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Geylang Methodist School (Secondary) Preliminary Examination 2016

PHYSICS

5059/01

Paper 1

Sec 4 Express

Additional materials : OAS

1 hour

Setter : Mr Yip Cheng Hou

1 August 2016

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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

Answer **all** questions. Shade your answers on the OAS provided.

At the end of the examination, submit OAS and the question paper separately.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark.

Any rough work should be done in this booklet.

Acceleration due to gravity, g , is assumed to be 10 m/s^2 unless otherwise specified.

- 1 Which group of quantities consists of only vectors?

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

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

- 2 The chart shows the densities of some materials.

material	density in kg m^{-3}
petrol	800
water	1000
aluminium	2700
lead	11 400
gold	19 300

Which statement is true?

- A 1 m^3 of lead is heavier than 1 m^3 of gold.
B 1 kg of petrol has a smaller volume than 1 kg of water.
C 1 mg of lead will sink in 1 kg of petrol.
D 1 cm^3 of aluminium will not sink in 1 m^3 of water.

- 3 Aliens landed on several planets. From the information given, which two aliens landed on the same planet?

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

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

- 4 An object of mass 60 kg hits a stationary air bag. The velocity of the object at the instant of impact is 30 m/s. After 3 s, the object comes to a complete stop.

Calculate the average force acting on the object during this time interval.

- A 60 N B 600 N C 6 000 N D 60 000 N

- 5 A wooden block is pushed across a table at constant speed.

Which statement is correct?

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

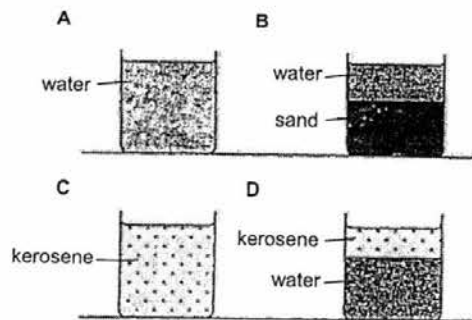
- 6 A uniform metre rule is balanced at its mid-point P on a pivot. A 10 N weight is hung from the rule at various positions.

Which moment of force about point P is **not** possible?

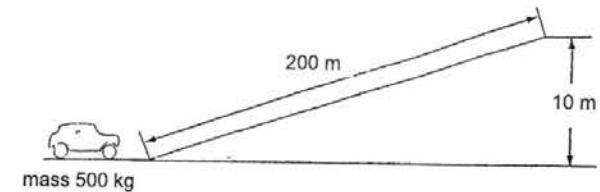
- A 0 Nm B 1 Nm C 5 Nm D 10 Nm

- 7 Four identical beakers A, B, C and D are filled as shown.

Which beaker is the most stable?



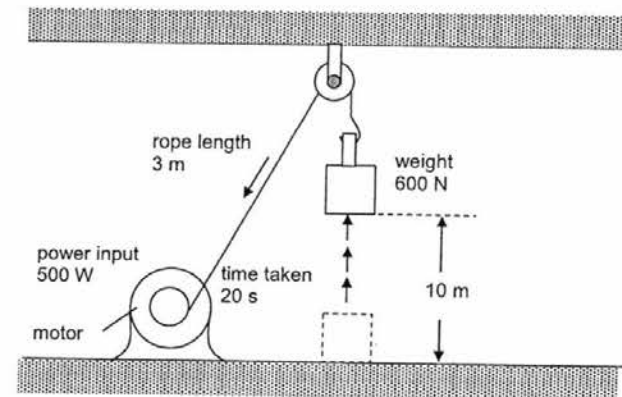
- 8 The diagram shows a small car of mass 500 kg approaching a hill. It moves up the hill with uniform speed.



How much work is done in moving the car up the hill? You may ignore frictional forces.

- A 5×10^3 J B 5×10^4 J C 1×10^5 J D 1×10^6 J

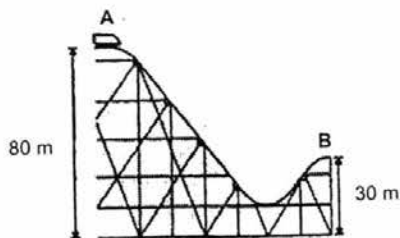
- 9 The motor in the diagram has a power input of 500 W. It is used to lift a load weighing 600 N through a vertical height of 10 m in 20 s.



What is the useful power output of the motor?

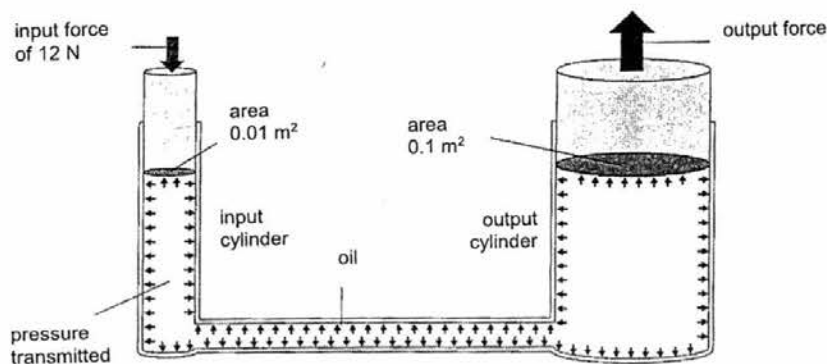
- A 300 W B 390 W C 500 W D 800 W

- 10 In a roller-coaster, a 500 kg cart with 2 seated passengers each of mass 50 kg passes from A to B. The speed of the cart at A is 2 m/s. Assuming the distance of the rail between A and B is 100 m and the average friction along the rail is 200 N, what is the speed of the cart at B?



- A 30.4 m/s B 30.6 m/s C 31.3 m/s D 31.7 m/s

- 11 Calculate the output force for the simple hydraulic system as shown below.

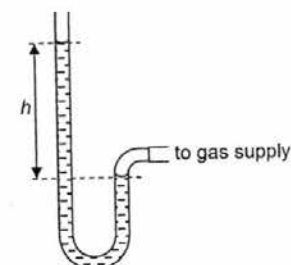


- A 1.2 N B 12 N C 120 N D 1 2000 N

- 12 If a mercury barometer reads 76 cm, what will be the reading on a barometer if it is filled with water and the reading is taken at the same place? The density of mercury is 13.6 times more than that of water.

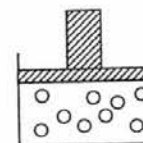
- A 5.6 cm B 76 cm C 103.4 cm D 1034 cm

- 13 The diagram shows a manometer connected to a gas supply. The liquid levels on both limbs of the manometer have a height difference of h .



Which change would make the value of h larger?

- A Increase the cross sectional area of the limbs.
 B Use another liquid which has a lower density.
 C Use another liquid which has a higher density.
 D Carry out the experiment on a planet which has a stronger gravity.
- 14 The diagram shows a frictionless piston being pushed slowly into an airtight cylinder such that the temperature of the gas remains unchanged.



Which statement accounts for the increase in the pressure of the trapped gas?

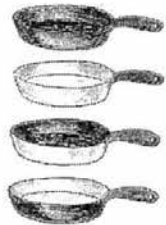
- A Each gas molecule bombards the wall with a greater force.
 B The average speed of the gas molecules increases.
 C The gas molecules make more frequent collisions with the wall.
 D The number of gas molecules increases.

- 15 When fine pollen grains suspended in water are viewed under a microscope, they are seen to be making small, erratic movements.

Why is this?

