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NAME	CLASS	INDEX No.
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ST. PATRICK'S SCHOOL PRELIMINARY EXAMINATIONS 2017

SUBJECT : PHYSICS 5059 PAPER 1 DATE : 25 Aug 2017
 LEVEL : SECONDARY 4 EXPRESS DURATION : 1 H

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.

INFORMATION FOR CANDIDATES:

The number of marks is given in brackets [] at the end of each question.
 Take acceleration due to gravity, $g = 10 \text{ m/s}^2$.

For Marker's Use Only

Section	Total (40 m)
Score	

Teacher's comments (if any): _____

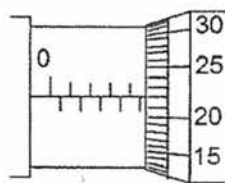
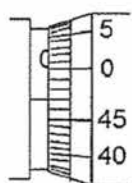
Parent's / Guardian's Signature: _____ Date: _____

This question paper consists of 15 printed pages including the cover page.

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.

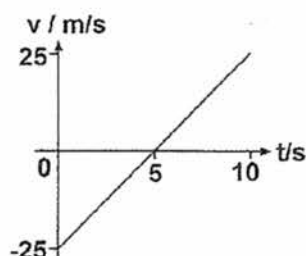
Answer all questions. Shade your answers in the OTAS sheet provided.

- 1 A micrometer screw gauge is used to measure the thickness of a uniform rod. The figure below shows the reading on the micrometer screw gauge when it is closed before measurement is taken and the reading when it is taken with the rod.

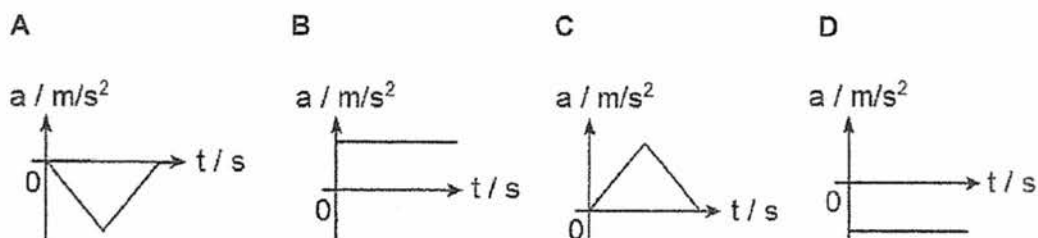


What is the cross-sectional area of the rod?

- A 14.7 mm² B 14.9 mm² C 17.3 mm² D 17.7 mm²
- 2 Which of the following physical quantities consist only of vectors?
- A acceleration, force, volume B acceleration, force, velocity
C acceleration, mass, velocity D mass, time, velocity
- 3 The graph below shows how the velocity of an object varies with time.



Which of the following graphs shows how the acceleration of the object varies with time?



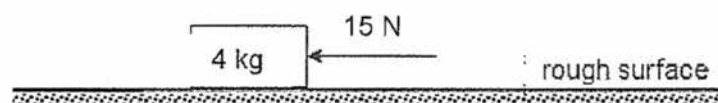
- 4 A sky-diver, jumps out of a plane and falls towards the ground. Soon, he reaches terminal velocity. Which of the following statements is not true?
- A The acceleration when the sky-diver exits the plane is 10 m/s^2 .
 - B The sky-diver's speed decreases until he reaches terminal velocity.
 - C At terminal velocity, there is no net force acting on the sky-diver.
 - D The sky-diver's acceleration decreases to zero as he falls from the plane.

- 5 A car travels along a road at 50 km/h . The driver applies the same braking force at the same place on a day when the surface is dry and then on a day when the road is wet.

On the wet surface, how many of these distances are greater than on the dry surface?

	braking distance	stopping distance	thinking distance
A	0	B 1	C 2
			D 3

- 6 A brick of mass 4 kg accelerates uniformly at 3 m/s^2 when it is pushed horizontally across a rough surface using a forward force of 15 N .



What forward force is needed instead to move it at constant speed?

- | | | | |
|---------|---------|----------|----------|
| A 3.0 N | B 4.0 N | C 12.0 N | D 15.0 N |
|---------|---------|----------|----------|
- 7 Which statement about mass and weight is correct?
- A A mass experiences a weight due to a gravitational field.
 - B Mass and weight are different types of force.
 - C Mass and weight have the same unit.
 - D When an object expands, its mass changes but its weight stays the same.
- 8 An astronaut lands on a planet where the acceleration of free fall at its surface is greater than that on the Earth. Which of the following will be the same as on the Earth?
- A the ease in changing the motion of a moving ball.
 - B the maximum height reached by the astronaut when he jumps.
 - C the period of oscillation of a simple pendulum.
 - D the weight of the astronaut as measured by a spring balance.

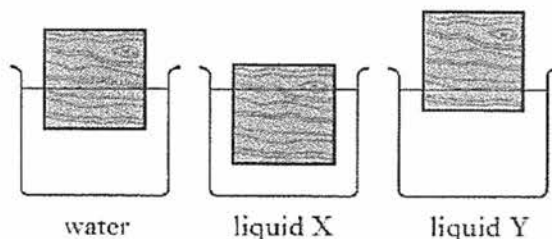
- 9 A large bucket, lifted by a rope attached to a crane, is used on a building site to raise heavy loads.

The bucket, of total mass m when fully loaded, rises at a uniform velocity v before decelerating uniformly to rest in time t . The gravitational field strength is g .

What is the difference between the tensions in the rope supporting bucket when the bucket is travelling at uniform velocity and when the bucket is decelerating?

- A $\frac{-mg}{t}$ B $\frac{-mv}{t}$ C $m\left(g - \frac{v}{t}\right)$ D $m\left(\frac{v}{t} - g\right)$

- 10 Three identical blocks of wood are floating in different liquids as shown.



A student makes the following statements.

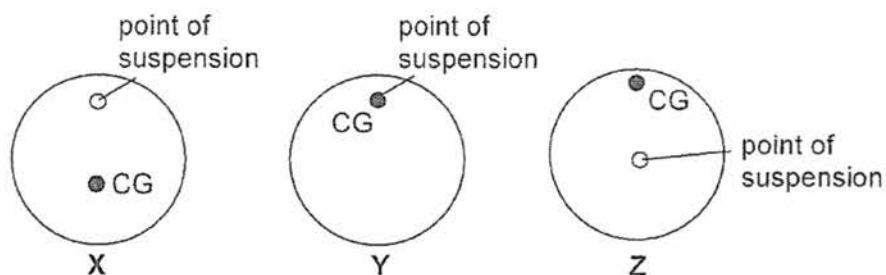
- I The density of the wood is less than the density of water.
- II The density of liquid X is less than the density of water.
- III The density of liquid X is greater than the density of liquid Y.

Which of the statements is/are correct?

- A I only B II only C I & II only D I & III only
- 11 What affects the stability of an object?

- A only its base area and the location of its centre of mass
- B only its weight and its base area
- C only the location of its centre of mass
- D only its weight

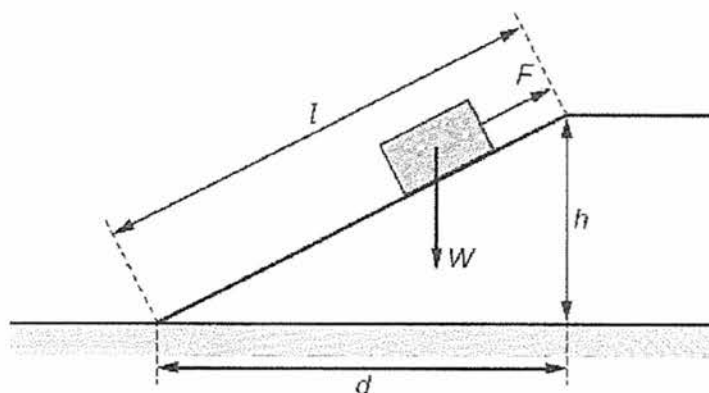
- 12 Three circular objects are suspended from three different positions as shown below. (CG: centre of gravity)



Which of the following matches the figure with their types of equilibrium?

