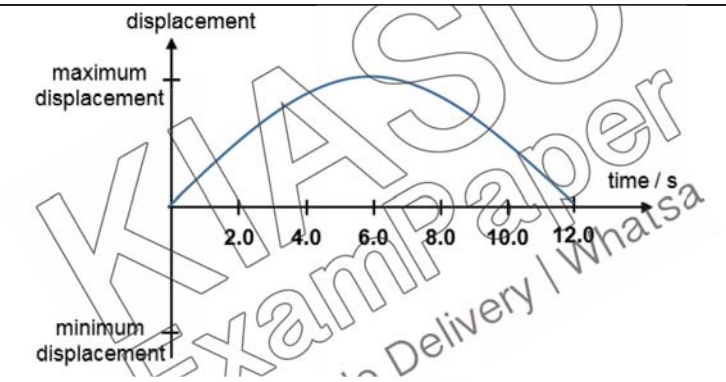
1	C	**11**	B	**21**	C	**31**	B
2	C	**12**	A	**22**	B	**32**	D
3	D	**13**	B	**23**	A	**33**	C
4	B	**14**	A	**24**	B	**34**	A
5	D	**15**	D	**25**	D	**35**	A
6	D	**16**	B	**26**	C	**36**	B
7	C	**17**	D	**27**	D	**37**	A
8	B	**18**	A	**28**	B	**38**	C
9	B	**19**	D	**29**	D	**39**	A
10	D	**20**	C	**30**	A	**40**	D

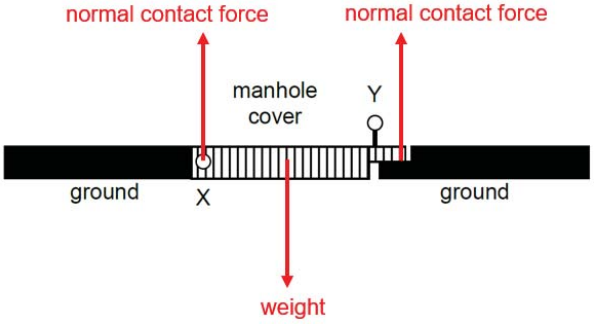
Paper 2

Deduct 1 mark for the following errors:
- Wrong / missing units
- Numerical ans not expressed in 3 s.f
- Answers expressed in fractions

Maximum of 2 marks deduction in a paper (due to any error above).

Section A

Q No.		Answers	Marks
1	(a)	6.0 s	1
	(b)	$acc = \frac{0-15.0}{6.0-0}$ $= -2.5\ m/s^2$	1 1
	(c)	Total distance travelled $= \frac{1}{2}(10)(4.0) + \frac{1}{2}(15)(6.0)$ $= 65\ m$ Average speed $= \frac{65}{10.0}$ $= 6.5\ m/s$	1 1
	(d)	 • Correct shape with max displacement at t = 6.0 s • Decreasing gradient from t = 0.0 s to t = 6.0 s and increasing gradient from t = 6.0 s to t = 12.0 s	1 1

Q No.			Answers	Marks
2	(a)			

			3 correct forces – **B2** 1 or 2 correct forces **– B1** 0 correct force **– B0**	1+1
	(b)	**(i)**	The product of the force and its perpendicular distance from the pivot to the line of action of the force	1
		(ii)	The perpendicular distance from the pivot to the line of action of the force is the longest when the pulling force at **Y** is normal to the manhole cover Force required to apply to the manhole cover will hence be the smallest, in order to produce the same anti-clockwise moment as the clockwise moment due to the weight of the manhole cover	1 1
		(iii)	CW moment = ACW moment $30.0 \times 45.0 = 55.0 \times F$ $F = 24.54545$ $\approx 24.5\ N$ upward	1 1

Q No.		**Answers**	**Marks**
3		Correctly drawn parallelogram method - Solid lines with arrows and labels for forces - Dotted lines for construction - Double-headed arrow for resultant force - Length of arrows drawn for according to stated scale - Correct measurement of angle between the forces	1+1
		Suitable scale - 1 cm : 50 N or 1 cm : 25 N – **B1**	1
		T_1 = 275 N (260 N ~ 290 N)	1
		T_2 = 175 N (160 N ~ 190 N)	1

