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NAME	CLASS	INDEX No.
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ST. PATRICK'S SCHOOL
PRELIMINARY EXAMINATIONS 2015

SUBJECT : PHYSICS 5059 (PAPER 1) DATE : 31 AUG 2015
LEVEL : SECONDARY 4 EXPRESS DURATION: 1 HOUR

INSTRUCTIONS TO CANDIDATES

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. Write your name, class and index number on the Question Paper and the Optical Answer Sheet in the spaces provided. It is also required that you WRITE and SHADE your index number on the Optical Answer Sheet.
2. Answer ALL questions on the Optical Answer Sheet provided.
3. Throughout the paper, the acceleration due to gravity on Earth is taken as 10 N/kg unless stated otherwise.
4. Calculators may be used where necessary. Where numerical answers are not exact, give answers to THREE (3) significant figures.
5. Submit the Optical Answer Sheet and the Question Paper SEPARATELY at the end of the examination.

This question paper consists of 16 printed pages.

Each question is provided with **four** possible answers (A, B, C and D). Select the most appropriate answer and **shade** your choice on the **Optical Answer Sheet** provided.

1 Which one of the following is **correct**?

- A The length of a bus is about 1×10^2 m.
- B The diameter of an atom is about 1×10^{-5} m.
- C The diameter of the Earth is about 1×10^7 m.
- D The thickness of a human's hair is about 1×10^{-3} m.

2 **Figure I** shows the reading of the zero error of the micrometer screw gauge. **Figure II** shows the reading of the same instrument when it is used to measure the width of an object.

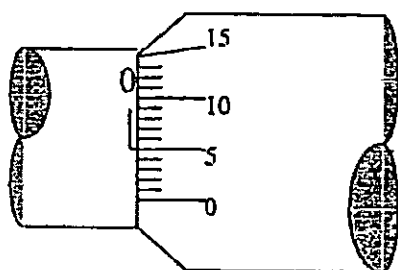


Figure I

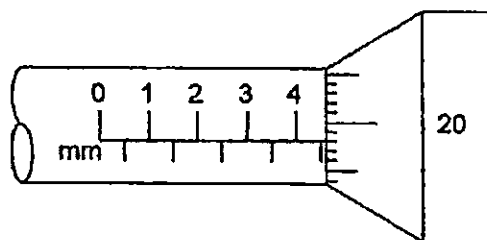


Figure II

What is the **actual** width of the object?

- | | |
|-----------|-----------|
| A 4.63 mm | B 4.73 mm |
| C 4.83 mm | D 4.85 mm |

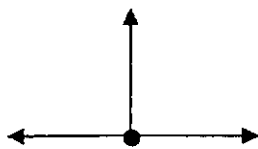
3 A pendulum clock is found to be too slow.

Which one of the following would set the clock right?

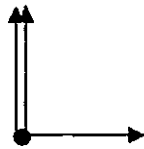
- A Increase the angle of displacement
- B Increase the length of the pendulum
- C Decrease the angle of displacement
- D Decrease the length of the pendulum

- 4 Three forces of the same magnitude F act simultaneously on a small object.

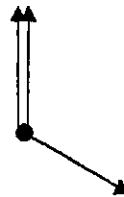
Which one of the following combination of forces will give the greatest resultant force?



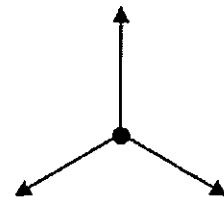
A



B



C



D

- 5 A car, initially travelling at 20 m/s, took 5 seconds to slow down to 5 m/s.

What was the average deceleration of the car?

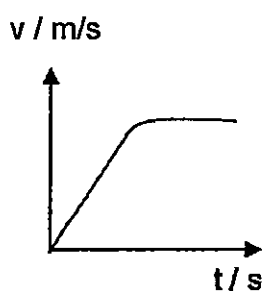
A -5 m/s^2
C 3 m/s^2

B -3 m/s^2
D 5 m/s^2

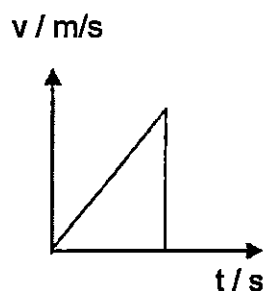
- 6 The diagram shows a trolley that starts rolling down a sloping runway connected to a flat floor. All the surfaces are smooth.



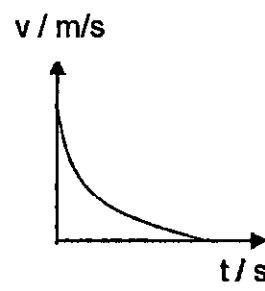
Which one of the following velocity-time graphs best illustrates the motion of the trolley?



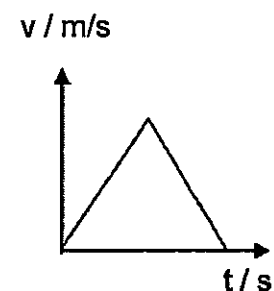
A



B

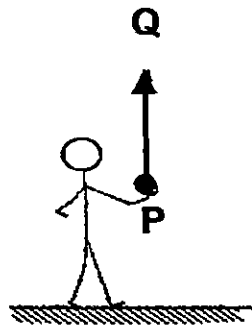


C



D

- 7 A ball is thrown vertically upwards from a point P. It reaches the greatest height at Q and then falls back to P where it is caught.



Neglecting air resistance, which of the following statement(s) is/are correct?

- I Acceleration at Q is zero.
 II The total displacement of the ball is zero.
 III The ball experiences a steady decreasing upward force when it rises from P to Q.

- A** I only
B II only
C II and III only
D I, II and III

- 8 A motorist travelling at 10 m/s can bring his car to rest in a distance of 10 m. If he had been travelling at 30 m/s, in what distance could he bring the car to rest using the same braking force?

- A** 17 m **B** 30 m
C 52 m **D** 90 m

- 9** A car travelling at 30 m/s has to brake suddenly to avoid an accident. If the man inside weighs 80 kg and it takes 3 seconds to stop completely, what is the average force the safety belt exerts on the man?

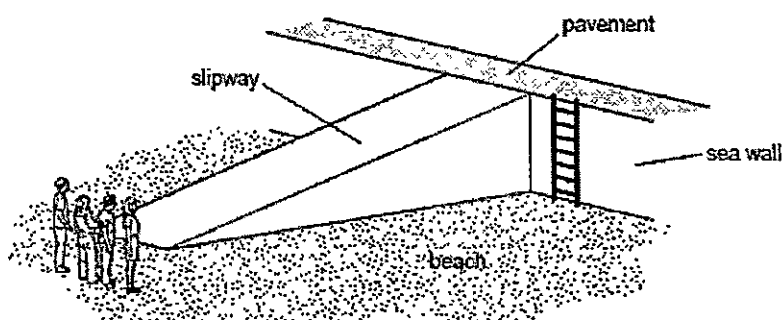
- | | | | |
|----------|--------------|----------|--------------|
| A | 240 N | B | 400 N |
| C | 500 N | D | 800 N |

- 13 A ball is released from a height h above a table. The air resistance is assumed to be negligible and 50% of its kinetic energy is lost at each bounce. What is the speed of the ball right before it touches the ground for the third bounce?

A $\frac{gh}{\sqrt{4}}$
 C $\sqrt{\frac{gh}{4}}$

B $\frac{gh}{\sqrt{2}}$
 D $\sqrt{\frac{gh}{2}}$

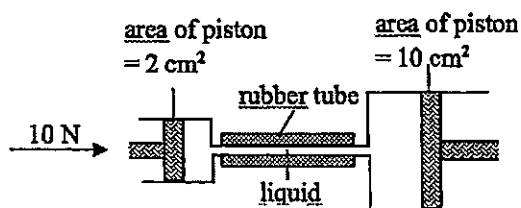
- 14 Four people of equal weight are standing on a beach. Each of them uses a different route to get to the top of a sea wall.



Which person produces the **greatest** average power?

	<u>Route</u>	<u>Time taken /s</u>
A	Runs up the slipway	5
B	Runs across the beach and climbs up the ladder	8
C	Walks up the slipway	10
D	Walks across the beach and climbs up the ladder	16

- 15 The diagram shows two syringes connected by a rubber tube. The space between the two pistons is filled with a liquid. The areas of the small piston and the large piston are 2 cm^2 and 10 cm^2 respectively. A force of 10 N is applied to the small piston. What is the ratio of the pressure acting on the small piston to the pressure acting on the large piston?

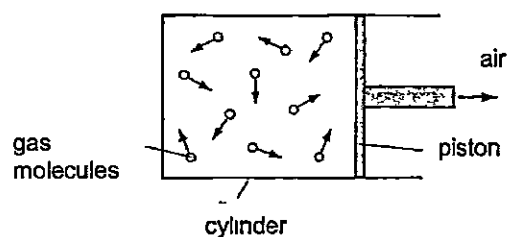


A 1 : 1
 C 1 : 5

B 1 : 2
 D 5 : 1

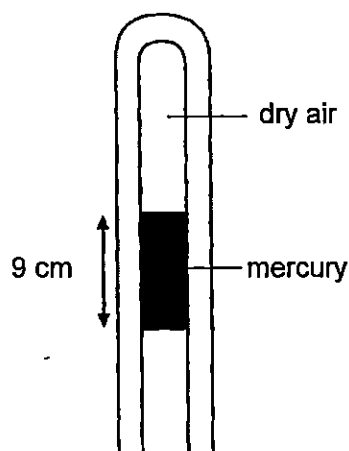
- 16 Gas inside a cylinder is heated slowly to a higher temperature. The pressure inside the cylinder remains constant as the piston moves outwards.