- A There are convection currents in the water.
 B They are being hit by random moving water molecules.
 C They are moving and colliding with one another.
 D They are living organisms so they move around.
- 16 A consultant for a cookware manufacturer wishes to make a pan that will have two features: (a) absorb thermal energy from a flame as quickly as possible, and (b) have a cooking surface that stays as hot as possible when heated.

Which pan would be recommended?



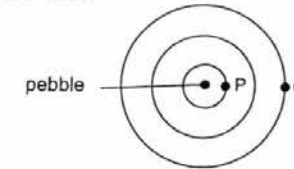
- A outer and inner surface black;
 B outer and inner surface shiny.
 C outer surface shiny and inner surface black.
 D outer surface black and inner surface shiny

- 17 Ice is taken from a freezer and left in a room. The ice melts and eventually the water reaches room temperature.

Which energy transfers take place?

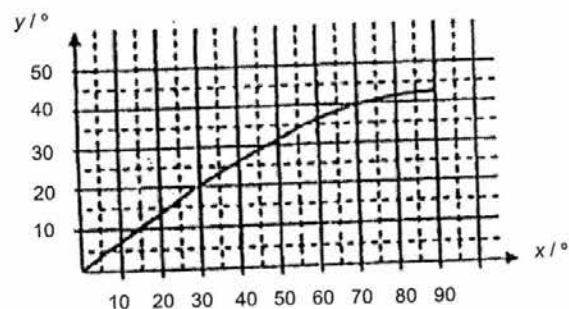
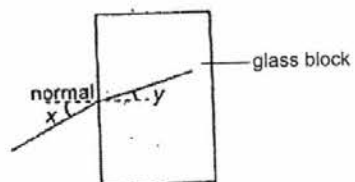
	energy transfer during melting	energy transfer after melting
A	from ice to room	from water to room
B	from ice to room	from room to water
C	from room to ice	from room to water
D	from room to ice	from water to room

- 18 A pebble is dropped into still water so that circular wavefronts are seen to travel outwards with a speed of v . If the wavelength is λ , what is the time taken for the wave to travel from P to Q?



- A $\lambda / (2v)$ B λ / v C $3\lambda / (2v)$ D $2\lambda / v$
- 19 Which type of wave is used to send telephone signals to and from a satellite?
- A infra-red waves
 B light waves
 C microwaves
 D sound waves
- 20 A girl stands 20 m from her image when facing a flat, large mirror. How far must she walk to be 2.5 m from the mirror?
- A 5 m B 7.5 m C 15 m D 17.5 m
- 21 What happens to light as it passes from glass into air?
- A Its frequency decreases because its speed decreases.
 B Its frequency increases because its speed increases.
 C Its wavelength decreases because its speed decreases.
 D Its wavelength increases because its speed increases.

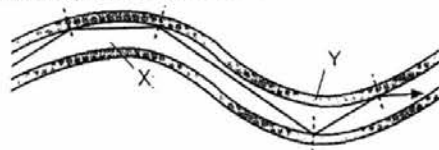
- A student conducts an experiment to determine the angle of refraction y for light entering a glass block at various angles of incidence x as shown in the diagram below. A graph of y against x is also plotted below the diagram.



What is the critical angle of the glass used in the glass block?

- A 0° B 29° C 43° D 90°

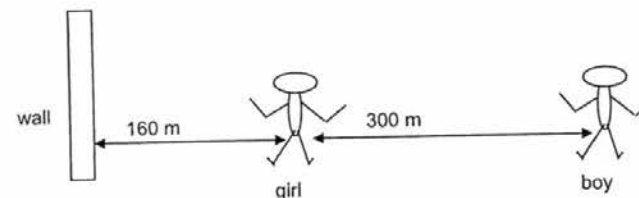
- 23 The diagram shows how light travels through the optical fiber of an endoscope used to look into stomach of ulcer patients. X represents the inner material of the optical fiber while Y represents the outer material.



Which of the following statements is **not** true?

- A No light is lost through the optical fiber.
 B The light in the optical fiber obeys the Laws of reflection.
 C The refractive index of X is greater than the refractive index of Y.
 D The refractive index of Y is greater than the refractive index of X.

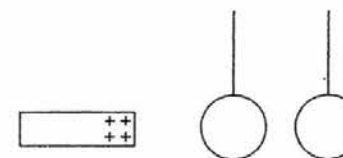
- 24 A boy, standing 460 m in front of a large wall, fires a shot with a starting pistol. A girl, standing 300 m in front of him, hears two bangs 1.0 s apart.



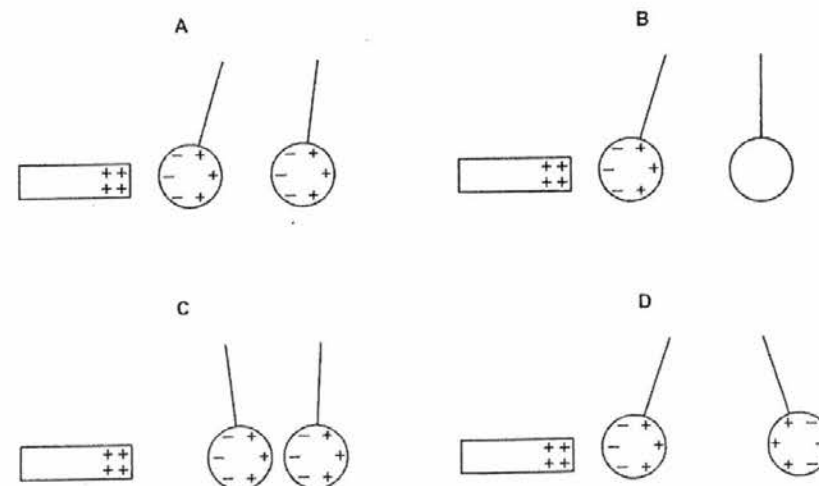
From the information given, calculate the speed of sound in air.

- A 160 m/s B 300 m/s C 320 m/s D 460 m/s

- 25 Two uncharged metal spheres, not touching one another, are suspended by means of cotton thread. A positively charged rod is brought near.



Which diagram shows what happens to the spheres?

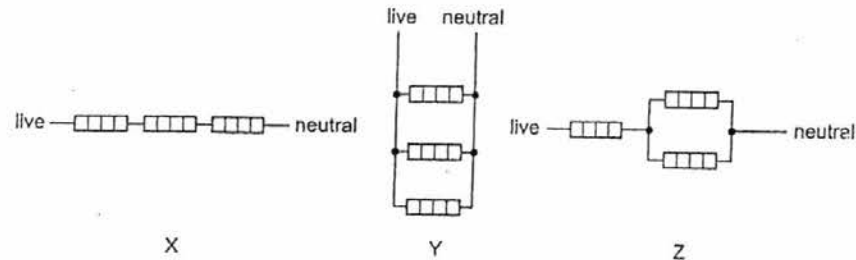


- 26 An accumulator supplies 9600 C in 7200 s to a resistance wire of $18\ \Omega$.

What is the work done to move a charge of 1 C through the wire?

- A 12.0 J B 21.5 J C 24.0 J D 32.0 J

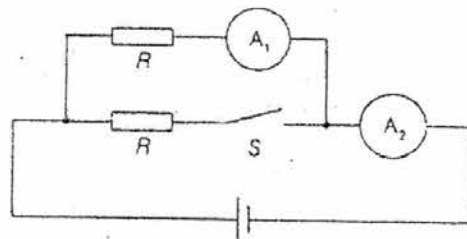
- 27 Three identical heating elements are wired to the mains supply in the three arrangements as shown.