	X	Y	Z
A	neutral	unstable	stable
B	stable	unstable	neutral
C	stable	neutral	unstable
D	unstable	neutral	stable

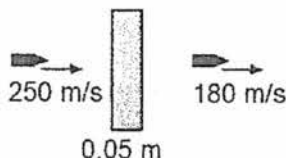
- 13 A constant force F pulls a block of weight W up the slope shown.



How much work is done in pulling the block up the slope?

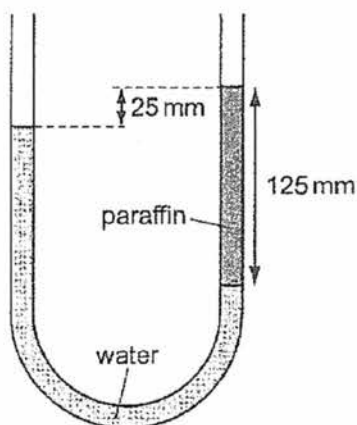
- A $F \times h$ B $F \times l$ C $W \times d$ D $W \times l$

- 14 When a bullet of mass 0.15 kg moving at 250 m/s strikes a metal plate of thickness 0.05 m , it emerges with a speed of 180 m/s as shown in the figure below.



Find the frictional force acting on the bullet as it is going through the metal plate.

- A 1400 N B 2260 N C $22\,600\text{ N}$ D $45\,200\text{ N}$
- 15 A rock climber of weight 600 N climbs up a rock face of vertical height 300 m in 1 hour. What is the average power she generates against gravity during this time?
- A 0.020 W B 50 W C 1800 W D 7200 W
- 16 Paraffin floats on water. Some paraffin is poured into one arm of a U-tube containing water. The figure below shows a difference of 25 mm in the surface level of the water and paraffin in the two arms. The length of the paraffin column in the tube is 125 mm .



A small volume of paraffin is added to the right-hand arm increasing the length of the paraffin column in the tube to 150 mm .

What is the new difference between the surface levels of the water and paraffin in the two arms?

- A 25 mm B 30 mm C 38 mm D 50 mm

17 Which statement explains how a pressure is exerted by a gas on a container?

- A Gas molecules collide with other gas molecules in the container.
- B Gas molecules collide with the walls of the container.
- C Gas molecules exert strong attractive forces on each other.
- D Gas molecules exert strong repulsive forces on each other.

18 A fixed mass of gas is heated while kept at constant volume. How do the properties of the molecules of the gas change?

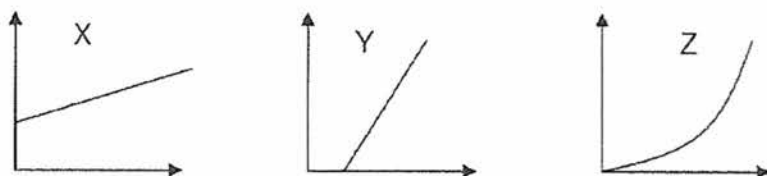
	average speed	frequency of collision with walls	average distance apart
A	increases	decreases	increases
B	increases	increases	unchanged
C	decreases	unchanged	unchanged
D	decreases	increases	unchanged

19 A faulty thermometer with uniform scale reads 10°C and 90°C when placed in melting ice and steam over boiling water respectively.

What should be the true temperature if the thermometer reads 36°C ?

- A 26.0°C B 36.0°C C 32.5°C D 45.0°C

20 Graphs of how three physical quantities X, Y and Z vary with temperature respectively are shown below.



Which of them is/are having suitable physical quantities to measure temperature?

- A X only B Z only C X & Y only D Y & Z only

21 Which statement about copper explains why it is a better conductor of heat than glass?

- A Atomic vibration is passed on to neighbouring copper atoms quickly.
- B Atoms move through the copper and pass on kinetic energy.
- C There are density changes within the copper.
- D There are free electrons in the copper.

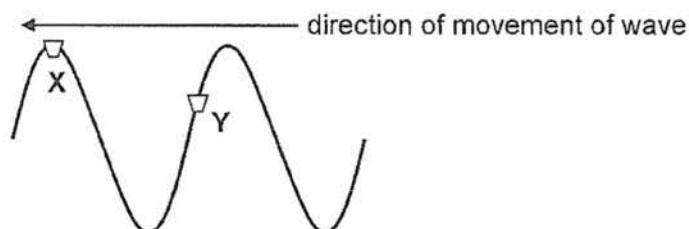
- 22 A woman stands by a fire to warm her hands and legs.



How does most of the thermal energy reach her hands and legs?

	hands	legs
A	convection	conduction
B	convection	radiation
C	radiation	convection
D	radiation	radiation

- 23 The diagram shows two corks, X and Y, floating on water.



What will happen to both corks as the wave passes?

- A both X and Y will move downwards
 B both X and Y will move upwards
 C X will move upwards and Y will move downwards
 D X will move downwards and Y will move upwards
- 24 A student makes the following statements about different types of electromagnetic waves.

- I Light waves are transverse waves.
 II Radio waves travel at 340 m/s through air.
 III Ultraviolet waves have a longer wavelength than infrared waves.

Which of these statements is/are correct?

- A I only B I & II only C I & III only D II & III only

- 25 Which two types of electromagnetic radiation are used to kill cancerous cells and to sterilize medical equipments?

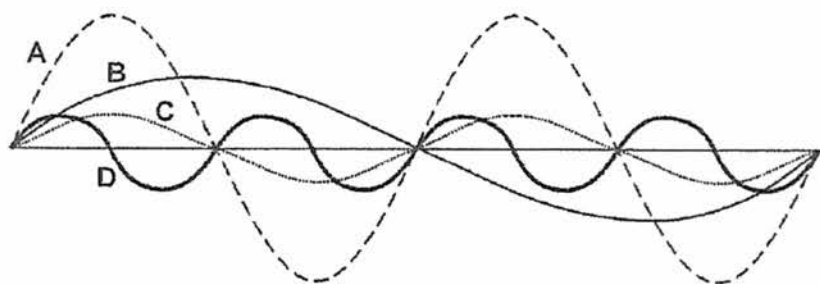
A gamma-rays and microwaves
B gamma-rays and ultra-violet radiation
C gamma-rays and X-rays
D microwaves and ultra-violet radiation

- 26 A thin converging lens is used to focus the rays from the Sun onto a piece of paper, causing a hole to be burnt. The distance between the lens and the paper is

A equal to half the focal length of the lens.
B equal to the focal length of the lens.
C equal to twice the focal length of the lens.
D less than half the focal length of the lens.

- 27 The diagram shows the different waveforms of the musical notes played on a flute.

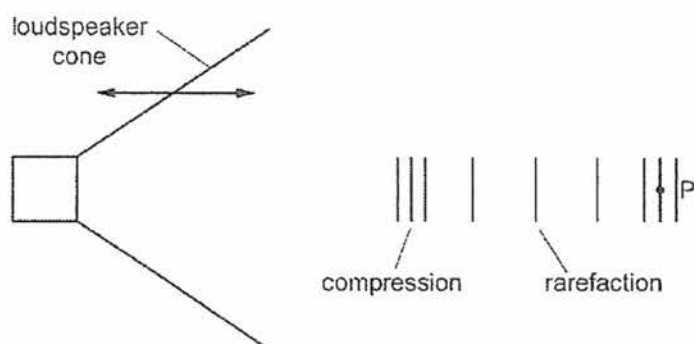
Which waveform, A, B, C or D, has the highest pitch?