How does the speed of the gas molecules and their rate of collision with the piston compare with their initial values at the lower temperature?



	<u>Speed of molecules</u>	<u>Rate of collision</u>
A	Greater	Greater
B	Greater	Reduced
C	Greater	Same
D	Same	Greater

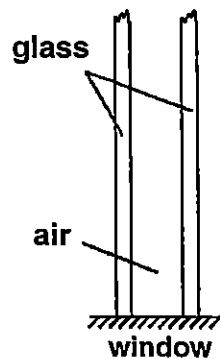
- 17 The diagram shows a column of air enclosed in a narrow capillary tube by a thread of mercury 9 cm in length. The atmospheric pressure is 76 cm Hg.



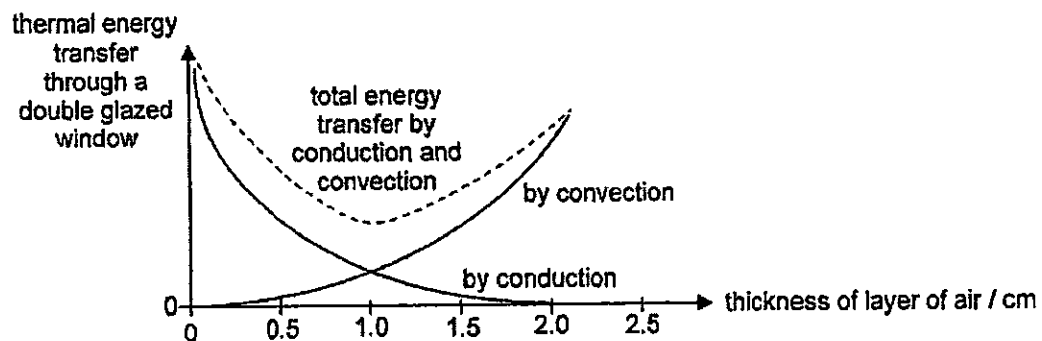
What is the pressure on the trapped air?

- | | | | |
|---|----------|---|----------|
| A | 9 cm Hg | B | 67 cm Hg |
| C | 76 cm Hg | D | 85 cm Hg |
- 18 When an object is being heated, which of the following statements is/are true?
- I The object's temperature will increase continuously.
 - II The total internal energy of the object will increase.
 - III The kinetic and potential energy of the particles of the object cannot rise at the same time.
- | | | | |
|---|-----------------|---|---------------|
| A | I only | B | I and II only |
| C | II and III only | D | I, II and III |

- 19 A double-glazed window has two sheets of glass separated by a layer of air.



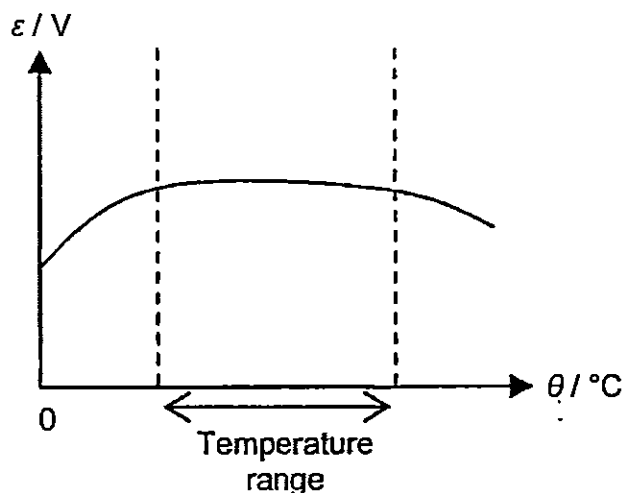
Thermal energy is transferred through the layer of air by conduction and convection. The amount of conduction and convection depends on the thickness layer of air as shown in the graph.



A specially designed room is to be installed with these double-glazed windows. The temperature of this room is kept constant with fluctuations in temperature to be kept to a minimal. What thickness layer of air of the installed double-glazed windows will best maintain the temperature of the room and why?

- A 0.5 cm because there is little convection.
 - B 1.0 cm because the total thermal energy transfer is minimal.
 - C 1.5 cm because the total thermal energy transfer is small and conduction is low.
 - D 2.0 cm because there is little conduction.
- 20 Which one of the following observations shows that conduction is a faster mode of heat transfer than convection and radiation?
- A The people sitting around a camp fire feel the heat.
 - B Food in microwave oven seldom takes more than 3 minutes to cook.
 - C The barbeque sausage usually has a burnt pattern alike the barbeque mesh when left unattended for some time.
 - D Heating the base of a test tube of water with some ice floating at the top of the tube usually takes some time for the ice to melt.

- 21 The diagram shows a graph of how the e.m.f., ε / V , of a thermocouple varies with temperature, $\theta / ^\circ\text{C}$.



Why is the thermocouple inappropriate for measurement of temperature in the range as shown?

- A The thermocouple produces an e.m.f. at 0°C .
- B The relationship between ε and θ is non-linear.
- C The thermocouple does not always indicate a unique value of e.m.f..
- D The e.m.f. has not been measured using temperatures using the kelvin scale.

- 22 Four bars, all exactly the same size, are placed with one end in boiling water. The time taken for the temperature of the other end to increase by 2°C are measured.

Material of bar	Time for 2°C rise / s
1	10
2	5
3	800
4	1200

To design a kettle with a heating element with the least heat loss, which materials should be used for the heating element of the kettle and its insulation?

	<u>Heating element</u>	<u>Insulation</u>
A	1	3
B	1	4
C	2	3
D	2	4

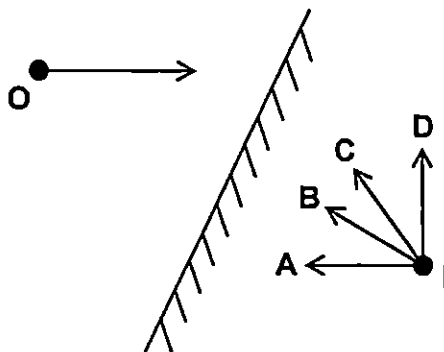
- 23 A copper container has a mass of 84 g. It contains 84 g of cold water at 10 °C. 46 g of hot water at 100 °C is poured into the water in the copper container.

Given that the specific heat capacity of water is 4200 J/(kg°C) and the specific heat capacity of copper is 400 J/(kg°C).

What is the final temperature of the mixture in the container?

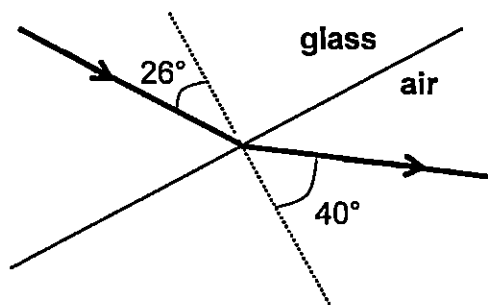
- | | | | |
|---|---------|---|---------|
| A | 10.0 °C | B | 26.7 °C |
| C | 40.0 °C | D | 80.0 °C |

- 24 An object placed in front of a plane mirror at O produces an image at I.



If the object moves towards the mirror in the direction shown, in which direction does the image move?

- 25 The diagram shows a ray of light traveling from glass into air.



The angle of incidence is 26° and the angle of refraction is 40°.

If the speed of the light in air is 3.0×10^8 m/s, what is the speed of light in the glass block?

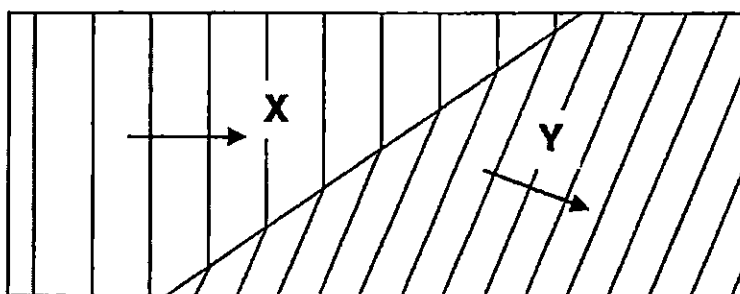
- | | | | |
|---|-----------------------|---|-----------------------|
| A | 1.7×10^8 m/s | B | 2.0×10^8 m/s |
| C | 2.2×10^8 m/s | D | 4.4×10^8 m/s |

- 26 Converging lenses **A** and **B** have the same focal length, but **B** is only half the diameter of **A**. Both lenses are used to form images of a distant object on a screen on two separate occasions.

Which one of the following statements is **correct** about the images formed?