Which arrangement has the lowest and highest current flowing through?

	lowest current	highest current
A	X	Z
B	X	Y
C	Y	X
D	Y	Z

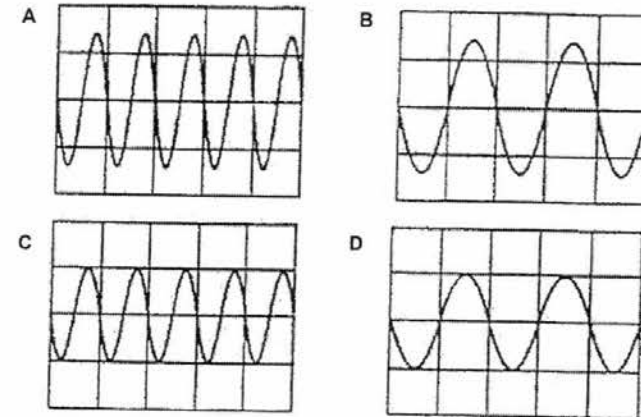
- 28 If the switch on the diagram below is closed, what will happen to the readings of ammeters A_1 and A_2 ?



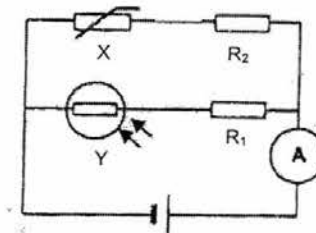
	A_1	A_2
A	decreases	increases
B	increases	decreases
C	increases	increases
D	unchanged	increases

- 29 The Y-input terminals of an oscilloscope are connected to a voltage supply of peak value 5.0 V and of frequency 50 Hz. The time-base is set at 10 ms per division and the Y-gain at 5 V per division.

What trace could be obtained?



- 30 In the circuit shown, R_1 and R_2 are identical resistors.



Which of the following changes to the electrical components X and Y will increase the reading of the ammeter by the greatest amount?

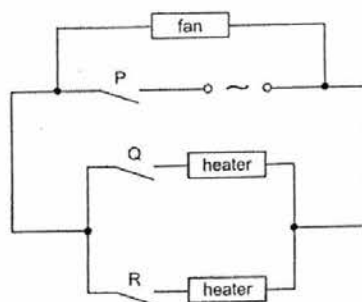
- A Immerse X in a beaker of ice water and decrease the light intensity on Y.
 B Immerse X in a beaker of ice water and increase the light intensity on Y.
 C Immerse X in a beaker of hot water and decrease the light intensity on Y.
 D Immerse X in a beaker of hot water and increase the light intensity on Y.

Five electrical appliances are switched on for the given duration.

In which appliance is the greatest amount of energy converted?

	appliance	time
A	3 kW water heater	0.5 hr
B	1.5 kW hot-plate	2.0 hr
C	750 W pressing iron	3.0 hr
D	100 W lamp	15 hr

32 The diagram shows the circuit for a hair-dryer.

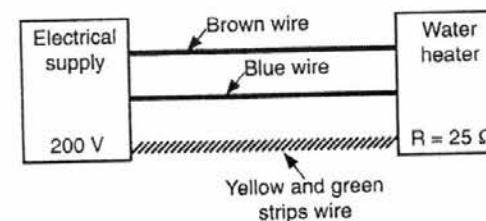


The fan has a power rating of 0.1 kW and the heaters each have a rating of 0.4 kW. The cost of electricity is 8 cents/kWh.

What is the cost of running the dryer for two hours with switches P and Q closed and switch R open?

- A 1.6 cents B 3.2 cents C 6.4 cents D 8.0 cents

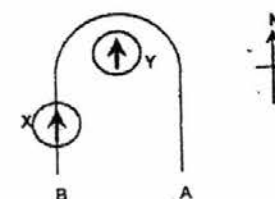
33 The diagram shows the three wires of an electrical supply connected to a water heater.



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 strip 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

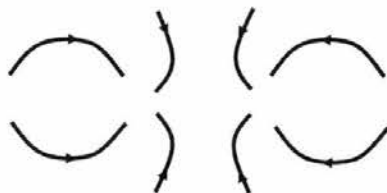
34 The diagram shows a wire AB that is bent into a U-shaped and placed along the earth's north-south direction. Two plotting compasses are placed at positions X and Y. The compass at X is below the wire.



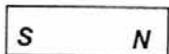
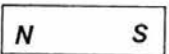
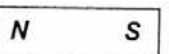
What will happen when a current flows from A to B in the wire?

	compass at X	compass at Y
A	deflects to the right	remains in the position shown
B	deflects to the right	deflects to the left
C	deflects to the left	remains in the position shown
D	remains in the position shown	remains in the position shown

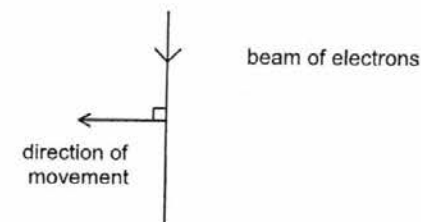
- 35 The diagram shows a magnetic field lines pattern.



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

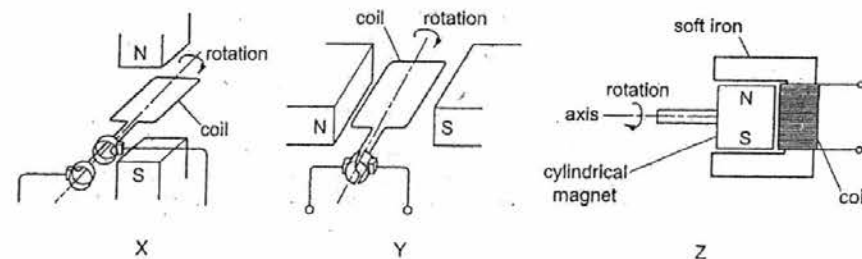
- A  
- B  
- C  
- D  

- 36 A beam of electrons travels between the poles of a magnet. The beam starts to move in the direction shown.



Which is the most likely direction of the magnetic field?

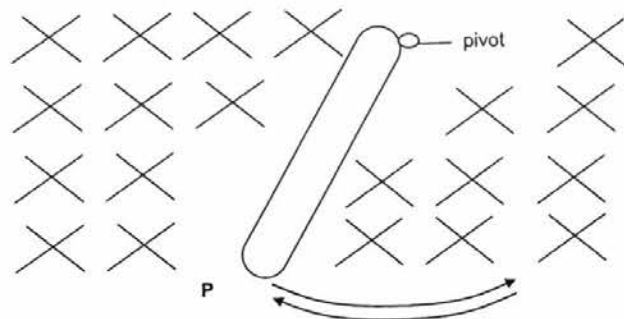
- A into the paper
B out of the paper
C to the right
D to the left
- 37 The diagrams show three generators, X, Y and Z.



Which is/are alternating current generator(s)?

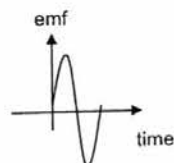
- A X only
B Y only
C X and Y only
D X and Z only

- i The diagram shows a metal bar swinging like a pendulum across a uniform magnetic field. The motion induces an e.m.f. between the ends of the bar.

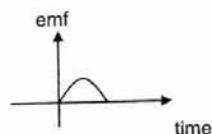


Which graph represents this e.m.f. during one complete oscillation of the bar, starting and finishing at P?