- 28 A student stands 50 m from a wall and knocks two wooden blocks together. When the frequency of knocking is 3 knocks per second, the echo of a knock is heard at the instant of the next one. What is the speed of sound in air?

A 150 m/s B 200 m/s C 300 m/s D 350 m/s

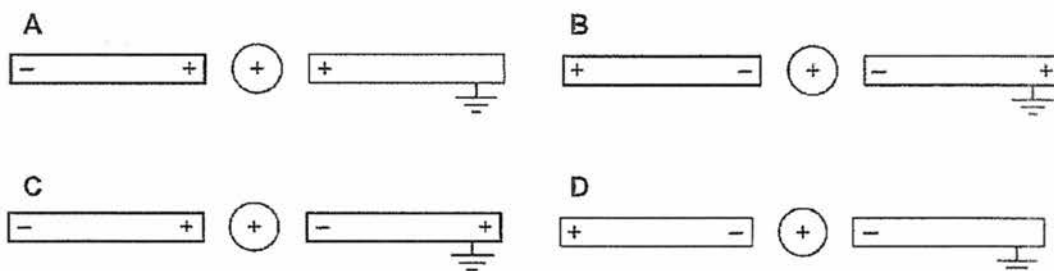
- 29 Compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forwards. The frequency of vibration is 50 Hz.



A compression is at point P. How much time elapses before the next rarefaction arrives at P?

- A 0.010 s B 0.020 s C 25 s D 50 s
- 30 A positively charged metal sphere is placed midway between two previously uncharged metal rods, one of which is connected to earth.

Which diagram shows the charges on the rods?

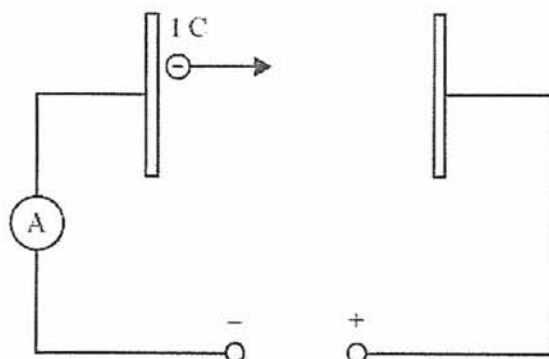


- 31 A 6.0 V battery is connected to a 3.0 M Ω resistor.

How much charge flows through the resistor in 20 s?

- A 0.50 μC B 2.0 μC C 10 μC D 40 μC

- 32 One joule of work is done in moving one coulomb of charge between two plates as shown.



From the information given, which of the following statements must be true?

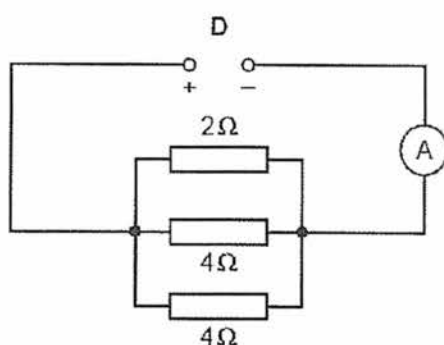
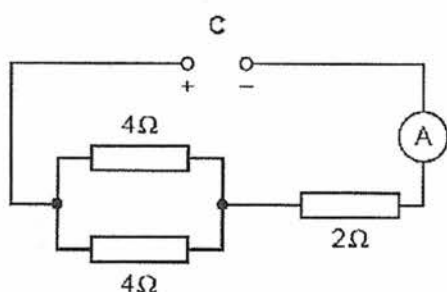
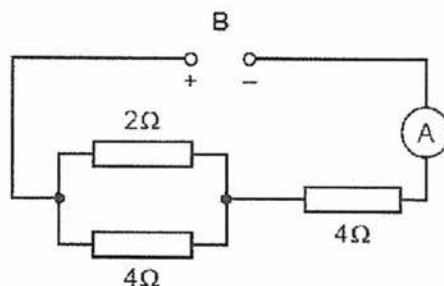
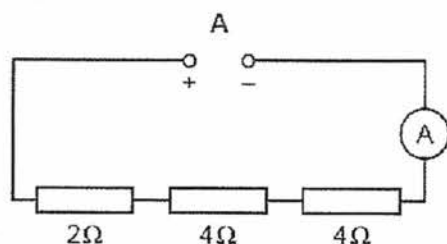
- A The distance between the plates is one metre.
 - B The current in the circuit is one ampere.
 - C The resistance of the circuit is one ohm.
 - D The potential difference between the plates is one volt.
- 33 A piece of wire 0.50 m long has a cross-sectional area of 1.0 mm^2 .

Which wire of the same material has twice the resistance?

	length	area/ mm^2
A	0.25	1.0
B	0.25	2.0
C	0.50	0.5
D	0.50	2.0

- 34 An ammeter is connected to three resistors and a power supply.

Which arrangement of resistors gives the greatest ammeter reading?



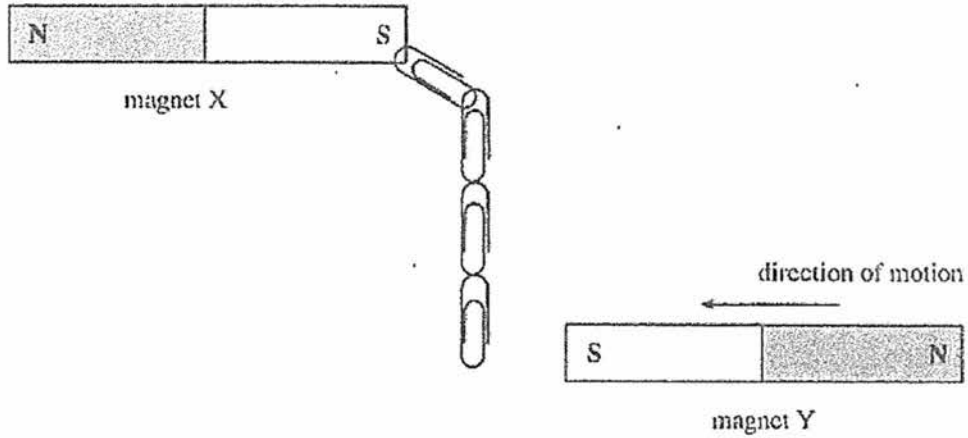
- 35 A metal bar PQ hangs from a thin thread and always comes to rest with end P pointing north.

Another bar XY of the same metal settles in no definite direction.

What happens if the two bars are brought near one another?

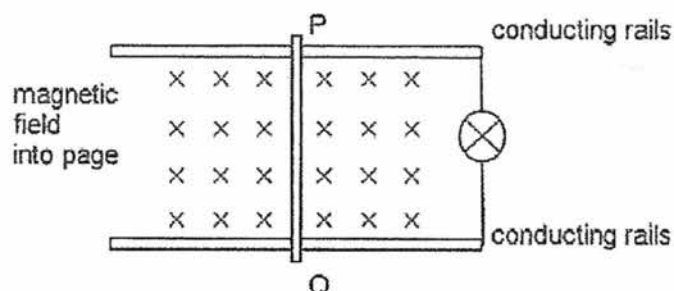
- A End P and end Q both attract end X.
- B End P attracts end X but repels end Y.
- C End P neither attracts nor repels end X.
- D End P repels end X but attracts end Y.