- A Both the images are real and inverted.
- B Both the images are of the same brightness.
- C Image formed by **B** is bigger than image formed by **A**.
- D Image formed by **B** is closer to the lens than image formed by **A**.

- 27 The diagram shows water waves travelling from section **X** to section **Y** in a ripple tank.

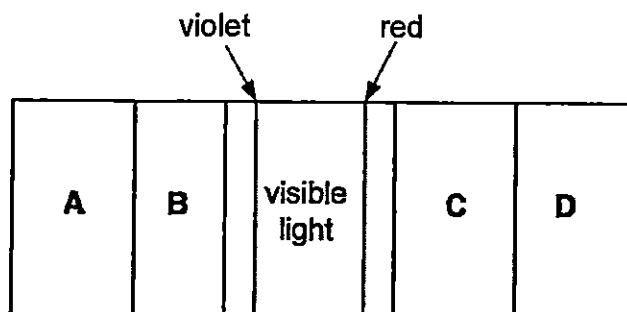


Which of the following statement(s) is/are **correct**?

- I Section **X** is deeper than section **Y**.
- II The speed of the waves in section **X** is higher than that of the waves in section **Y**.
- III The frequency of the waves in section **X** is equal to that of the waves in section **Y**.

- A I only
- B III only
- C I and II only
- D I, II and III

- 28 The diagram shows the electromagnetic spectrum, with the blue and red ends of the visible spectrum marked. Which section of the spectrum has waves that are used in satellite communication?



- 29 A man stands between two parallel walls. When he claps his hands once, he hears the first two echoes 0.4 s and 0.8 s later. If the speed of sound in air is 340 m/s, what is the distance between the walls?

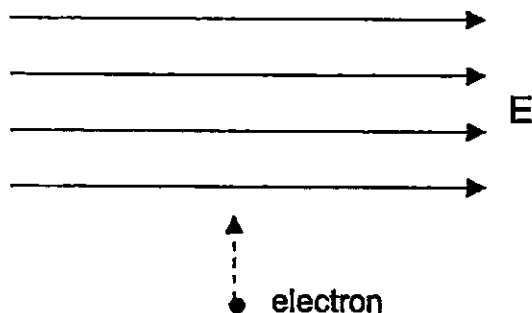
A	68 m	B	136 m
C	204 m	D	408 m

- 30 Which of the following will affect the speed of sound in air?

I The loudness of the sound.
II The frequency of the sound.
III The temperature of the air.

A	I only	B	III only
C	I and II only	D	I, II and III

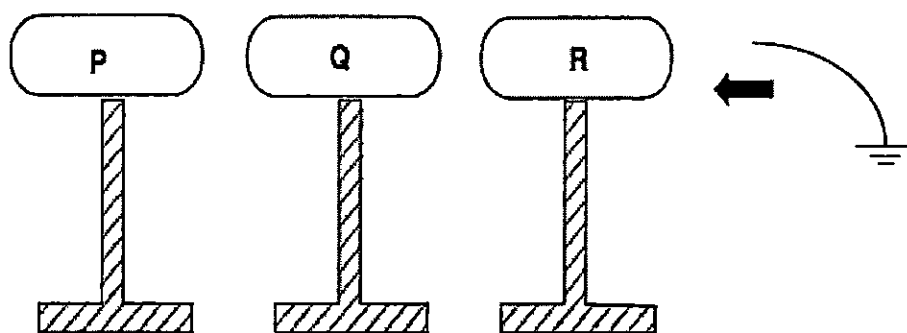
- 31 An electron is projected at right angles to a uniform electric field **E** as shown in the diagram.



In the absence of other fields, in which direction is the electron deflected?

A	To the left	B	To the right
C	Into the plane of the paper	D	Out of the plane of the paper

- 32 P, Q and R represent blocks of copper mounted on insulating stands that are apart from each other as shown in the diagram.

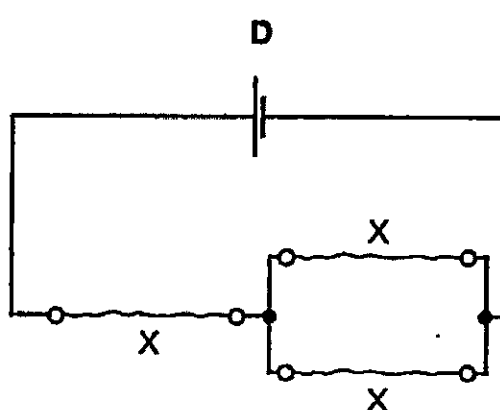
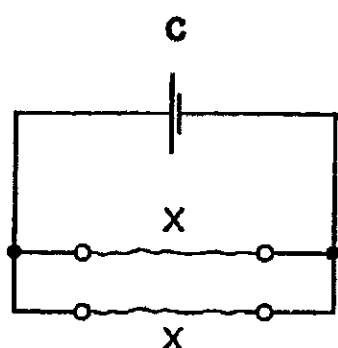
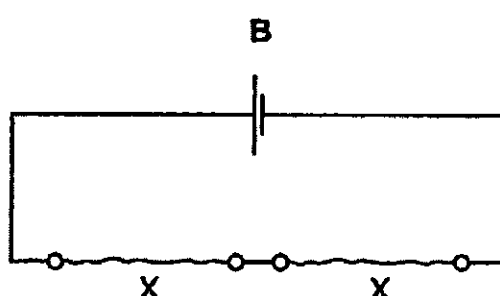
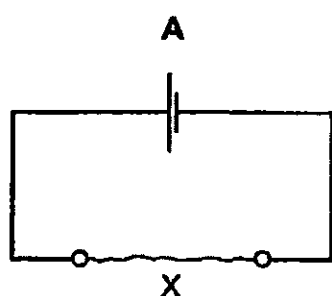


At the start of an experiment, P was charged positively while Q and R were electrically neutral. When R is momentarily earthed, which one of the following statements describes **correctly** the charges on Q and R?

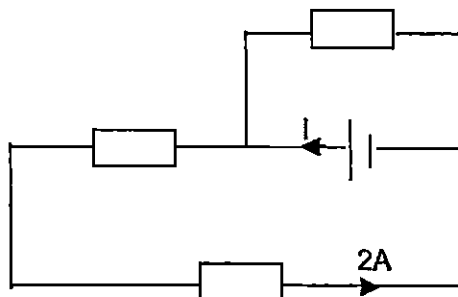
- A Q and R both carry positive charges.
- B Q and R both carry negative charges.
- C Q remains neutral but R carries negative charges.
- D Q carries negative charges but R carries positive charges.

- 33 The circuit diagrams show identical pieces of resistance wire X connected to the same cell in different ways.

In which circuit will the cell lose its energy at the **fastest** rate?



- 34 Three identical resistors are connected in a circuit as shown.

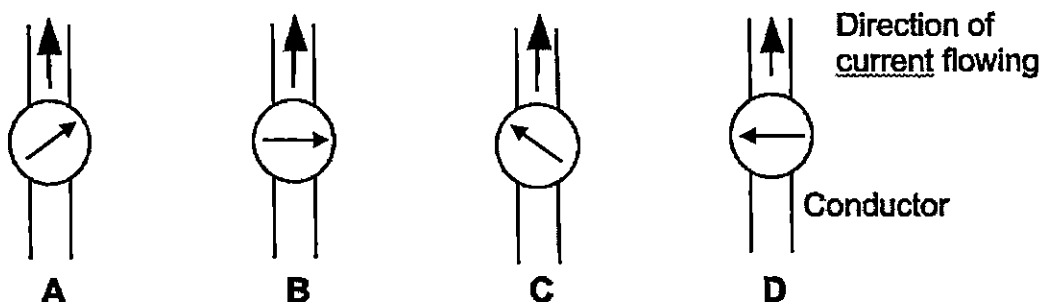


Find the value of the current, I .

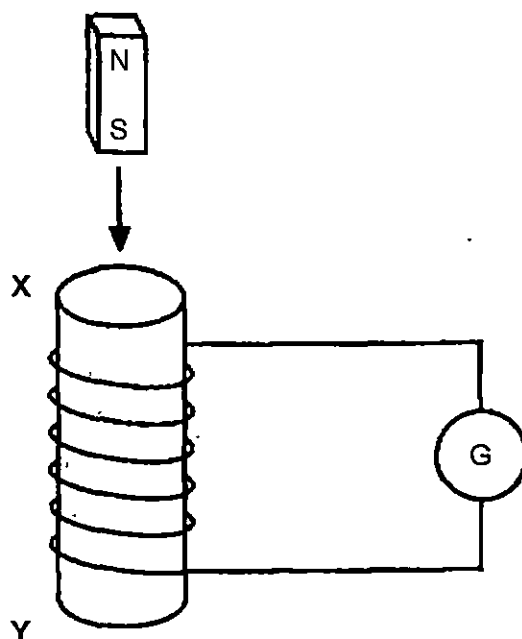
- A 2 A
B 3 A
C 4 A
D 6 A
- 35 Why is it dangerous to connect many appliances with high power ratings to one socket?
- A The current in each appliance will increase.
B The current in each appliance will decrease.
C The voltage supplied to each appliance will increase.
D A large current will flow in the mains supply causing the main cable to overheat.
- 36 An electrical household appliance uses 12 kWh of electrical energy after 4 hours of operation. If one unit of electricity costs 26 cents, find the electrical power of the appliance and the cost of energy usage.