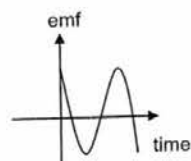
A



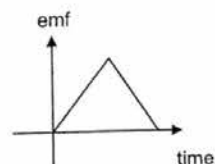
B



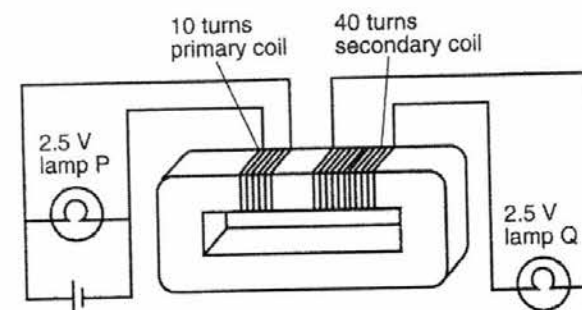
C



D



- 39 A pupil sets up a model transformer as shown.



It is connected to a 2.5 V d.c. supply. Both lamps have a voltage of 2.5 V.

What does the pupil notice about the lamps?

	lamp P	lamp Q
A	normal brightness	not lit
B	very bright	dim
C	normal brightness	very bright
D	dim	very bright

- 40 The number of turns in a primary coil and secondary coil of a transformer is N_P and N_S respectively.

Which pairs of values for N_P and N_S will result in an output voltage of 240 V when the input voltage is 20 000 V?

	N_P	N_S
A	2000	240
B	10 000	240
C	10 000	480
D	30 000	360



Geylang Methodist School (Secondary) Preliminary Examination 2016

Candidate
Name

Class

Index Number

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PHYSICS

5058/02

Paper 2 Physics

Sec 4 Express

Additional materials : Nil

1 hour 45 minutes

Setter : Mr Yip Cheng Hou

1 August 2016

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

Write your answers to **Section A** in the spaces provided in the Question Paper.

Write your answers to **Section B** in the spaces provided in the Question Paper.

Question 13 has a choice of parts to answer.

Candidates are reminded that all quantitative answers should include appropriate units.
You are advised to show all your working in a clear, orderly manner.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

Acceleration due to gravity, **g**, is assumed to be 10 m/s² unless otherwise specified.

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

This document consists of **19** printed pages and **1** blank page.

[Turn over

Section A

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

- 1(a) Fig. 1.1 shows a certain amount of heat is supplied to 1 kg of insulated aluminium and the temperature of the aluminium rises by 1°C .

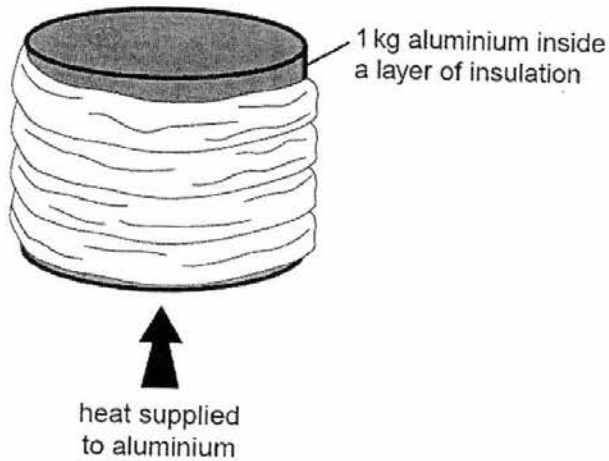


Fig. 1.1

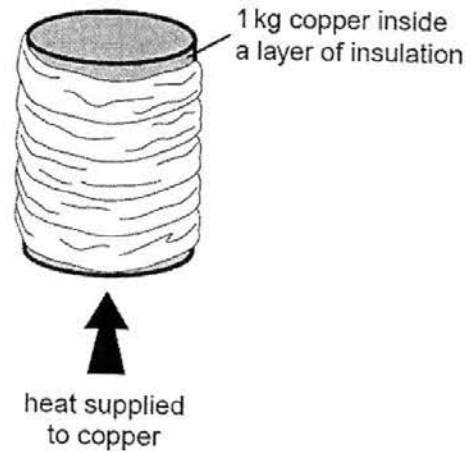


Fig. 1.2

In what form does the aluminium store the energy that has been supplied?

_____ [1]

- 1(b) The same amount of heat is supplied to 1 kg of insulated copper, as shown in Fig. 1.2. The temperature rise of the 1 kg copper block is greater than the temperature rise of the 1 kg aluminium block in (a).

Explain, in terms of heat capacity, why this is so.

_____ [2]

2

A boy throws a 250 g stone vertically upwards to knock down a kite that is stuck between the branches of a tree. Unfortunately, the stone fails to reach the kite and falls back to his hand 6 s after throwing the stone. You are to assume that the time taken for the moving stone to rise and fall is the same.

- (a) Calculate the velocity of the stone just as it leaves the boy's hand.

velocity = _____ [2]

- (b) Calculate the loss in kinetic energy when the stone reaches its maximum height.

loss in kinetic energy = _____ [2]

- (c) Sketch and label a speed-time graph for the moving stone for the entire 6 s.

[2]

- (d) Calculate the maximum height reached by the stone.

maximum height = _____ [1]

- 3 (a) Fig. 3.1 represents a trapdoor hinged at **A**, which is pulled open by force **F**.

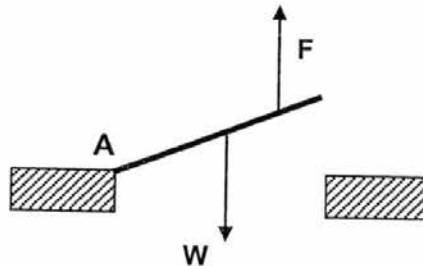


Fig. 3.1

Indicate on Fig. 3.1, the best position and direction to **reapply** a **smaller** force **F** so that the trapdoor stays in its current position. [1]

- (b) Fig. 3.2 shows a trapdoor **XY** of length 1.4 m and weight 60 N is hinged at **X**. It is opened by pulling a rope inclined at an angle of 45° to the horizontal.

If the centre of gravity of the trapdoor is 75 cm from **X**, what is the tension **T** in the rope to just lift the trapdoor?

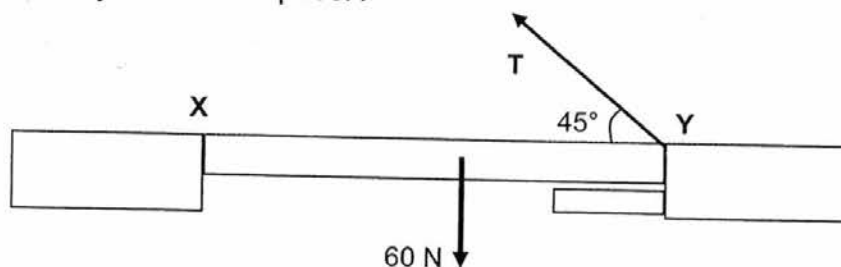


Fig. 3.2

tension = _____ [2]

- 4 Fig. 4.1 shows a simple thermocouple connected to a very sensitive millivoltmeter. A millivoltmeter is used to measure e.m.f.

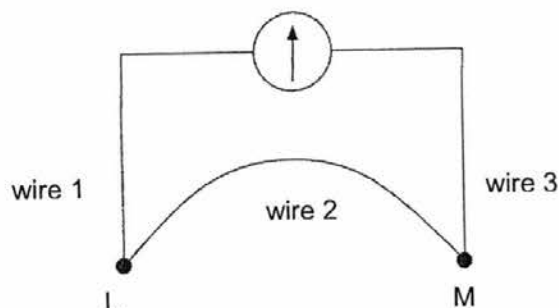


Fig. 4.1

- (a) When junction L is placed inside melting ice and M in steam, the millivoltmeter registers a reading of 20 mV. The millivoltmeter reading changes to 25 mV when junction M is placed inside a sample of molten solid. Junction L remains inside melting ice.