- 36 A bar of permanent magnet, X, is used to pick up some steel paper clips from a table. When another permanent magnet, Y, is brought near the clips as shown below, how will the chain of paper clips behave?



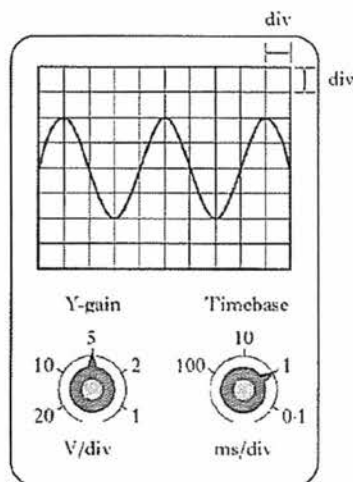
- A A few clips will start to break off from the bottom of the chain and get attracted to magnet Y.
B The chain of clips will bend away from magnet Y.
C The chain of clips will bend towards magnet Y.
D The chain of clips will not be affected by the presence of magnet Y.
- 37 Which of the following statements best describes the function of a split ring commutator in a d.c. motor?
- A It increases the turning effect of the coil of wire.
B It allows electrical contact between the coil of wire and the battery.
C It reverses the direction of the current in the coil of wire after half a revolution.
D It reverses the direction of the rotation of the coil of wire after half a revolution.

- 38 A light metal rod PQ is moved to the right on two conducting rails.



Which statement is correct?

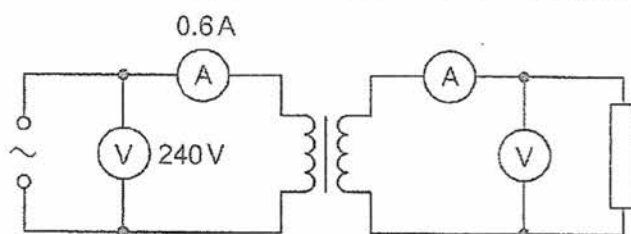
- A P is a higher potential and current flows from P to Q through the rod.
 - B P is at a higher potential and current flows from Q to P through the rod.
 - C Q is at a higher potential and current flows from P to Q through the rod.
 - D Q is at a higher potential and current flows from Q to P through the rod.
- 39 The output from a signal generator is connected to the input terminals of an oscilloscope. The trace observed on the oscilloscope screen, the Y-gain setting and the timebase setting are shown.



The frequency of the signal shown is calculated using the

- A timebase setting and the vertical height of the trace
- B timebase setting and the horizontal distance between the peaks of the trace.
- C Y-gain setting and the vertical height of the trace
- D Y-gain setting and the horizontal distance between the peaks of the trace

- 40 The diagram shows an ideal transformer connected to a resistor.



Which one of the following shows possible readings for the voltmeter and the ammeter in the output circuit?

	voltmeter reading	ammeter reading
A	40 V	360 mA
B	120 V	300 mA
C	360 V	0.4 A
D	400 V	1 A

~ End of Paper ~

NAME	CLASS	INDEX No.
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ST. PATRICK'S SCHOOL PRELIMINARY EXAMINATIONS 2017

SUBJECT : PHYSICS 5059 PAPER 2 **DATE :** 18 Aug 2017

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. Make sure your name, class and register number are clearly written in ink on this cover page.
2. **For Section A:** Answer ALL questions. Write your answers in the spaces provided.
3. **For Section B :** Answer ALL questions. Write your answers in the spaces provided. Question 12 is an **EITHER / OR QUESTION. SELECT ONLY ONE PART OF THIS QUESTION.**
4. Calculators may be used where necessary. **Where numerical answers are not exact, give answers to Three (3) significant figures.**
5. **DO NOT DETACH** any sections from this paper.

INFORMATION FOR CANDIDATES:

The number of marks is given in brackets [] at the end of each question.
Take acceleration due to gravity, $g = 10 \text{ m/s}^2$.

For Marker's Use Only

Section	A (50 m)	B (30 m)	P2 Total (80 m)	Total (120)	Grade
Score					

Teacher's comments (if any): _____

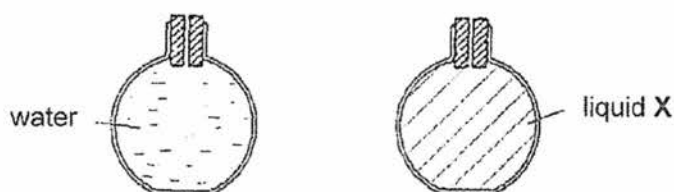
Parent's / Guardian's Signature: _____ Date: _____

This question paper consists of 22 printed pages including the cover page.

Section A : [50 marks]

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

1. An experiment was carried out to measure the density of a liquid using a thick-walled glass bottle fitted with a glass stopper. The figure below shows the bottle filled completely with water and another liquid X.



The following results were obtained:

mass of empty bottle	= 31.1 g
mass of bottle completely filled with water	= 82.3 g
mass of bottle completely filled with liquid X	= 72.1 g

Given that the density of water is 1.00 g/cm^3 , calculate the

- (a) mass of water;

mass of water = _____ [1]

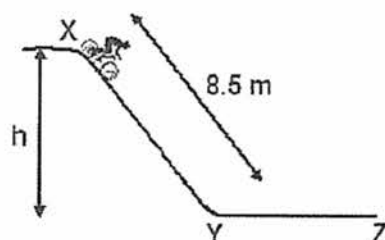
- (b) volume of the glass bottle;

volume of glass bottle = _____ [1]

- (c) density of liquid X.

density of liquid X = _____ [2]

2. The figure below shows a mountain-biker cycling down a steep slope during an X-treme Games competition. The total mass of the biker and his bicycle is 82 kg and gravitational field strength is 10 N/kg.



The biker moves at a speed of 2.0 m/s at X, the top of the slope. When he reaches the bottom of the slope at Y, his speed is 9.0 m/s. The length of the slope XY is 8.5 m and the average frictional force between the bike wheels and the slope XY is 300 N.

- (a) Calculate the kinetic energy of the biker and his bike at Y.

kinetic energy = _____ [2]

- (b) By neglecting air resistance, calculate the height h .

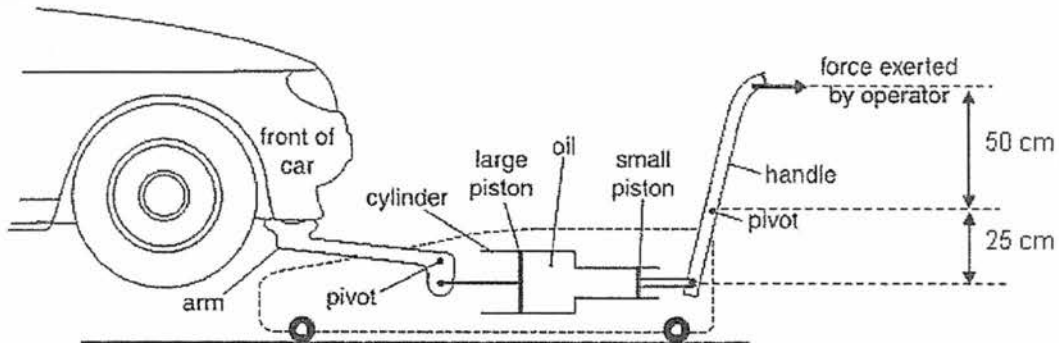
h = _____ [3]

- (c) After the slope, the biker travels at a constant speed on a rough pavement YZ.

Describe the energy conversion of the biker and his bike from Y to Z.

_____ [1]

3. The figure below shows part of a hydraulic jack used to lift the front of a car.



The operator pulls the handle and the force exerted by the operator is 60 N. The force exerted by the oil on the large piston is F . The large piston moves and rotates the arm about the pivot. This raises the front of the car.