	<u>Electrical power / kW</u>	<u>Cost / cents</u>
A	3	104
B	3	312
C	12	312
D	48	1248

- 37 Which one of the following diagrams **correctly** indicates the position of a small compass needle placed above a straight conductor carrying current flowing as shown?



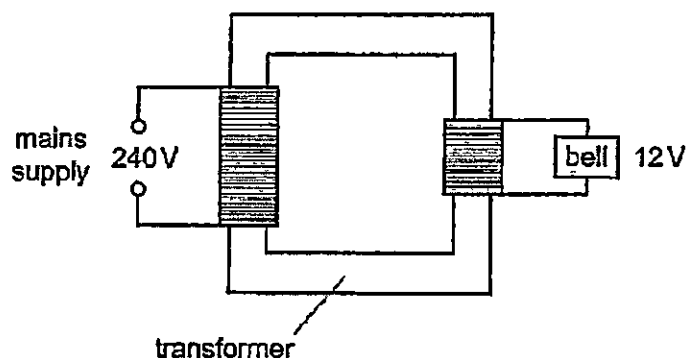
- 38 A magnet enters a coil at X and leaves at Y.



What is the polarity of the two ends of the coil when the magnet is entering and leaving the coil?

	<u>Polarity of X</u> (Magnet entering)	<u>Polarity of Y</u> (Magnet leaving)
A	N	N
B	N	S
C	S	N
D	S	S

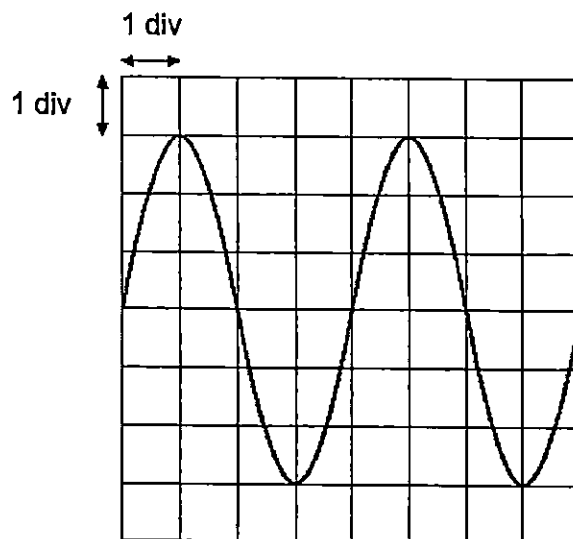
- 39 The diagram shows a transformer operating a door bell.



The mains supply of 240 V is connected to the transformer. The bell has a resistance of $8.0\ \Omega$ and the output voltage from the transformer is 12 V. What is the current drawn from the mains supply?

- | | | | |
|---|---------|---|--------|
| A | 0.075 A | B | 0.40 A |
| C | 1.5 A | D | 30 A |

- 40 The diagram shows a voltage output waveform of an a.c. generator as displayed on a cathode-ray oscilloscope (C.R.O.).



If the frequency is 25 Hz and the voltage is 12 V, which one of the following shows the correct settings for the time-base and the Y-gain?

	<u>Time-base</u>	<u>Y-gain</u>
A	10 ms / div	4.0 V / div
B	10 ms / div	2.0 V / div
C	20 ms / div	2.0 V / div
D	20 ms / div	4.0 V / div

END OF PAPER

NAME	CLASS	INDEX No.
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ST. PATRICK'S SCHOOL PRELIMINARY EXAMINATIONS 2015

SUBJECT : PHYSICS 5059 (PAPER 2) DATE : 24 AUG 2015
LEVEL : SECONDARY 4 EXPRESS DURATION : 1 H 45 MIN

INSTRUCTIONS TO CANDIDATES

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. Write your name, class and index number on the **Question Paper** in the spaces provided.
2. Answer **ALL** questions in **Section A** in the spaces provided.
3. Answer **ALL** questions in **Section B** in the spaces provided. Question 12 is an **EITHER / OR QUESTION. SELECT ONLY ONE PART OF THIS QUESTION.**
4. Throughout the paper, the **acceleration due to gravity on Earth** is taken as 10 N/kg unless stated otherwise.
5. Candidates are reminded that all quantitative answers should include appropriate units. The use of an approved scientific calculator is expected, where appropriate.
6. 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.
7. **DO NOT DETACH** any sections from this paper.
8. Submit this paper at the end of the examination.

For Examiner's Use Only

Section	A [50 m]	B [30 m]	P1 [40 m]	Total [120 m]	Grade	Target Grade
Score						

This question paper consists of 20 printed pages.

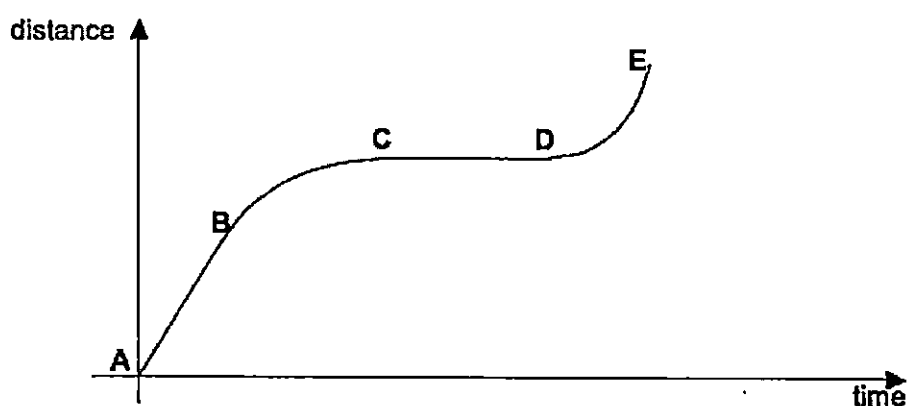
SECTION A : [50 marks]

Answer **ALL** questions in this section. Show your working and write your answers in the space provided.

- 1 (a) State a difference between **speed** and **velocity**.

[1]

- (b) The diagram shows a distance-time graph for an object.



Describe the motion of the object from A to E.

[2]

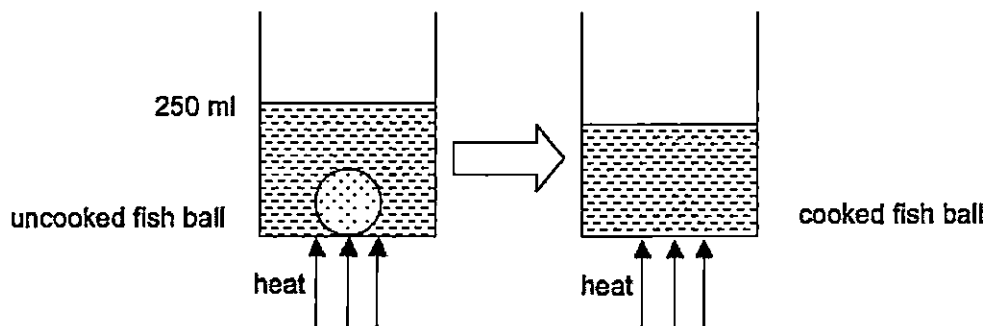
- (c) State how you can obtain the average speed of the object for the entire journey.

[1]

- (d) The object travels in a straight line and in the same direction from A to E. Would the **average speed** and the **average velocity** of the object be the same for the entire journey? Explain your answer.

[2]

- 2 An uncooked fish ball of 52 g is placed into a beaker of 200 ml water and the water rises to 250 ml. Heat is applied to the beaker of water. The process is shown in the diagram.



- (a) Calculate the density of the uncooked fish ball.

[2]

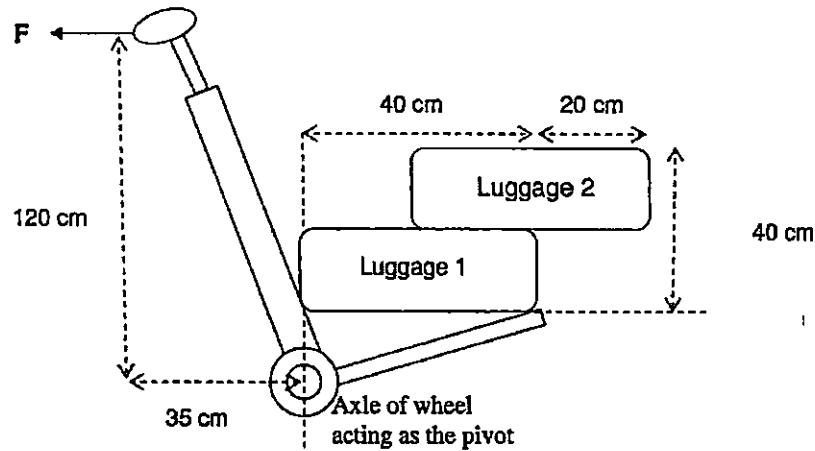
- (b) Draw in the diagram, the position of the cooked fish ball. Explain your answer.