Calculate the temperature of the molten solid.

temperature = _____ [2]

- (b) State the material of each of the wire used to make junctions L and M.

wire 1 _____

wire 2 _____

wire 3 _____

[2]

- (c) Explain why a thermocouple thermometer can be used to measure temperatures up to 1000 °C or more.

 _____ [1]

- 5 Fig. 5.1 shows an object is placed in front of a converging lens. The diagram is drawn to scale.

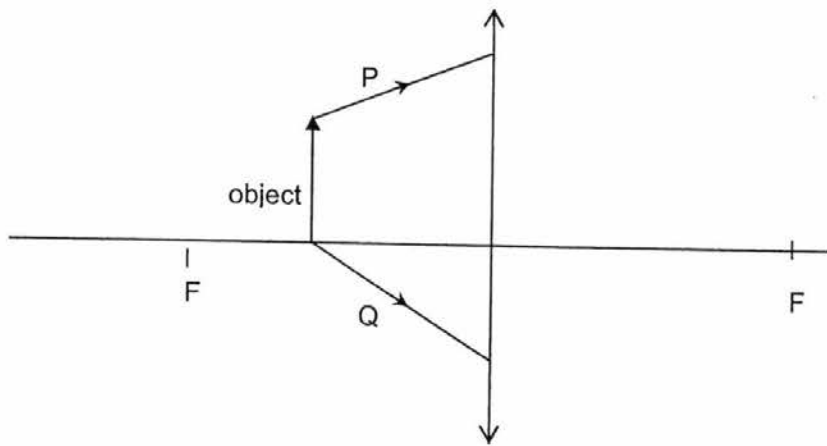


Fig. 5.1

- (a) By drawing two rays from the object, locate the position of the image. [3]
- (b) State the nature of the image. [1]
- (c) On Fig. 5.1, complete the paths of the rays P and Q. [2]
- 6 A siren consists of a disc with 30 equally spaced holes drilled near its edge. A jet of air is directed at the holes as the disc rotates at a rate of 16 revolutions per second.
- (a) Explain why a note is heard.

[2]

- (b) Calculate the frequency of the note.

frequency = _____ [1]

- (c) Calculate the wavelength of the note in air. You are to assume that the speed of sound in air is 330 m/s.

wavelength = _____ [2]

- (d) State, with reasons (if any), the effect of an increase in the rate of rotation on

- (i) the pitch of the note, and

_____ [1]

- (ii) the time taken for the sound to reach a distant observer.

_____ [1]

- 7 A circuit was set up to measure the current and the potential difference across the wire. Two wires A and B of the same material and length were connected to the circuit one at a time. Readings of the current and the potential difference were taken for each wire and graphs were plotted as shown in Fig. 7.1.

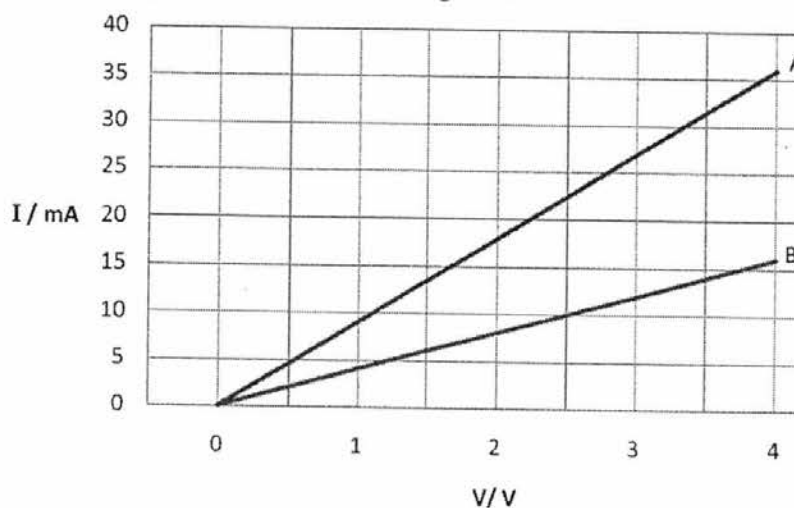


Fig. 7.1

- (a) Define the term *potential difference*.

[1]

- (b) Draw a labelled diagram of the circuit which would enable these measurements to be made.

[2]

- (c) Which wire, A or B, is the thinner one? Justify your answer.

[3]

8

Fig. 8.1 shows a carpet charged positively as a man ran across it in a dry room.

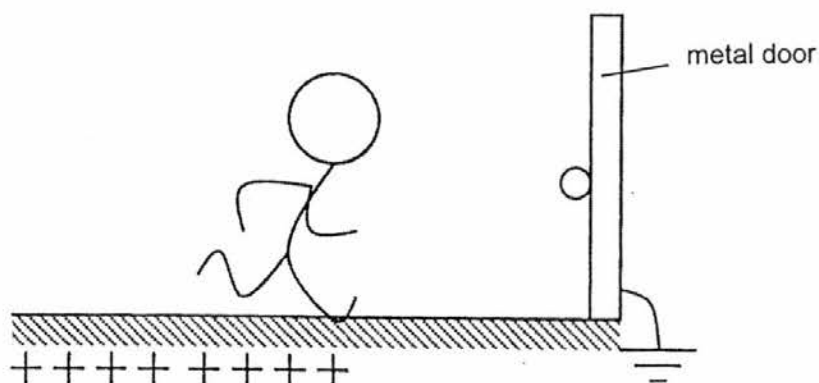


Fig. 8.1

- (a) Explain how the carpet could be charged positively.

[1]

- (b) Describe and explain the distribution of charges on the metal door from the time when the man runs towards the door until the time when he is next to the door.

[2]

- (b) Explain why the man experiences an electric shock upon touching the door handle.

[1]

Fig. 9.1 shows two electromagnets placed next to each other.

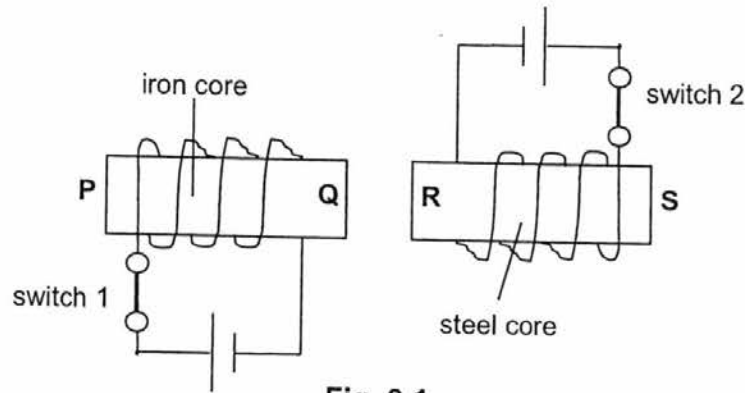


Fig. 9.1

- (a) State the polarities at the ends **P**, **Q**, **R** and **S** of the two magnets when both switch 1 and switch 2 are closed.

P _____ **Q** _____ **R** _____ **S** _____ [1]

- (b) If switch 2 is now opened and the iron electromagnet is brought near to the steel electromagnet (i.e. bring end **Q** towards end **R**), state and explain what would be observed.

 _____ [3]

- 10 Fig. 10.1 shows a bar magnet moving at a constant speed into a coil. An e.m.f. is induced in the coil.