The cross-sectional area of the small piston is 1.5 cm^2 .
The cross-sectional area of the large piston is 5.0 cm^2 .

(a) Calculate

- (i) the force acting on the small piston,

force = _____ [2]

- (ii) the pressure in the oil caused by the force on the small piston,

pressure = _____ [2]

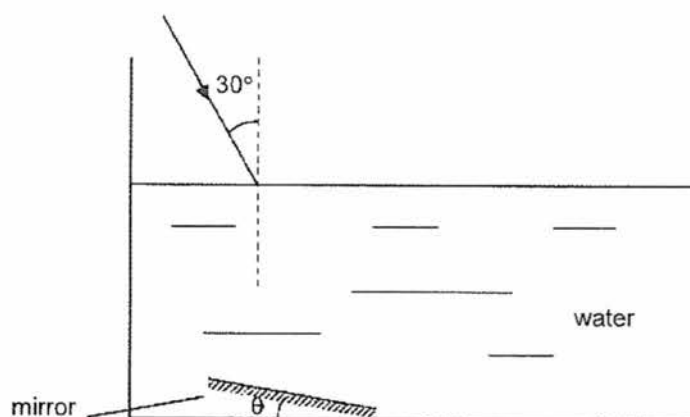
- (iii) the value of F .

F = _____ [1]

- (b) Explain why the large piston moves through a shorter distance than the small piston.

[2]

4. The figure below shows a horizontal rectangular tank containing water. A plane mirror is placed at an angle to the bottom surface of the tank. A ray of light is incident on the surface of the water at an angle of 30° as shown.



- (a) If the refractive index of water is 1.33, calculate
- (i) the angle of refraction for the ray as it enters the water,

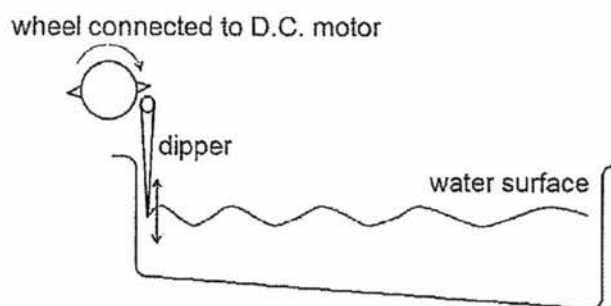
angle of refraction = _____ [1]

(ii) the critical angle at water-air boundary.

critical angle = _____ [2]

(b) On the same figure, draw the path of the ray of light through the liquid and after it has emerged from the water surface, given that angle $\theta = 10^\circ$. [2]

5. The figure below shows a dipper that will vibrate up and down vertically as the wheel turns, creating waves on a water surface.



(a) With reference to the figure above, explain what is meant by wave motion.

[2]

(b) The wheel makes 4 revolutions every second.
State the frequency of the vibration of the dipper.

frequency = _____ [1]

- (c) The table below shows how the wavelength of the waves varies with the depth of the water. The speed of revolution of the wheel remains constant.

depth of water/ cm	wavelength / cm
5.0	1.5
10.0	3.1
15.0	4.6
20.0	6.1
25.0	7.5

Using the values in the table, explain how wave speed varies with the depth of water.

[2]

6. A man is using an auto-focus camera to take a picture of an object. The camera determines the distance between the camera and the object by bouncing an ultrasonic sound wave off the object.

- (a) Explain why the man is unable to hear the sound wave.

[1]

- (b) Explain why the auto-focus function of the camera will not work if the man tries to take a picture of the scenery from inside a bus, through a window pane.

[1]

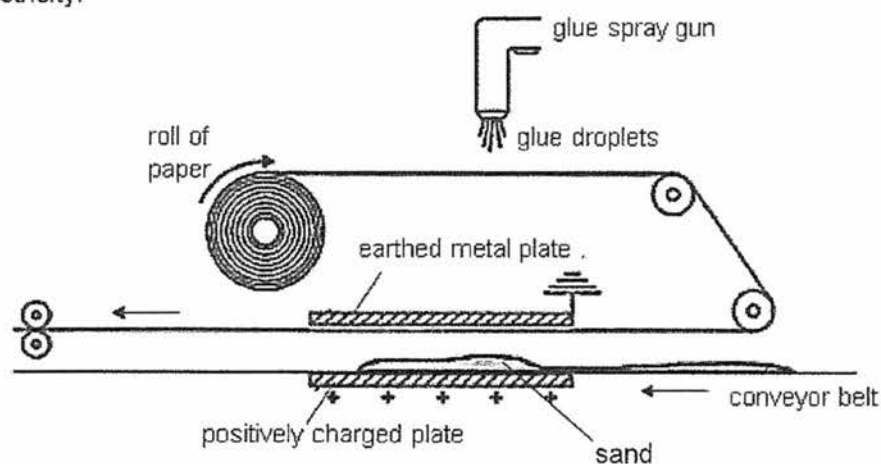
- (c) The distance between the camera and the object to be taken is 2.4 m. If the speed of sound in air is 340 m/s, calculate the time taken for the sound wave to return to the camera after leaving the camera.

time taken = _____ [2]

- (d) Suggest whether this method of auto-focus can be used for cameras in space and explain your answer.

[2]

7. The figure below 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.

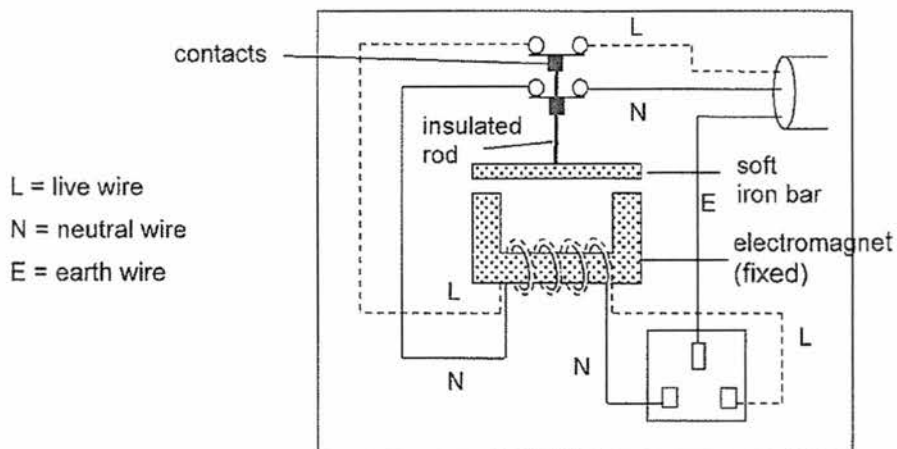
- (a) Explain the advantage of having all the droplets of glue negatively charged.

[2]

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

[2]

8. The figure below shows a circuit breaker with the contacts closed.



- (a) State a hazard which happens in the household circuit which causes this device to be triggered.

[1]

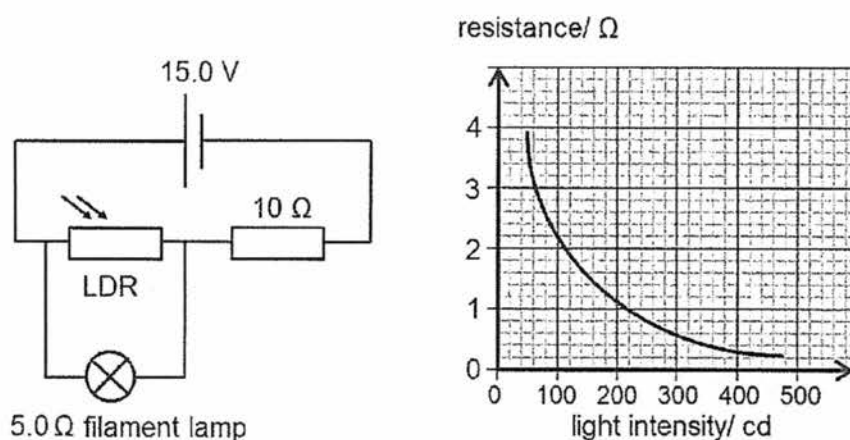
- (b) Explain how this device helps to switch off the mains supply whenever the hazard stated in (a) occurs.