[3]

- (c) The process is repeated using salt water, with a density of 1.2 g/cm^3 . State any observation(s) when both uncooked and cooked fish ball are placed in the beaker.

[1]

- 3 An airplane passenger places two identical luggages, each of mass 15 kg, onto a trolley as shown in the diagram. The centre of mass of each luggage is in the middle of each luggage. He applies a force F at the handle to raise the luggages to the horizontal position shown.



- (a) Calculate the force F applied at the handle to keep the luggage horizontal.

[2]

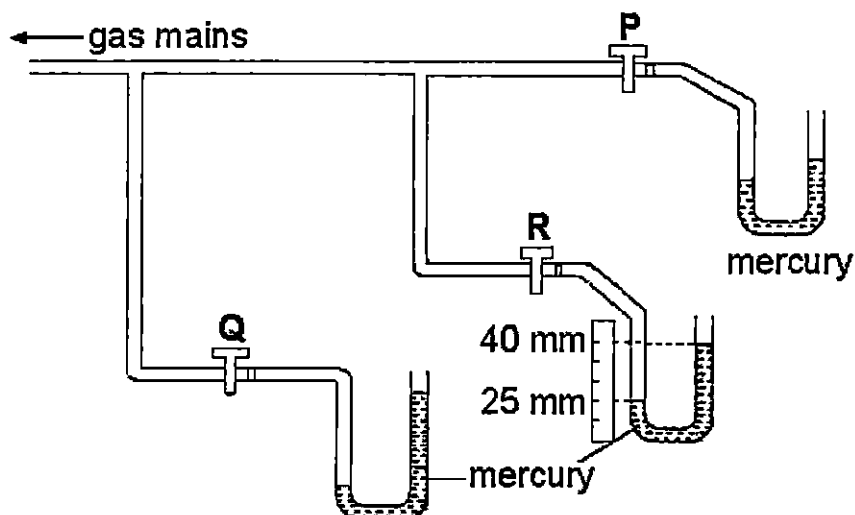
- (b) The airplane passenger wheels the trolley as shown in the diagram for a distance of 150 m. The frictional force on the trolley is 25 N. What is the useful work done by passenger?

[2]

- (c) If the airplane passenger let go of the handle, the trolley will become upright. What will happen to luggage 1 and 2? Explain your answer.

[3]

- 4 The diagram shows three identical mercury manometers connected to three gas taps for a particular experiment.



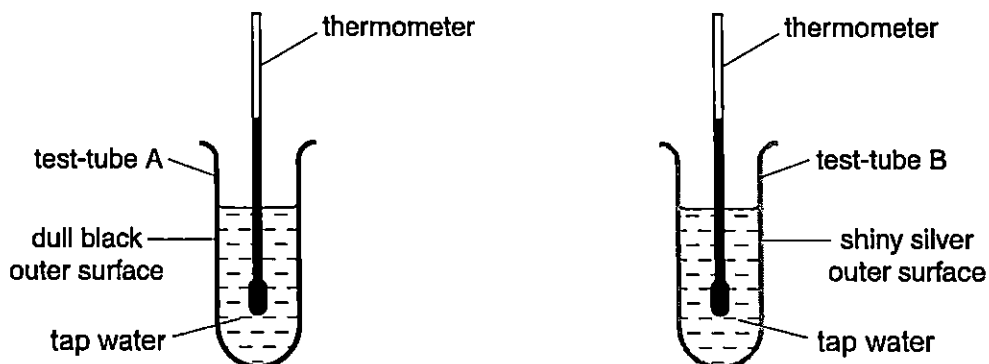
- (a) At which gas taps P, Q or R is the gas pressure highest? Explain your answer.

[2]

- (b) At gas tap R, a ruler is placed by the manometer to find the difference in height of the two limbs. The readings in millimetres are shown in the figure. What is the gas pressure at R in Pa? Take atmospheric pressure to be 1×10^5 Pa, density of mercury to be 13600 kg/m^3 and gravitational field strength to be 10 N/kg .

[2]

- 5 The effect of surface colour on heating an object is investigated. The diagram shows two sets of apparatus used in this investigation.



Test-tube A has a dull black outer surface and test-tube B has a shiny outer surface. The test tubes containing tap water to be heated. Readings are taken every minute to allow heating curves to be plotted.

- (a) Explain why it can be assumed that the tap waters in both test tubes are of the same temperature.

[2]

- (b) On the graph, the room temperature is indicated. **Sketch and label clearly** the shape of the heating curves for test-tube A and for test-tube B.

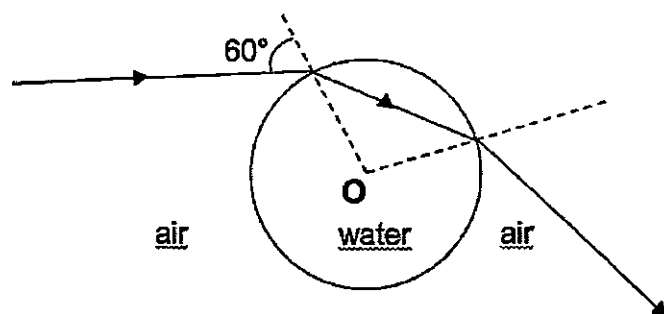


[3]

- (c) Explain how the different surfaces of the test-tubes affect the shapes of the heating curves you have drawn in (b).

[2]

- 6 The diagram shows the path of a light ray in a spherical water drop.



O is the centre of the water drop. The angle of incidence of the light ray to the water drop surface is 60° .

- (a) Given the refractive index of water is 1.33, calculate the angle of refraction of the light ray in the water drop.

[2]

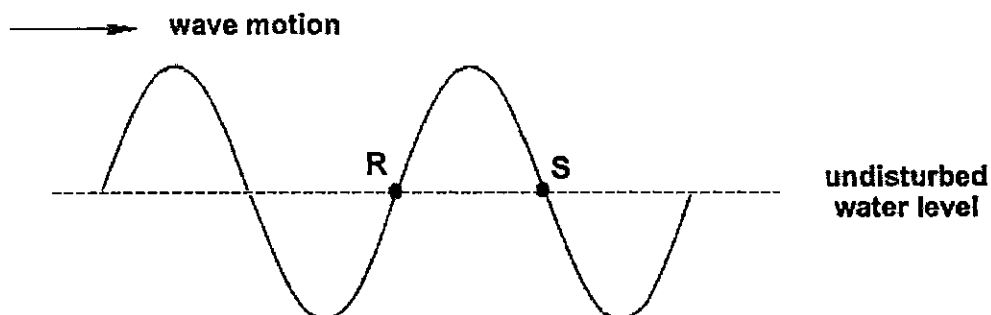
- (b) Calculate the critical angle of water.

[2]

- (c) Regardless of the angle of incidence of the light ray at the air-water boundary, the light ray will not exhibit total internal reflection at the water-air boundary as shown. By comparing the relevant angles at these two boundaries, explain why this is so.

[2]

- 7 A water wave is travelling from left to right across the water surface of a pond at a speed of 24 cm/s. The diagram shows a snapshot of the wave at a certain moment. R and S are two water particles on the water surface. R moves up and down 50 times in one minute.



- (a) What is the type of wave generated? Explain your answer.

[2]

- (b) Determine

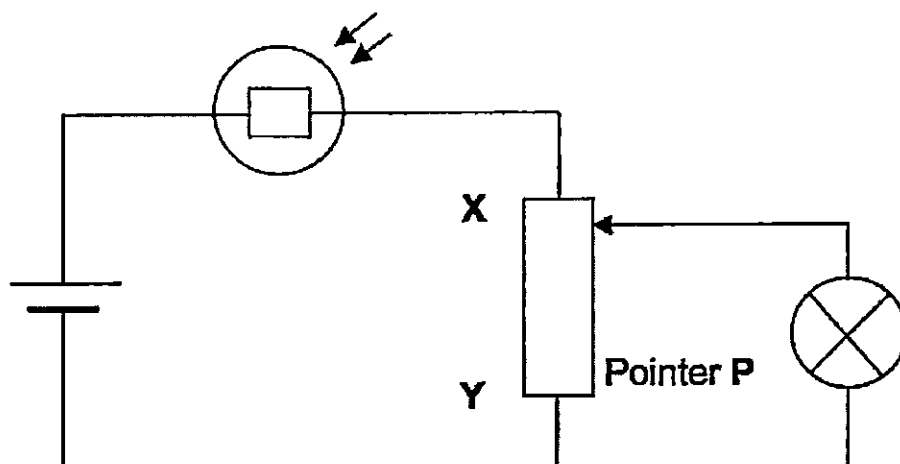
- (i) the distance between R and S.

[2]

- (ii) the time taken for R to reach the highest point.

[2]

- 8 The diagram shows a circuit consists of a light dependent resistor (LDR), a potentiometer XY and a lamp.



When little light falls on the LDR, its resistance is $3000\ \Omega$. When the light of strong intensity falls on the LDR, its resistance is $500\ \Omega$.