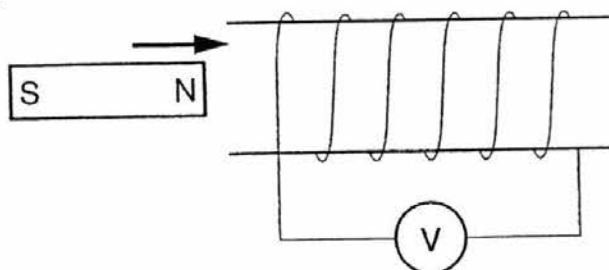


Fig. 10.1

- (a) State **two** ways in which the induced e.m.f may be increased.

_____ [2]

- (b) An e.m.f. is also induced when the bar magnet is replaced by a coil connected to an a.c. supply as shown in Fig. 10.2. Both coils do not move.

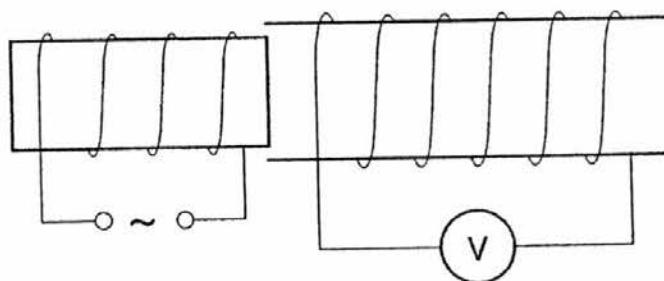


Fig. 10.2

State and explain how this induced e.m.f is different from the e.m.f. induced using the bar magnet.

_____ [3]

Section B

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

Answer only one of the two alternative questions in **Question 13**.

- 11** In an experiment to investigate Bernoulli's Principle on the wing of an aircraft, the effects of air velocity and pressure are recorded as the aircraft moves through air.

Fig. 11.1 shows how the air flow passes the wing. The velocity above the wing is faster than the velocity below the wing. The pressure and velocity data above and below the wing are recorded in Table 11.2.

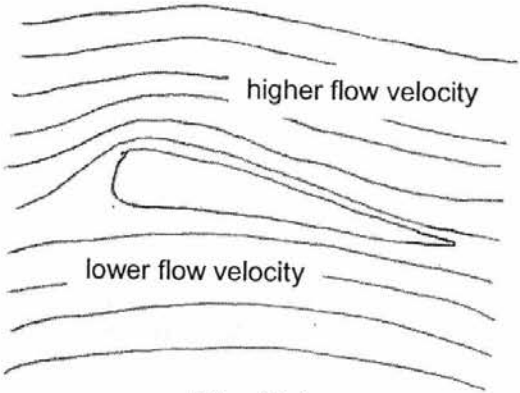


Fig. 11.1

	aircraft speed / ms ⁻¹	30.0	40.0	50.0	60.0	70.0	80.0
above wing	air velocity / ms ⁻¹	36.0	48.0	60.0	72.0	84.0	96.0
	air pressure / Pa	551	980	1531	2205	3001	3920
below wing	air velocity / ms ⁻¹	30.0	40.0	50.0	60.0	70.0	80.0
	air pressure / Pa	794	1411	2205	3175	4322	5645

Table 11.2

- (a) Based on the data provided in Table 11.2, state the relationship between the speed of the aircraft and the air pressure difference above and below the wing.

_____ [1]

- (b) Bernoulli's Principle is essential for producing "Lift". Explain why a pressure difference above and below the wing produces "Lift" and how this force is able to cause the aircraft to fly.

[3]

- (c) Calculate the lift force produced on a wing when the aircraft is moving at 30 m/s, given that the area of the wing is 25 m^2 .

lift force = _____ [3]

- (d) Given that the weight of the aircraft is 50 kN, estimate the required speed of the aircraft in order for it to take off from the ground.

speed = _____ [3]

- 12 Fig. 12.1 shows a periscope that uses two plane mirrors.

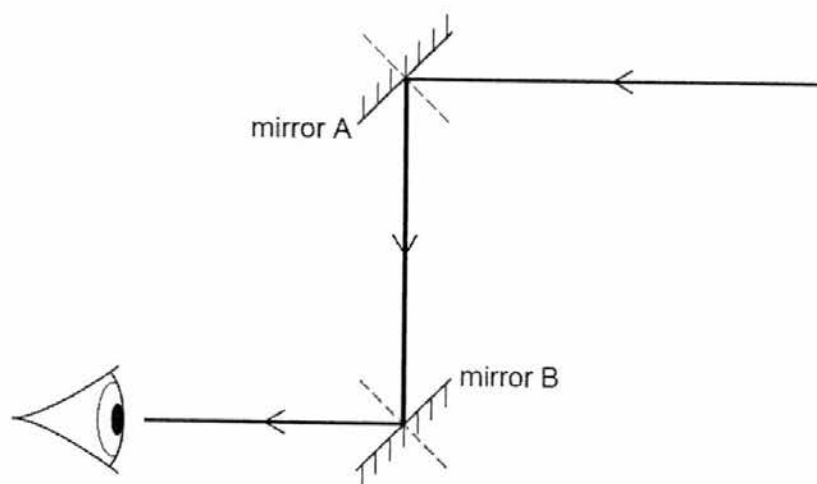


Fig. 12.1

- (a) (i) On Fig. 12.1, clearly label the angle of incidence i and the angle of reflection r at mirror A. [1]
- (ii) State the relationship between i and r .

[1]

- (b) The two prisms shown in Fig. 12.2 are made of glass.
A ray of red light enters each prism from the air, as shown.

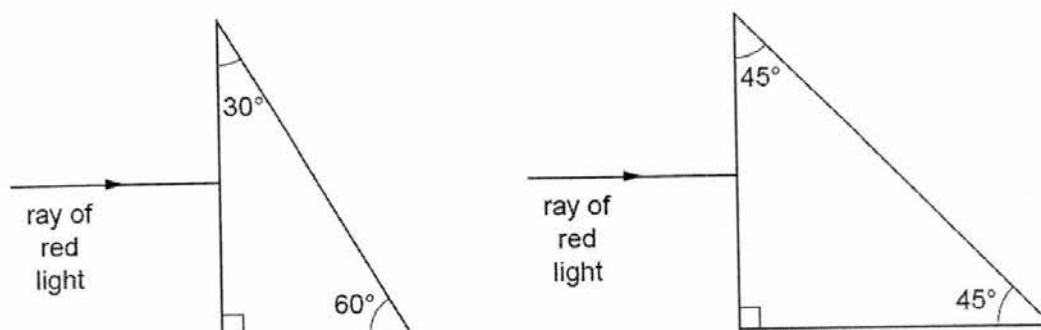


Fig. 12.2

The refractive index of the glass for both prisms is 1.5.

On Fig. 12.2, complete the paths of the rays through the prisms and out into air again without using a protractor. Show how you determine the paths with clear workings and label the angles between the ray and the normal at each surface of the prisms. [6]

- (c) In the space below, use a ruler to redraw the periscope, but using prisms like that in Fig. 12.1 instead of mirrors at A and B. [2]

13 EITHER

The brightness inside a new car model is built in such a way that it becomes brighter as the external environment gets darker. Fig. 13.1 shows how the brightness inside the car changes as it cruises through a tunnel.