[3]

- (c) State two modifications which can be made if this circuit breaker is to be used to break a circuit at a lower current.

[2]

9. The figure below shows a LDR connected to a battery of e.m.f. 15.0 V in a circuit and a graph that shows how the resistance of the LDR varies with the surrounding light intensity.



- (a) Describe and explain how the brightness of the filament lamp changes as the surrounding light intensity decreases.

[3]

- (b) Calculate the current passing through the light bulb when the surrounding light intensity is 100 cd.

current = _____ [3]

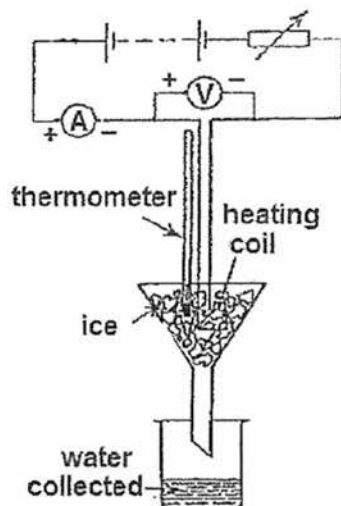
- (c) State one practical use for such a circuit.

[1]

SECTION B : [30 marks]

Each question is 10 marks. Answer ALL questions in this section. Question 12 is an EITHER / OR QUESTION. SELECT ONLY ONE PART OF QUESTION 12. Show your working and write your answers in the spaces provided.

10. A student performed an experiment using the apparatus as illustrated in the figure below.



A heating coil was placed in a filter funnel and surrounded by lumps of ice. The potential difference V across the heater and mass m of water collected in time t of 500 s were measured for various values of the heater current, I .

The values were recorded and a spreadsheet was used to make calculations as shown in table below.

	A	B	C	D	E
No	potential difference, V	Current, I	Mass of water collected, m	Time taken, t	Thermal energy supplied
	/ V	/ A	/ g	/ s	/ J
1	4.0	2.0	14.9	500	4000
2	6.0	3.0	29.8	500	9000
3	7.0	3.5	39.5	500	12250
4	8.0	4.0	50.6	500	

- (a) Explain how the values for the thermal energy supplied by the heating coil in column E were calculated from the relevant columns in the table.

_____ [1]

- (b) Calculate the thermal energy supplied when the mass of the water collected was 50.6 g.

thermal energy = _____ [2]

- (c) The student wishes to find out the value of the *specific latent heat of fusion of ice*.

- (i) State what is meant by *specific latent heat of fusion of ice*.

_____ [2]

- (ii) The student chose the values from row 4 to do the calculation. Write down the equation that will help him get started. (You should define symbols that are used in the equation.)

_____ [1]

- (iii) Hence, determine the value of the specific latent heat of fusion of ice.

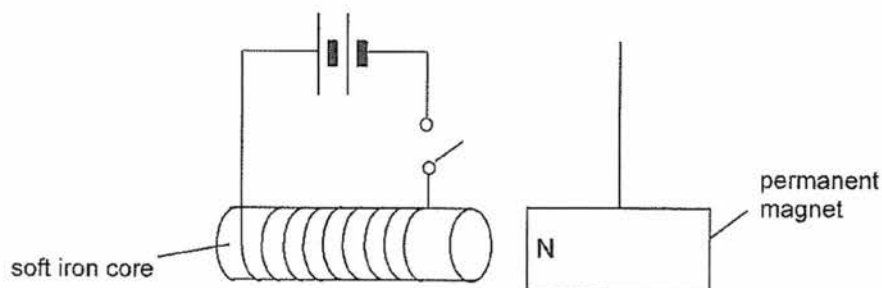
specific latent heat of fusion of ice = _____ [2]

- (d) Later, the student discovered that all four values of the specific latent heat of fusion of ice calculated from each row of data were less than actual value of 336J/g. Suggest a reason to explain the discrepancy.

[2]

11. A coil of wire wound round a soft iron core is connected to a switch and batteries in series.

A permanent magnet is suspended with its North pole near one end of the core as shown in the figure below.

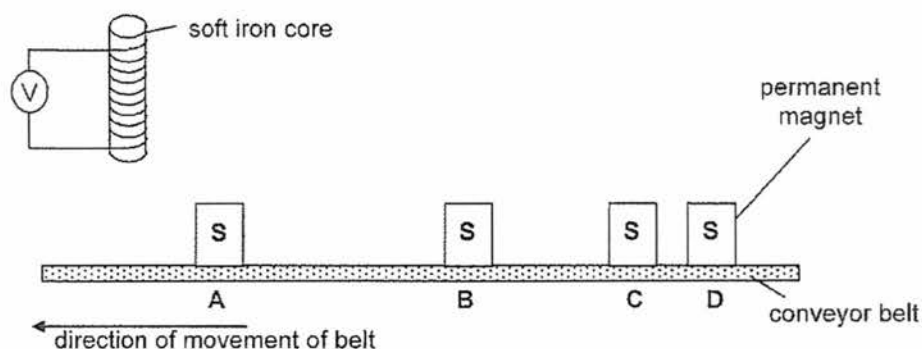


- (a) Describe and explain what will happen to the magnet when the switch is closed.

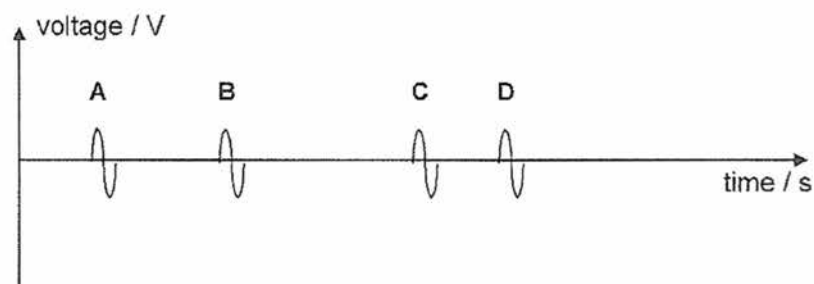
[2]

- (b) The switch and batteries connected to the coil are now removed and replaced by a sensitive voltmeter. Small permanent magnets, attached to a conveyor belt, are moved under the coil which act as a detecting device as shown in the figure below.

The voltmeter records voltage pulses as the conveyor belt moves along positions A, B, C and D at constant speed.



The graph below shows how the voltmeter reading varies time, with the letters A, B, C and D corresponding to the positions of the belt as each magnet passes under the coil.



- (i) Explain why the voltage pulses occur.

[1]

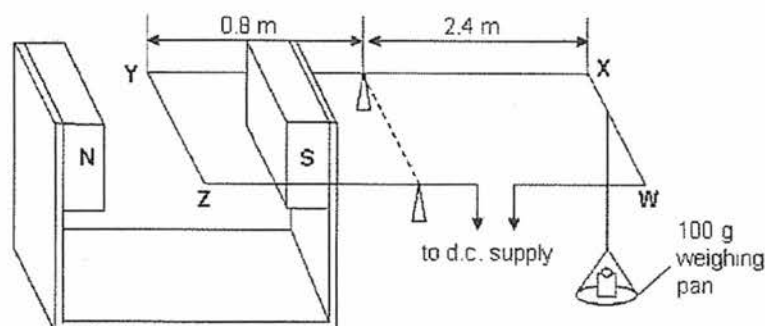
- (ii) Explain why the pulse produced by each magnet has a positive and a negative value as it passes the coil.