Describe and explain the conditions where the light bulb will be at its brightest.

[3]

- 9 An iron ball is held at rest in the manner shown in **Figure I**.

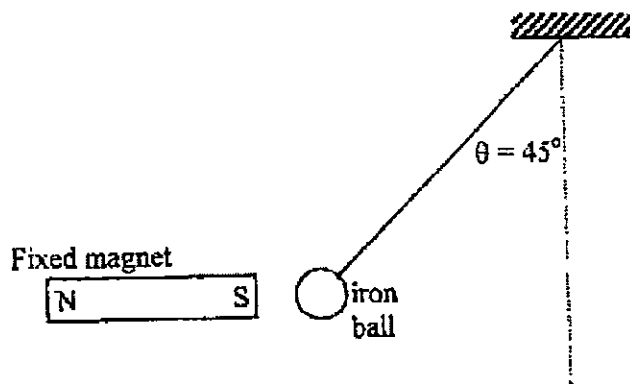


Figure I

When a horizontal bar magnet is held firmly about 2 cm away from the iron ball, the string attached to the iron ball makes an angle of $\theta = 45^\circ$ from the vertical.

- (a) Draw three arrows in **Figure I** showing the three forces acting on the iron ball.
- (b) If an iron cube is held firmly between the bar magnet and the iron ball as shown in **Figure II**, the angle θ would increase slightly.

[1]

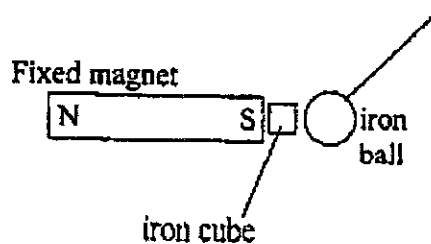


Figure II

Explain why θ increases.

[2]

- (c) A wide iron sheet, instead of the iron cube, is placed between the bar magnet and the iron ball is shown in **Figure III**. The iron ball falls and finally comes to rest in the position shown.

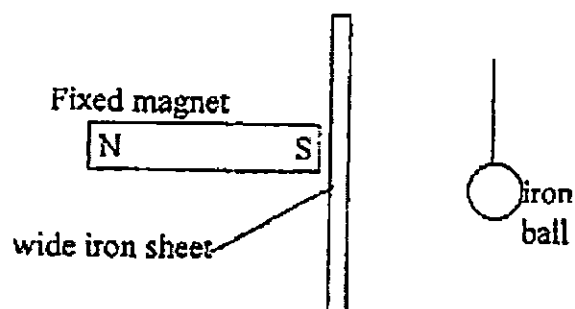


Figure III

Explain this. (You may draw a diagram to make your answer clear.)

[2]

SECTION B : [30 marks]

Each question is worth 10 marks. Answer ALL questions in this section. Question 3 is an EITHER / OR QUESTION. **SELECT ONLY ONE PART OF THIS QUESTION.** Show your working and write your answers in the spaces provided.

10 A wind turbine uses renewable energy source to generate electricity.

- (a) Figure 1 shows how the power output of a wind turbine varies with wind speed.

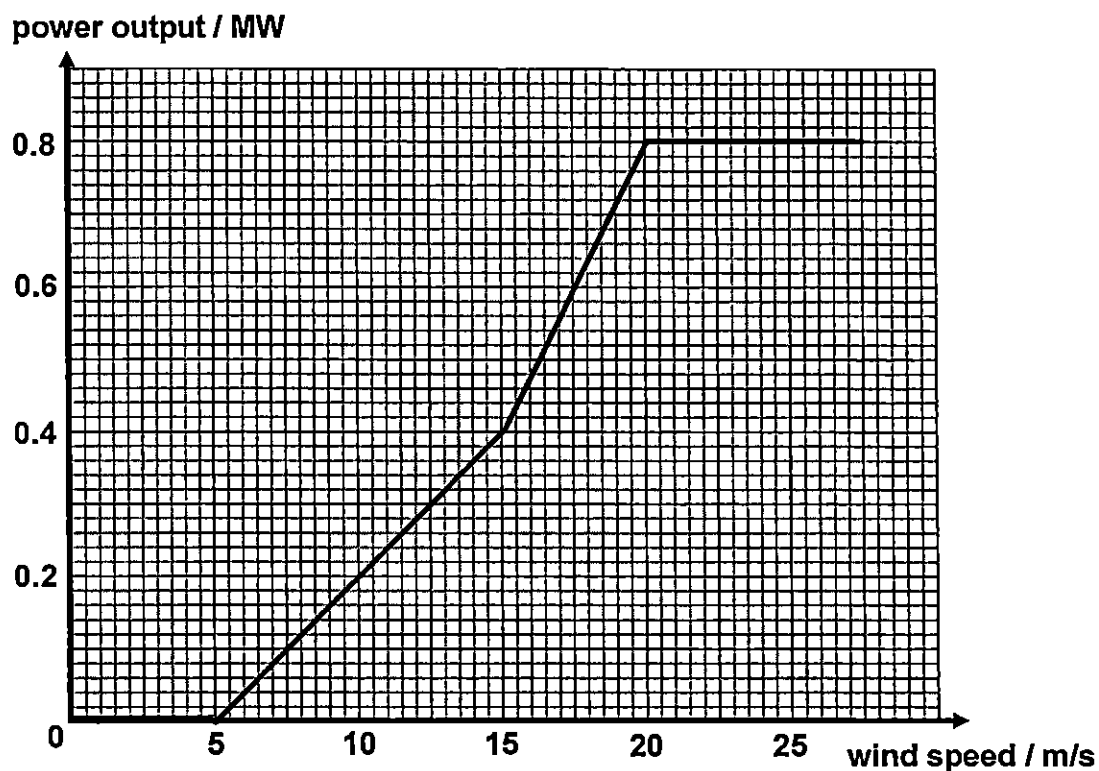


Figure 1

- (i) Calculate the rate of power output (in MW / m/s) of the wind turbine for wind speed of 10 m/s.

[1]

- (ii) Using the graph, describe how the power output varies with the wind speed of 5 m/s to 25 m/s. In your description, you are to include any numerical value(s) where necessary.

[3]

- (iii) The wind speed is recorded at two minute intervals as shown in **Figure II**.

time / min	0	2	4	6	8	10	12	14	16	18
wind speed / m/s	2	3	6	18	1	0	15	15	20	22

Figure II

Using the data provided in **Figure I** and **Figure II**, estimate the total energy produced in the twenty minute interval. Give your answer in joules.

[3]

- (iv) Explain why your answer in (a)(iii) is only an estimate and suggest one way to improve the accuracy of the estimation.

[1]

- (b) A wind turbine produces an alternating voltage of 600 V. Electric cables connect the wind turbine to houses some distance away. Energy is wasted within the cable.

State and explain one method to reduce the amount of energy that is wasted.

[2]

- 11 **Figure I** shows a simple d.c. motor. Seen from the front, the coil **ABCD** rotates in a clockwise direction as shown.

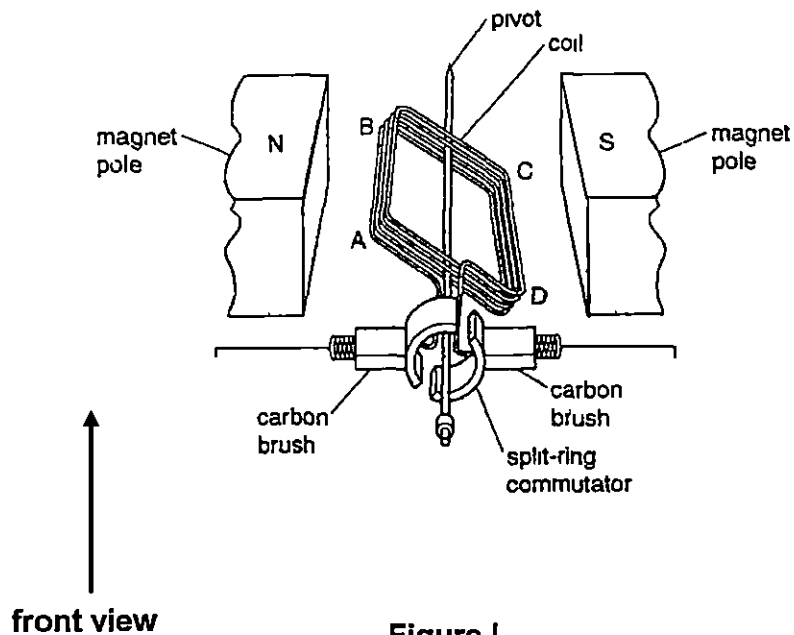


Figure I

- (a) Complete the circuit in **Figure I** by including a correctly connected battery and a variable resistor. [2]
- (b) **Figure II** shows the permanent magnets and the wires as seen from the front view. The wire from the front view are represented by the two circles **A** and **D**.