Q No.			**Answers**	**Marks**
4	**(a)**		There is greater temperature difference of 14 °C between outside the house and the bedroom than that between the main room and the bedroom which is a temperature difference of 4 °C / The greater the temperature difference, the faster the rate of transfer of thermal energy	1
	(b)	**(i)**	It needs to be placed at the top of the bedroom	1
		(ii)	As the air around the air conditioner cools, it contracts and becomes denser and sinks to the bottom of the room The warmer air, being less dense, rises to the top of the room to be cooled by the air conditioner A convection current is created from top to bottom of room which helps to cool the room efficiently	1 1 1
		(iii)	total thermal energy $= 4.5 \times 10^4 + 2.3 \times 10^6 + 1.1 \times 10^6 + 2.0 \times 10^5$ $= 3\ 645\ 000\ J$ $P = \frac{E}{t}$ $= \frac{3\ 645\ 000}{60 \times 60}$ $= 1012.5$ $\approx 1010\ W$	1 1

		(iv)	Any reasonable assumption: • There is no thermal energy entering or leaving the room other than what is stated. • The window and door is kept closed throughout. • The temperature outside the bedroom remains as stated.	1

Q No.		**Answers**	**Marks**
5	**(a)**	The amount of thermal energy required to change unit mass (1 kg) of the substance from solid state to liquid state, without a change in temperature	1
	(b)	<table><tr><td></td><td>Setup 1</td><td>Setup 2</td></tr><tr><td>mass of empty beaker / g</td><td>60</td><td>60</td></tr><tr><td>mass of beaker with melted ice / g</td><td>192</td><td>85</td></tr><tr><td>mass of melted ice / g</td><td>192 – 60 = 132</td><td>85 – 60 = 25</td></tr></table>	1
	(c)	Heat energy supplied by the surroundings to melt the ice can be determined / temperature changes in the environment affect both setups in the same way	1
	(d)	$E = IVt$ $= (10)(12)(5 \times 60s)$ $= 36\,000\ J$	1 1
	(e)	Mass of melted ice due to power supply $= 132 - 25$ $= 107\ g$ $E = ml$ $36\,000 = (107)(l)$ $l = 336.44859$ $\approx 336\ J/g$ $336\ J/g = 336\,000\ J/kg$	1 1 1
	(f)	The mass of melted ice due to the power supply should be higher than 107 g. There was additional transfer of thermal energy from setup 1 to setup 2, causing more ice to melt in setup 2 / Mass of melted ice in setup 1 should be more	1

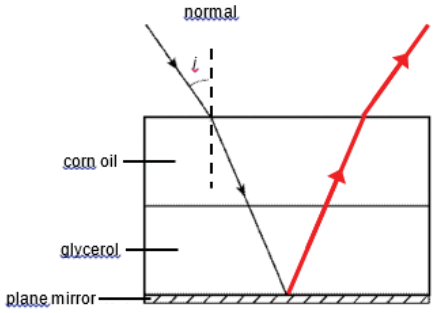
Q No.		**Answers**	**Marks**
6	**(a)**	The electrons from the plastic rod are transferred to the cloth. Hence there are now more electrons than protons, the rod therefore becomes positively charged	1
	(b)	The negative charges (electrons) move towards the rod, leaving positive charges on the left	1
	(c)	The negative charges in the ball are attracted to the positively charged rod The forces of attraction between the unlike charges are stronger than the forces of repulsion between like charges, hence the ball swings towards the charged rod due to the net force to the right	1 1
	(d)	Negative charges (electrons) flow up from earth to the ball through the wire to neutralise the induced positive charges The ball becomes negatively charged	1 1

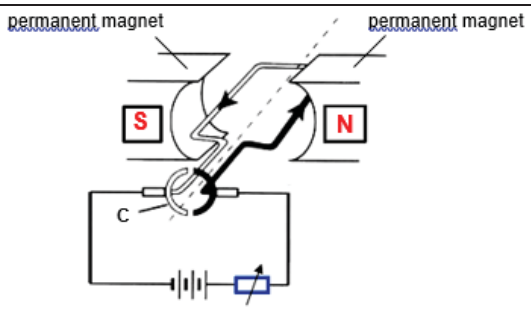
Q No.			Answers	Marks
7	(a)		$V = IR$ $= (0.025)(600)$ $= 15\,V$	 1 1
	(b)		$V = IR$ $20 - 15 = (0.025)(R)$ $R = 200\,\Omega$	 1 1
	(c)	(i)	Ammeter reading <u>increases</u> Resistance of thermistor <u>decreases</u> when its temperature increases which <u>decreases the overall effective resistance</u> of the circuit, hence current increases	1 1
		(ii)	voltmeter reading <u>increases</u> Resistance of thermistor <u>decreases</u> when its temperature increases hence its potential difference <u>decreases</u> and the potential difference of fixed resistor increases	1 1