[2]

- (iii) State one way to produce a voltage pulse of greater amplitude.

[1]

- (c) A rectangular coil is balanced in a horizontal position when current flows through it as shown in the figure below. The coil is pivoted at two fulcrums and connected to a d.c. power supply. A weighing pan of 100 g mass is hung at side WX, while side YZ is placed inside a magnetic field.



- (i) Calculate the moment produced by the weighing pan about the pivot and state the direction of this moment.

moment = _____ [1]

direction = _____ [1]

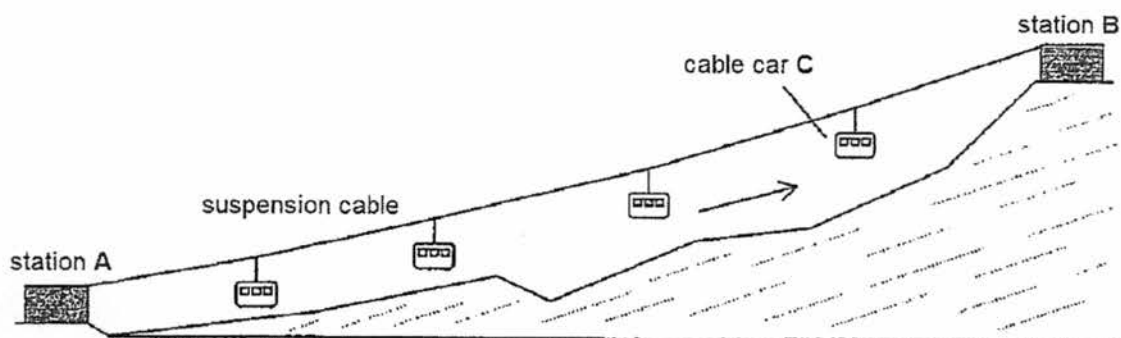
- (ii) Hence, state the direction of the current flowing in YZ and explain how you derived your answer.

[2]

Question 12 is an EITHER / OR question.

Either

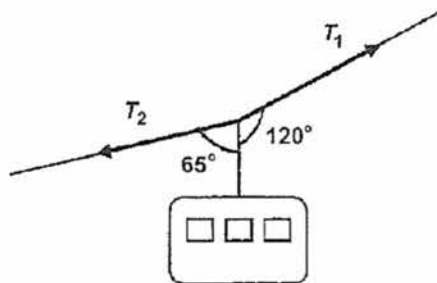
12. The figure below shows a cable car system for transporting passengers from station A to station B on top of a hill. The mass of the cable car C is 600 kg.



- (a) State the magnitude of cable car C's weight.

weight = _____ [1]

- (b) The figure below shows cable car C suspended by the cable with tensions T_1 and T_2 .



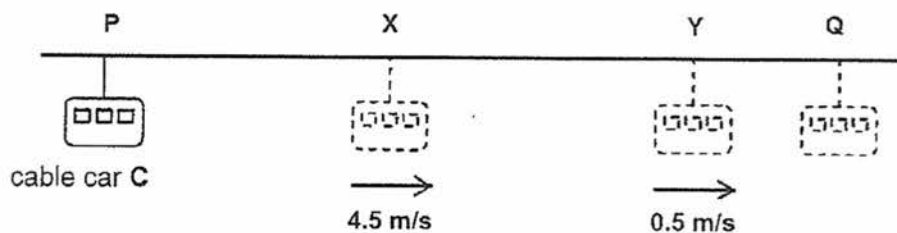
The cable car is moving at a constant velocity towards the top of the hill. By using a suitable scale, draw a vector diagram to determine T_1 and T_2 . Use a scale of 1 cm to represent 6000 N.

[1]

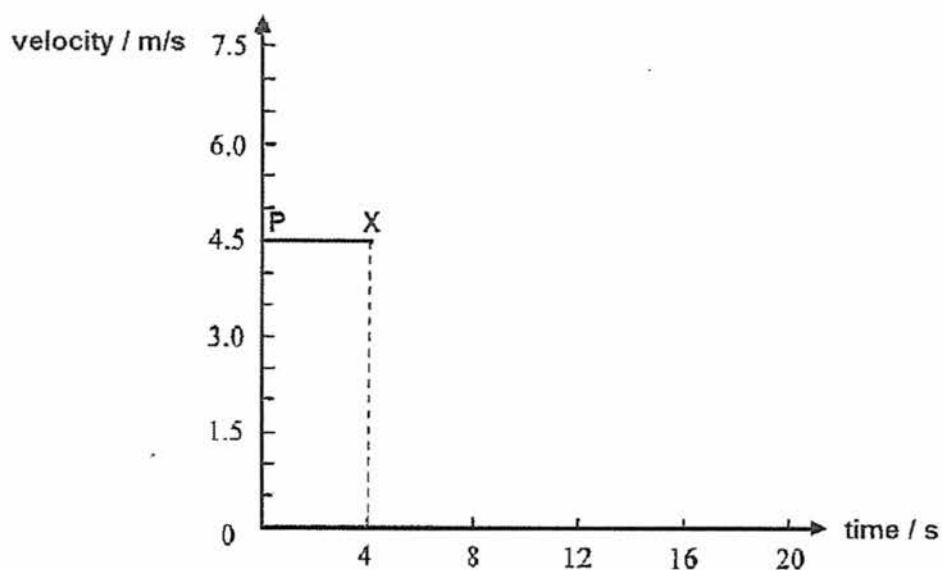
$$T_1 = \underline{\hspace{2cm}} \quad [1]$$

$$T_2 = \underline{\hspace{2cm}} \quad [1]$$

- (c) The cable car C enters station B with a constant velocity of 4.5 m/s in the horizontal direction as shown in the figure below. For passengers to leave the cabin, cable car C begins to slow down with constant deceleration after it passes X. The velocity is reduced to 0.5 m/s at Y, and it takes 8.0 s for cable car C to travel from X to Y. After Y, the cable car travels at constant velocity for the remaining journey.



- (i) Sketch the velocity-time graph of the cable car for the journey between X and Q. [2]



- (ii) Hence, find the distance between X and Y.

distance = _____ [2]

- (d) A 50 kg person sits in the cable car. Calculate the magnitude of the resultant force on the person during the deceleration from X to Y.

resultant force = _____ [2]

OR

12. The figure below shows a diver working below the surface of a lake. The density of the water in the lake is 1000 kg/m^3 , the atmospheric pressure at the surface is $1.0 \times 10^5 \text{ Pa}$ and the gravitational field strength is 10 N/kg .



The diver inflates a balloon with air at a depth of 15 m and attaches the balloon to a tray of objects.

- (a) Calculate the total pressure at 15 m below the surface of the lake.

total pressure = _____ [2]

- (b) The air in the balloon occupies a volume of 0.048 m^3 at the pressure calculated in (a). When the diver releases the tray, the balloon, started to ascend with the tray. The temperature of the air in the balloon does not change.

Calculate the volume occupied by the air in the balloon when it reaches the surface of the lake.

volume = _____ [2]

- (c) State one difference between the motion of the molecules of water in the lake and the molecules of air in the balloon.