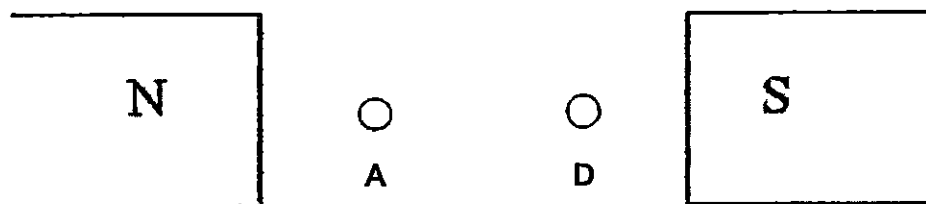


Figure II

- (i) In **Figure II**, indicate the direction of the current using dot and cross notation such that the motor rotates in the clockwise direction. [1]
- (ii) Draw the magnetic field pattern between the permanent magnets. [1]

- (c) Explain why a split-ring commutator is necessary.

[2]

- (d) Suggest **two** ways to increase the speed of rotation of the motor.

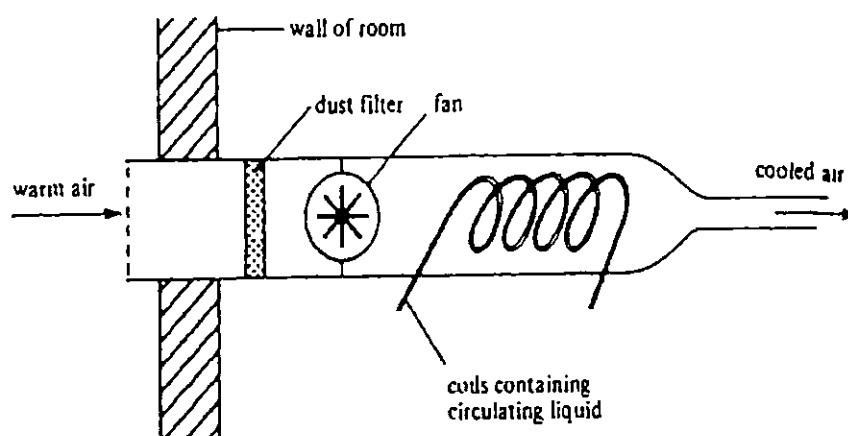
[2]

- (e) After a prolonged period of use of the motor, the wires in the coil start to heat up. Explain why this has a slowing effect on the motor.

[2]

12 EITHER

In an air-conditioning unit, air is cooled when it is blown past coils in which a liquid is continuously evaporated, as illustrated in the diagram.



- (a) Why does evaporation of the liquid cause the air flowing past the coils to be cooled?

[2]

- (b) What effect will increasing the surface area of the coils have on the cooling achieved? Explain your answer.

[2]

- (c) Why should the air-conditioning unit be placed high up in the room?

[2]

- (d) The air conditioning unit has a cooling power of 1200 W. It is installed in a room containing 100 kg of air at 30 °C. What will be the temperature of the room if the unit has been switched on for 30 minutes? You are to state any assumption made in your calculation. The specific heat capacity of air is to be taken as 1000 J/(kg °C).

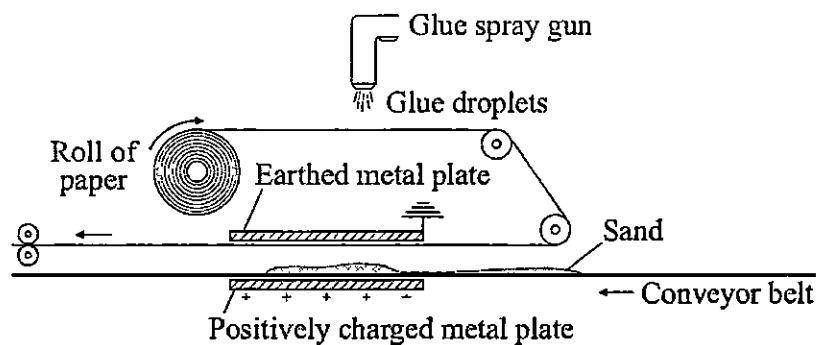
Calculation:

Assumption:

[4]

12 OR

- (a) The diagram shows a method of producing sandpaper using static electricity.



Glue is sprayed onto a moving strip of paper. As the glue leaves the spray gun, the glue breaks up into tiny negatively charged droplets which coat the paper. The sticky paper passes between two metal plates. Sand moving on a conveyor belt also passes between the metal plates.

- (i) What is the advantage of having all the glue droplets with the same (negative) charge?

[2]

- (ii) Explain why the sand moves towards the sticky paper.

[2]

- (b) Thunderclouds contain charges. The buildup of charges on the clouds causes a large potential difference between the cloud and the ground.

- (i) Explain, in terms of energy, what is meant by *potential difference* in this context.

[2]

- (ii) There is a potential difference of 1000 MV between a cloud and earth. In a lightning discharge from the cloud to earth, a charge of 20 C passes. Calculate the energy involved in this discharge.

[2]

- (iii) A lightning conductor is placed at the top of a building to help to reduce the chance of a lightning discharge. Describe how this is achieved.

[2]

END OF PAPER



ST. PATRICK'S SCHOOL
PRELIMINARY EXAMINATIONS 2015

SUBJECT : PHYSICS 5059

DATE : 24 AUG 2015 (P2)
31 AUG 2015 (P1)

LEVEL : SECONDARY 4 EXPRESS

DURATION :

PAPER 1 [40 marks] (DURATION: 1 HOUR)

1	2	3	4	5	6	7	8	9	10
C	A	D	B	C	A	B	D	D	A

11	12	13	14	15	16	17	18	19	20
A	B	D	A	A	C	B	C	B	C

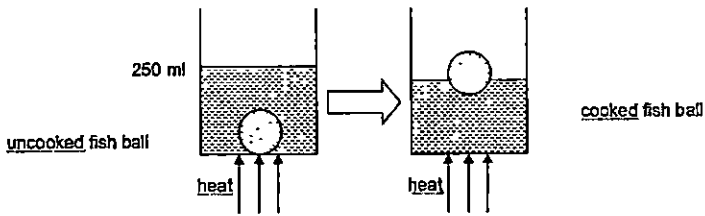
21	22	23	24	25	26	27	28	29	30
C	D	C	C	B	A	D	C	C	B

31	32	33	34	35	36	37	38	39	40
A	C	C	D	D	B	B	D	A	A

PAPER 2 (DURATION: 1 HOUR 45 MIN)

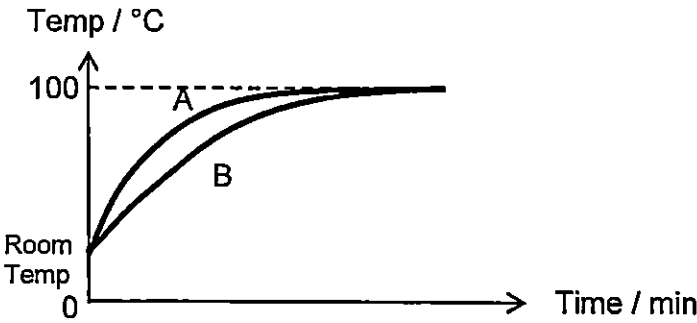
Section A [50 marks]

QN	Suggested Answers	Sub Ttl	Ttl
1a	Any one of the suggested answer below: Speed is distance covered per unit time while velocity is displacement covered per unit time. Speed is a scalar quantity while velocity is a vector quantity.	1	6
1b	AB: Constant speed BC: Deceleration / Decreasing speed CD: At rest DE: Acceleration / Increasing speed Any two correct answers: 1 m All correct answers: 2 m	2	
1c	Average speed is obtained using the <u>total</u> distance travelled divided by the <u>total</u> time taken. If student indicates on the graph the final distance and final time taken, the one mark is to be awarded.	1	
1d	The average speed and average velocity will be the same [1]. For the same time taken, both the <u>total distance</u> travelled and the <u>displacement</u> are the <u>same</u> [1].	2	

QN	Suggested Answers	Sub Ttl	Ttl
2a	$\rho = m \div v$ $= 52 \div 50$ $= 1.04 \text{ g/cm}^3 \text{ or } 1,040 \text{ kg/m}^3$ [Volume 1] [1]	2	5
2b	 Drawing: The cooked fish ball is floating on the water. [1] When the fish ball is cooked, it expands. As its volume increases but mass remains unchanged [1], its density decreases [1] causing it to float in the water.	3	
2c	Both the uncooked and cooked fishballs will be floating [1] in the salt water.	1	

QN	Suggested Answers	Sub Ttl	Ttl
3a	$F \times 120 = 150 \times 20 + 150 \times 40$ [1] $F = 75 \text{ N}$ [1]	2	7
3b	Useful work done $= (75 - 25) \times 150$ [1] $= 7500 \text{ J}$ [1] Do not accept the unit for workdone as Nm. [deduct 1 m]	2	
3c	Luggage 1 will remain on the trolley while Luggage 2 will fall off the trolley. [1] The line of action of weight of luggage 1 falls within the base of the trolley, hence it remains on the trolley / the weight of the luggage provides an anticlockwise moment causes the luggage to fall back onto the trolley. [1] The line of action of weight of luggage 2 falls outside the base of the trolley. There is a clockwise moment of its weight about the edge of the base of the trolley. [1]	3	