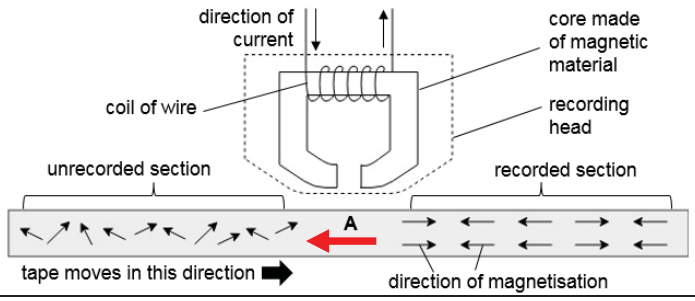
Section B

Q No.		Answers	Marks
8	(a)	$P = h\rho g$ $= (15)(800)(10)$ $= 120\,000\ Pa$	 1 1
	(b)	Atmospheric pressure = 100 000 Pa Net pressure acted at tap Q $= 120\,000 - 100\,000$ $= 20\,000\ Pa$ $P = \frac{F}{A}$ $20\,000 = \frac{F}{0.03}$ $F = 600\ N$	 1 1 1
	(c)	Pressure due to the oil depends on the height of the oil column above the tap P As level of oil falls in the tank decreases, the pressure due to the oil decreases The difference in pressure between oil and the atmosphere at P decreases Hence rate of flow of oil decreases	1 1 1
	(d)	Aluminium tap The larger the cross-sectional area of the tap, the larger is the force applied (due to $P = \frac{F}{A}$)	1 1

Q No.		Answers	Marks
9	(a)	$n = \frac{\sin i}{\sin r}$ $1.48 = \frac{\sin 35}{\sin r}$ $r = 22.80224$ $\approx 22.8^o$	 1 1
	(b)	Corn oil and glycerol have the same refractive index There is no change in the speed of light ray as it travels from corn oil to glycerol	1 1
	(c)	$\sin c = \frac{1}{n}$ $c = \sin^{-1}\frac{1}{1.48}$ $= 42.50664$ $\approx 42.5^o$	 1 1
	(d)	Angle of incidence will not be greater than critical angle / angle of incidence will be smaller than critical angle The maximum angle of incidence at corn oil-air interface is equal to the maximum angle of refraction at air-corn oil interface which has a maximum value of 42.5°	1 1

	(e)	 • correct reflected ray at mirror (*i* = *r* with no bending at glycerol-corn oil interface) • correct refracted ray (*r* for ray leaving corn oil is 35°)	 1 1

Q No.		Answers	Marks
10E	**(a)**		1
	(b)	Split ring commutator Function: Changes the direction of the current flow in the coil every half a revolution so that coil can rotate continuously	1 1
	(c)	Current in coil produces a magnetic field This field interacts with the permanent magnetic field to produce a force at the side of coil The forces at two sides are acting in opposite directions hence produces a moment about the axle to rotate coil	1 1 1
	(d)	As the slider shifts to the right, current has to flow through longer section of the resistance wire resistance increases and current decreases The force on the sides of coil due to the current and magnetic field decrease Hence speed of rotation decreases	1 1 1 1

Q No.			Answers	Marks
10O	**(a)**			1
	(b)	**(i)**	Soft magnetic materials form temporary magnets while hard magnetic materials form permanent magnets Soft magnetic materials are easily magnetised and demagnetised while hard magnetic materials are hard to be magnetised and demagnetised	1 1

		(ii)	Hard magnetic material	1
	(c)		As the magnetised tape approaches the recording head, there is a change in magnetic flux linking through the magnetic core to the coil of wire By Faraday's Law, an emf is induced in the coil of wire which is proportional to the rate of change of the magnetic flux (magnetic field lines linking the coil) Hence an electrical signal in the form of an induced current is produced	1 1
	(d)		The cassette player sends a strong alternating current to the coil of wire This produces a strong alternating magnetic field which causes the magnetisation on the tape to be disrupted as the tape passes the recording head **OR** The cassette player sends a strong direct current to the coil of wire This produces a strong magnetic field which causes the magnetisation on the tape to be reset to a single direction as the tape passes the recording head	1 1 **OR** 1 1
	(e)		• The cassette is exposed to heat causing the tape inside to be demagnetised • The cassette has been dropped / subjected to physical impact causing the tape inside to be demagnetised • Over time, Earth's magnetic field causes the direction of magnetisation to change • Different parts of the tape with different direction of magnetisation will affect one another, causing the directions to be altered *Any two*	1+1

– End of Paper –