[1]

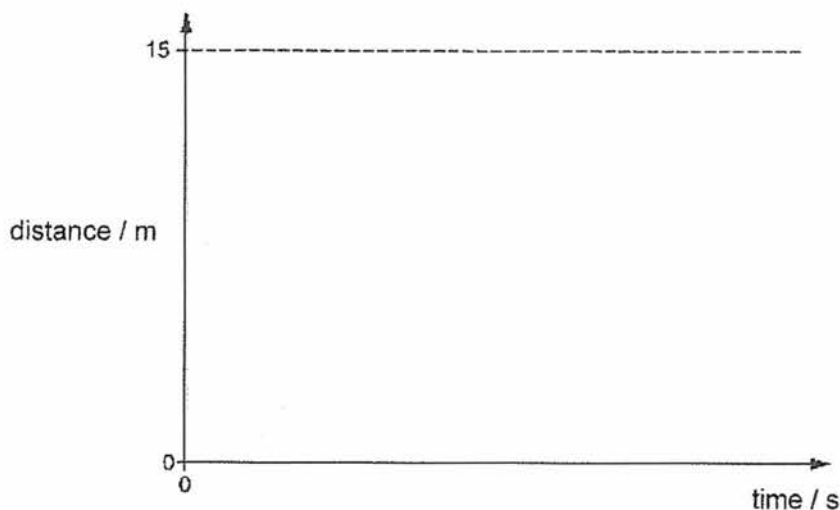
- (d) In ascending to the surface of the lake, the balloon first accelerates and before reaching a constant speed before it arrives at the surface.

- (i) Explain how the forces acting on the balloon cause it to behave in this way.

[3]

- (ii) On the axes below, sketch the distance-time graph for the balloon as it travels 15 m to the surface.

[2]



End of paper

Answer for Prelim Physics 4E 2017

Paper 1

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

Paper 2

Section A

missing/wrong unit – 1 mark per question

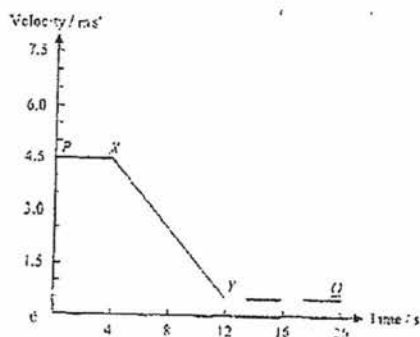
sig fig – 1 mark per question

1. (a) mass of water = $82.3 - 31.1$
= 51.2 g [1] Total 4
- (b) volume = $51.2 / 1$
= 51.2 cm³ [1]
- (c) density = $(72.1 - 31.1) / 51.2$
= 0.801 g/cm³ [1]
[1]
2. (a) KE at Y = $0.5 \times 82 \times (9)^2$
= 3321 J [1] 6
[1]
- (b) $\frac{1}{2} (82)(2)^2 + (82)(10)(h)$ = 3321 + (300)(8.5)
h = 6.96 m [2]
[1]
- (c) Kinetic energy to thermal energy [1]
3. (a) (i) Taking moment about the pivot, 7
 60×50 = Force $\times$ 25
Force = 120 N [1]
[1]
- (ii) pressure = $120 / 1.5$
= 80 N/cm² or 800000 Pa [1]
[1]
- (ii) F = 80 $\times$ 5
= 400 N [1]
- (b) Work done by both pistons are the same since energy is conserved, [1]
larger force in the large piston results in a shorter distance moved. [1]

4. (a) (i) $\frac{1.33}{r} = \frac{\sin(30^\circ)}{\sin r}$ [1] 5
 $r = 22.1^\circ$
- (ii) $\frac{1.33}{c} = \frac{1}{\sin c}$ [1]
 $c = 48.8^\circ$ [1]
- (b) Angle of incident at mirror is 32.1° [1]
 Light refracts out of water with angle of incidence 42.1° [1]
5. (a) Wave motion is the propagation of energy through the vibration of particles of a source and the medium. [1] 5
 The direction of vibration of particles is perpendicular to that of the direction of the wave. [1]
- (b) frequency = 8 Hz [1]
- (c) As the depth increases, wavelength increases and frequency remains constant. [1]
 resulting in speed increasing. [1]
6. (a) The ultrasonic sound wave is beyond the audible range of frequency of the human ear. [1] 6
- (b) The sound wave will be reflected from the window of the bus and the distance measured by the camera would be the distance between the camera and the window. [1]
- (c) time = $(2 \times 2.4) / 340$ [1]
 $= 0.0141 \text{ s}$ [1]
- (d) It cannot be used in space [1]
 because sound waves cannot travel in vacuum. [1]
7. (a) The glue droplets will repel each other due to their like charges. The glue will be evenly coated on the paper. [1] 4
[1]
- (b) As the sand passes the positively charged plate, it becomes positively-charged. [1]
 The positive charges on the sand are attracted to the electrons on the glue. [1]
8. (a) Short circuit [1] 6
- (b) The large current causes the solenoid to become a stronger electromagnet [1]
 that can attract the soft iron bar downwards. [1]
 This causes the circuit to become open and current no longer flows through it. [1]
- (c) Increase the number of turns of coil in the electromagnet [1]

- Decrease the distance between the electromagnet and the soft iron bar. [1]
9. (a) When the surrounding light intensity decreases, resistance of the LDR increases [1]
 According to the potential divider rule, potential difference across LDR will increase [1]
 The lamp will be brighter [1]
- (b) resistance of LDR = 2.2Ω
 Total resistance = $[1 / ((1/2.2 + 1/5.0)) + 10]$
 = 11.5Ω [1]
 current = $15 / 11.527$
 = 1.30 A [1]
 $V_{10\Omega} = 1.3 \times 10$
 = 13 V
 $V_{\text{lamp}} = 15 - 13$
 = 2 V
 current in lamp = $2 / 5$
 = 0.40 A [1]
- (c) Street lamp [1]
10. (a) Thermal energy = $V I t$, values from column A, B D are multiplied [1] 10
- (b) energy = $8 \times 4 \times 500$ [1]
 = 16000 J [1]
- (c) (i) Amount of energy needed to change 1kg of ice to water or water to ice [1]
 without a change in temperature. [1]
- (ii) Energy needed = mass x specific latent heat of fusion [1]
- (iii) $50.6 \times l_f = 16000$ [1]
 $l_f = 316 \text{ J/g}$ [1]
- (d) Heat was absorbed from the surrounding by the ice. [1]
 As such, more mass of ice was melted causing calculated value of l_f to be lesser than 336 J/g . [1]
- 11 (a) When switch is closed and current flows in the coil, the end of the coil facing the magnet becomes a North pole [1]
 Hence the magnet repels from the coil as like poles repel. [1]
- (b) (i) As the magnet moves with the conveyor belt, the coil experiences a changing magnetic flux, thus inducing an emf in the coil. [1]

(c) (i)



XY
YQ

[1]
[1]

(ii) distance = $\frac{1}{2} \times (4.5 + 0.5) \times 8$
= 20 m

[1]
[1]

(d) acceleration = $(0.5 - 4.5) / 8$
= -0.5 m/s^2
resultant force = 50×0.5
= 25 N

[1]
[1]

12 (a) pressure = $(1000 \times 15 \times 10) + 1.0 \times 10^5$
= $2.5 \times 10^5 \text{ Pa}$

[1]
[1]

10

(b) $250\,000 (0.048) = 100\,000 (V_2)$
 $V_2 = 0.12 \text{ m}^3$

[1]
[1]

(c) The particles in water slides past one another while the particles in air moves randomly at high speeds.

[1]

(d) (i) The upward force is initially greater than the downward force, which results in an upward resultant force.
As the speed increases, the resistance increases.
Resultant force is zero when the resistance equals to the upward force.

[1]
[1]

(ii) Increasing gradient
Constant gradient

[1]
[1]
[1]