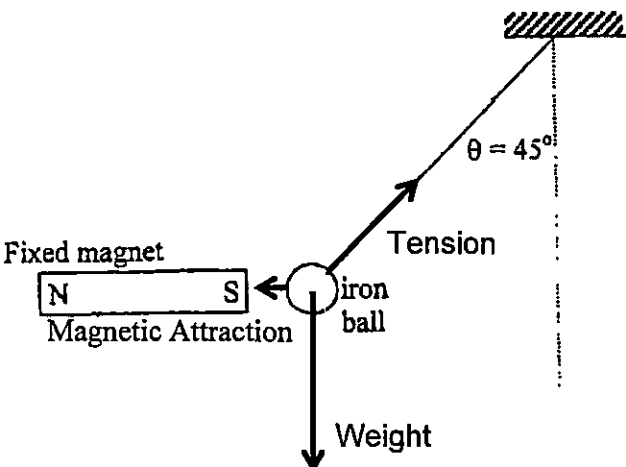
QN	Suggested Answers	Sub Ttl	Ttl
4a	At Q, the gas pressure highest [1]. The column of mercury at the right side is the highest [1] above the mercury level on the left side.	2	6
4b	Pressure at R $= 1 \times 10^5 + 0.015 \times 13600 \times 10$ [1] $= 100\,000 + 2040$ $= 102\,040 \text{ Pa}$ $= 102\,000 \text{ Pa (3sf)}$ [1]	2	

QN	Suggested Answers	Sub Ttl	Ttl
5a	The waters from the tap have been in the surrounding for a long time [1] and has reached thermal equilibrium [1] with the surrounding. Other points accepted: The waters have reached room temperature. The waters are obtained from the same source.	2	7
5b	 Shape of graphs A and B [1] Graph of A above graph of B [1] Boiling point reached by both A and B [1]	3	
5c	The dull black surface of test tube A is a better absorber [1] of radiation compared to the shiny surface of test tube B, hence test tube A gains heat faster [1] and therefore heats up faster.	2	

QN	Suggested Answers	Sub Ttl	Ttl
6a	$n = \sin i \div \sin r$ $1.33 = \sin 60^\circ \div \sin r$ [1] $r = \sin^{-1} (\sin 60^\circ \div 1.33)$ $= 40.628^\circ$ $\approx 40.6^\circ$ [1]	2	6
6b	$n = 1 \div \sin c$ $1.33 = 1 \div \sin c$ [1] $c = \sin^{-1} (1 \div 1.33)$ $= 48.753^\circ$ $\approx 48.8^\circ$ [1]	2	
6c	The angle of incidence at the water-air boundary (exit) is always equal to the angle of refraction at the air-water (entrance) boundary [1]. Since the angle of refraction will always be less than [1] the critical angle of 48.8°, total internal reflection cannot occur. OR The angle of incidence at the air-water boundary (entrance) is always equal to the angle of refraction at the water-air (exit) boundary [1]. Since the angle of incidence is always less than [1] 90°, the angle of refraction is always less than 90°.	2	

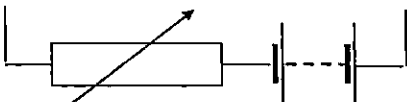
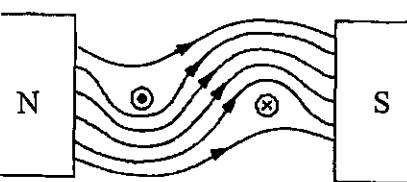
QN	Suggested Answers	Sub Ttl	Ttl
7a	Transverse wave [1]. The direction of vibration of particle is perpendicular [1] to the direction in which the wave travels.	2	6
7bi	$\lambda = v \div f$ $= 24 \div (50 \div 60)$ $= 28.8 \text{ cm}$ [1] Distance RS $= \lambda \div 2$ $= 28.8 \div 2$ $= 14.4 \text{ cm}$ [1]	2	
7bii	At the moment shown, R is moving downwards. Time taken to reach the highest point $= \frac{3}{4} T$ [1] $= \frac{3}{4} (1 \div f)$ $= \frac{3}{4} (60 / 50)$ $= 0.900 \text{ s}$ [1]	2	

QN	Suggested Answers	Sub Ttl	Ttl
8	The bulb will be at its brightest under strong light intensity and when point P is at end X of the potentiometer. [1] Under strong intensity, LDR resistance is the lowest, leaving a greater fraction of the e.m.f across the potentiometer [1]. With P at point X, the potential difference across bulb is the largest [1].	3	3

QN	Suggested Answers	Sub Ttl	Ttl
9a	 Note: Tension must be in the string. The force of attraction by the magnet must be in contact with the iron ball. The weight of the iron ball must be drawn from the c.g. of the iron ball.	1	5
9b	Magnetic field concentrates [1] through the iron cube and thus produces a stronger attractive force [1].	2	
9c	Magnetic field flows along [1] iron sheet causing the iron ball to be protected by magnetic shielding [1].	2	

Section B [30 marks]

QN	Suggested Answers	Sub Ttl	Ttl
10ai	Rate of power output $= 0.4 \div 10$ $= 0.040 \text{ MW / m/s}$ [1]	1	10
10aii	For wind speed from 5 m/s to 15 m/s, the power output increases at a constant rate of 0.040 MW every 1 m/s [1]. For wind speed from 15 m/s to 20 m/s, there is a the power output increases of 0.080 MW every 1 m/s [1]. For wind speed greater than 20 m/s, there is a constant power output of 0.80 MW [1].	3	
10aiii	Total energy produced $= (0.04 + 0.64 + 0.4 + 0.4 + 0.8 + 0.8) \times 10^6 \times 2 \times 60$ [1] $= 3.70 \times 10^8 \text{ J}$ [1] [1 m for the correct power output]	3	
10aiv	As the wind speed is measured every 2 minute interval, it is assumed that the wind speed is constant throughout that interval which may not be true. To increase the accuracy of estimation is to measure the speed of the wind at smaller time interval. [1]	1	
10b	By transmitting the power at high voltages [1] with the help of a step up transformer, the current flowing in the cable will be smaller [1] and thus the power loss due to the resistance of the cable will be reduced.	2	

QN	Suggested Answers	Sub Ttl	Ttl
11a	 Battery with correct polarity [1] Variable resistor [1]	2	10
11bi 11bii	 Dot and cross as shown in diagram [1] Centre lines passing above and below wires (at least two lines) Line above and line below [1] [-1] for wrong/missing arrows	2	
11c	To reverse the direction [1] of the current in the coil every half a revolution, to ensure the coil will always turn in the same direction [1]. OR To reverse the current [1] in the coil each time it passes the vertical position [1]	2	
11d	Any two: Increase the current. Increase the number of turns. Increase the strength of the magnet. Increasing the voltage of the battery. Insert a soft iron core. <u>In this context:</u> Reducing the resistance of the variable resistance	2	
11e	As temperature increases, the resistance of the wire increases [1], causing current to decrease [1] and hence the force on the coil decreases.	2	

Either

QN	Suggested Answers	Sub Ttl	Ttl
12a	Evaporation of liquid is achieved by absorbing thermal energy from the surrounding. [1] Thus the thermal energy from the warm air is lost to the liquid and the air becomes cooled. [1]	2	10
12b	Increasing surface area of the coils will cool the air even more. [1] Increase of surface area increases the rate of thermal energy transfer.[1]	2	
12c	So that a convection current can be achieved in the room where the cooled [1], denser air will sink and the warmer air rises [1] to be cooled by the air-conditioning unit.	2	
12d	$E = Pt$ $= 1200 \times 30 \times 60$ $= 2160000 \text{ J} \quad [1]$ $Q = mc\Delta\theta$ $= 100 \times 1000 \times (30 - T) \quad [1]$ $100000 \times (30 - T) = 2160000$ $30 - T = 21.6$ $T = 8.4 \text{ }^{\circ}\text{C} \quad [1]$ Assumptions: • There is <u>no heat gained</u> from the surrounding. • The <u>heat</u> loss by the air in the room <u>is removed</u> by the air conditioning unit. • The mass of the air in the room is 100 kg. No air enters or leaves the room.[1]	3	

Or

QN	Suggested Answers	Sub Ttl	Ttl
12ai	The droplets will repel [1] each other, resulting in even coating [1] of glue/sand on the paper.	2	10
12aii	The sand becomes positively charged [1]. They are attracted to [1] the negatively charged paper as unlike charges attract.	2	
12bi	Potential difference is the energy [1] in carrying a unit charge from the ground at zero potential to the charged cloud [1].	2	
12bii	$E = Q \times V$ $= 20 \times 1000 \times 10^6$ [1] $= 2 \times 10^{10} \text{ J}$ [1]	2	
12biii	There is a great potential difference between the cloud and the lightning conductor and this causes the air between to ionize [1]. The oppositely charged ionized air will discharge the charges in the cloud preventing the charges in the cloud to accumulate [1]. This reduces the potential difference between the cloud and the lightning conductor. Thus, the chance of lightning striking is much reduced.	2	