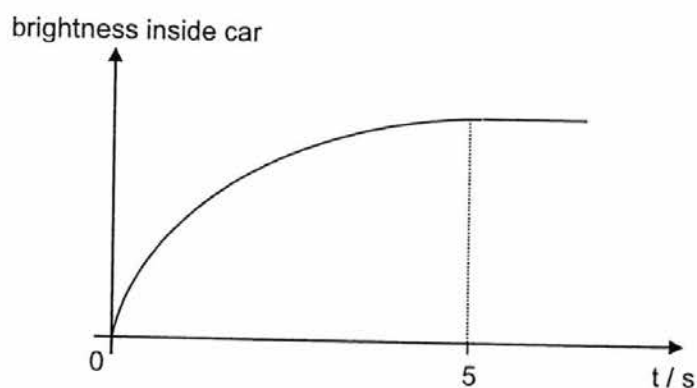


Fig. 13.1

At $t = 0$, the car starts to enter the tunnel.

- (a) If the 12 V battery of the car is using up its energy at a rate of 60 mW, calculate the current flowing through the lamps.

current = _____ [2]

- (b) Suggest why the curve flattens out after 5 s.

_____ [2]

- (c) Sketch, on the same set of axes in Fig. 13.1, a similar curve if the car is cruising at twice the original speed. [2]

- (d) (i) In the space below, draw a circuit consisting of a 12 V battery, an LDR, a fixed resistor and four lamps with independent switches that can be used for lighting the inside of the car.

[2]

- (ii) Explain how the circuit works.

[2]

13 OR

- (a) It has been said that a transformer is one of the most efficient of all machines. Explain what it means to say that a transformer is 'efficient'.

_____ [1]

- (b) No real transformer is 100% efficient. State two of the main energy losses in transformers.

1. _____

2. _____ [2]

- (c) A pupil is given three transformers labelled A, B and C. She is asked to investigate the relationship between the primary (input) and secondary (output) voltages of each transformer. She applies different voltages to the primary coil of each transformer and measures the voltages produced across the secondary coil. The following graphs were plotted from her results.

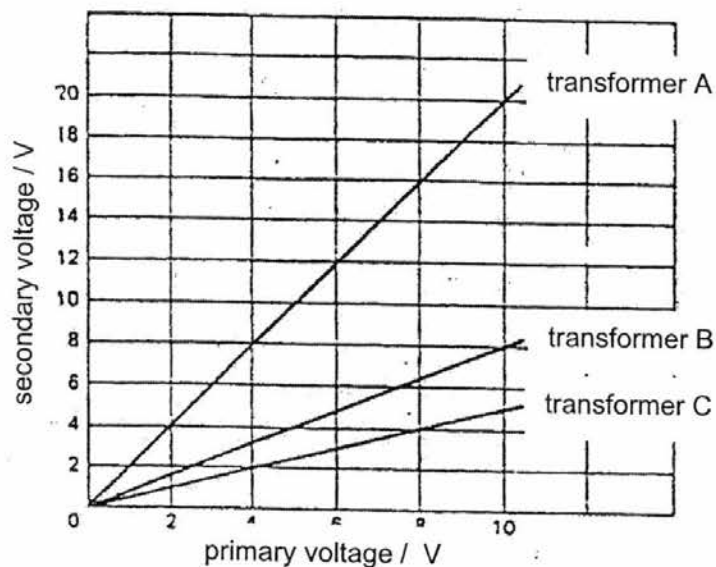


Fig. 12.3

- (i) Which transformer is operating as a step-up transformer?

_____ [1]

- (ii) The primary coil of each transformer has 250 turns of wire. Complete the following table, using information from the graph, whenever necessary.

transformer	primary voltage/V	secondary voltage/V	primary turns	secondary turns
A	7		250	
B	6		250	
C		4	250	

[2]

- (d) At Singapore Power, transformers are used so that electrical energy can be transmitted over long distances.

- (i) Describe, with the use of a diagram, how the transformer works and how it is able to step down the input voltages.

[3]

- (ii) Why are high voltages used in the National Grid?

[1]

END OF PAPER 2

GEYLANG METHODIST SCHOOL (SECONDARY)
Prelim Exam 2016
SEC 4 Physics
Suggested Marking Scheme

Paper 1 [40 marks]

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

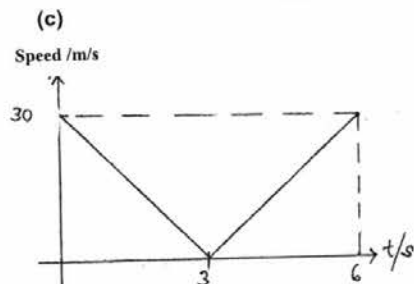
Paper 2 [80 marks]

Section A (Structured Qns)

- 1 (increased) internal energy OR (increased) KE of molecules OR (increased) thermal/heat (energy) [B1]
any mention of smaller / larger thermal capacity for copper / aluminum less / more energy is required to raise by 1°C [C1] [A1]

- 2 (a) (If down is +ve) OR (If up is +ve)
 $a = (v-u)/t$ OR $a = (v-u)/t$
 $10 = (0-u)/3$ [C1] $-10 = (0-u)/3$ [C1]
 $u = -30\text{m/s}$ [A1] $u = 30\text{m/s}$ [A1]

- (b) $K.E. = \frac{1}{2}mv^2$ [C1]
 $= \frac{1}{2} \times 0.25 \times 30 \times 30$ [A1]
 $= 112.5\text{J}$

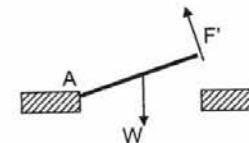


Correct shape of graph. [B1]
Axes labelled correctly AND
Correct markings on axes. [B1]

- (d) Area under the graph = $\frac{1}{2} \times 3 \times 30$
 $= 45\text{m}$

[B1]
Qn 2-7m

- 3 (a) [B1]



- (b) Sum of clockwise moment = sum of anti-clockwise moment
 $60 \times 0.75 = T \times 1.4 \cos 45^\circ$
 $T = 45.5\text{ N}$

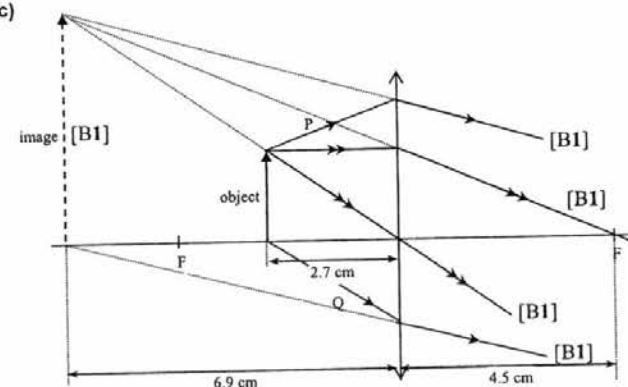
[C1]
[A1]
Qn 3-3m

- 4 (a) 20 mV rep 100 °C [C1]
1 mV rep 5 °C
5 mV rep 25 °C [A1]
Hence, temp of molten solid is $100 + 25 = 125^\circ\text{C}$

- (b) Wires 1 & 3 – same low resistance metal [B1]
Wire 2 – any resistance metal [B1]

- (c) Metals used have a melting point greater than 1000 °C [B1]
Qn 4-5m

- 5 (a) & (c)



- b) Nature: virtual, Upright and Enlarged

[B1]
Qn 5-6m

- 6 (a) This is because compression and rarefactions are formed when the flow of air are allowed to pass through and blocked by the holes on the rotating disc [B1]
The rate of rotation produced a sound with frequency that is above 20 Hz but less than 20 000 Hz which is then transmitted and heard. [B1]

- (b) frequency of note = 30×16 [B1]
 $= 480\text{ Hz}$

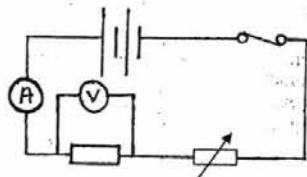
(c) Wavelength = v/f
 = $330/480$ [C1]
 = 0.688 m [A1]

(di) When the rate of rotation is increased, the frequency of the sound produced increases. Therefore the pitch of the sound increases [B1]

(dii) Since the physical conditions of the medium, air in this case, remain the same the speed of the sound is constant. Therefore time taken for the sound to reach the distant observer is the same [B1]
Qn 6 – 7m

7 (a) It is defined as work done to convert electrical energy to other forms of energy when a unit charge passes through two points in a circuit. [B1]

(b)



Circuit drawn correctly with appropriate symbols [B1].

3 out of 5 symbols drawn and connected properly [B1].

(c) According to the I-V graph, B has a higher resistance than A due to the lower gradient / lesser current for the same potential difference. [B1]
 Since, resistance of a wire is inversely proportional to cross-sectional area of the wire, wire B is thinner than wire A. [B1]

Qn 7 – 6m

8 (a) Rubbing between the shoes of the man and the carpet by friction causes electrons to be transferred from the carpet to the man. Carpet hence becomes positively charged. [B1]

(b) Excess negative charges on man sets up an electric field around him. In the presence of this electric field, force of repulsion exerted on the electrons on the surface of the metal door repels them to the earth. [B1]
 The end of the door nearer to man becomes deficient of electrons and has a net positive charge. [B1]

(c) Upon touching the door handle, the electrons on the man are discharged through his body down to the earth. The rate of flow of a large quantity of charges through the man gives him the sensation of electric shock. [B1]

Qn 8 – 4m

9 (a) P – North, Q – South, R – South, S – North [B1]

(b) Q will be repelled from R. [B1]
 Steel is a hard magnetic material and will retain its magnetism (i.e. R still south) [B1]
 Like poles repel, unlike poles attract. [B1]

Qn 9 – 4m

10 (a) moving magnet faster OR coil more turns OR using stronger magnet [any 2 – B2]

(b) Induced e.m.f. is alternating for Fig. 10.2 [B1]
 Because alternating current changes direction [B1]
 While the magnet in Fig. 10.1 only moves in 1 direction [B1]

Qn 10 – 5m

Section B (Essay Qns)

Qn 11

(a) The faster the aircraft, the greater the pressure difference [B1]

(b) As air moves faster above the wing, the pressure above the wing is lower than the bottom of the wing. [B1]
 As a result, an upward force acting on the wing is produced [B1]
 Once the lift is larger than the downward force (weight of the aircraft), it will fly. [B1]

(c) At 30 m/s, pressure difference = $794 - 551 = 243\text{ Pa}$ [C1]
 Lift = $P \times A = 243 \times 25$ [C1]
 = 6075 N [A1]

(d) Required lift on each wing = $50\,000 / 2 = 25\,000\text{ N}$ [B1]
 Pressure difference = $F/A = 25000/25 = 1000\text{ Pa}$
 Required aircraft speed ~ 70 m/s

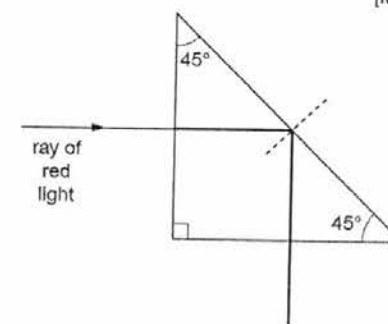
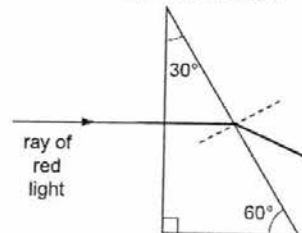
Qn 11 – 10m

Qn 12

(ai) i and r both correctly marked [B1]

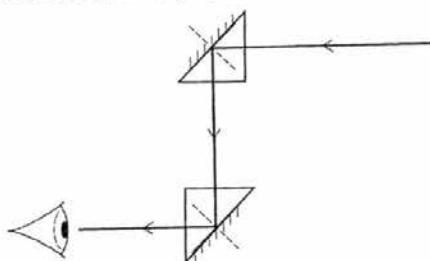
(aii) i = r in symbols or words NOT $\sin i = \sin r$ [B1]

(b) both rays straight on at first surface [B1]
 30° prism ray refracted down in air at 2nd surface [B1]
 45° prism ray reflected down in glass at 2nd surface [B1]
 90° reflection, by eye [A1]
 straight on at 3rd surface [A1]
 clear workings & label shown [M1]



- (c) upper prism correctly positioned, by eye
lower prism correctly positioned, by eye

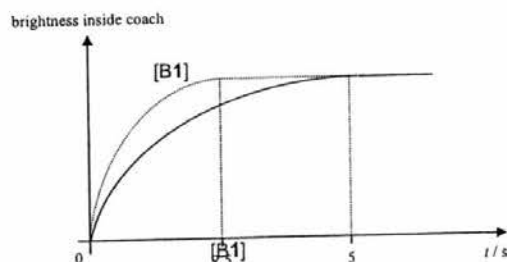
[B1]
[B1]



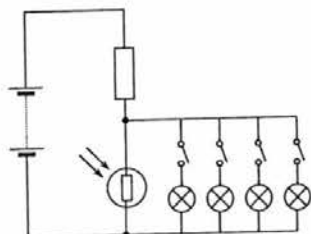
Qn 12 – 10m

Qn 13 Either

- a) Current through lamps = $P / V = 0.06 / 12$ [B1] = 0.005 A or 5 mA [B1]
b) The lamps are working at maximum power [B1] and no external light [B1] enters the coach.
c)



- b) i) Potential divider circuit [B1]
Lamps in parallel [B1]
ii) light intensity $\downarrow \Rightarrow R_{LDR} \uparrow$ [B1]
 $\Rightarrow V_{LDR} \uparrow$
 $\Rightarrow$ light intensity of lamps $\uparrow$ [B1]



Qn 12 Either – 10m

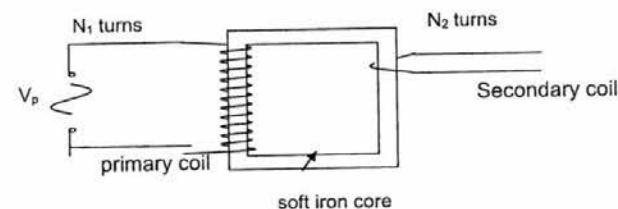
Qn 13 OR

- a. An efficient transformer will have a high ratio of output voltage to the input voltage. [B1]
b. Energy lost in the form of: [B2– Any Two]
▪ Heating effect of the current in the copper wires of the coil
▪ Energy is used in the process of magnetizing and demagnetizing of the iron core. (work has to be done to alter the directions of the domains)
▪ There is eddy currents induced in the iron core.
▪ Some of the magnetic field lines produced by the primary coil do not link with the secondary, reducing the output voltage.
c. i. Transformer A. [B1]

ii. [B1– Primary & Secondary Voltage; B1 – Secondary Turns]

Transformer	Primary voltage/V	Secondary voltage/V	Primary turns	Secondary turns
A	7	14	250	500
B	6	5	250	208
C	8	4	250	125

- d. i.



[B1]

As the primary coil carries an alternating current, the magnetic flux linkage with the secondary coil continuously changes and an e.m.f. is induced – [B1]. The number of turns in the secondary coil is less than the primary coil to reduce the output voltage – [B1].

- ii. If the voltage is high, then the current would be small to reduce power loss along the cables. [B1] The cables used to carry low currents need not be very thick. Thus, it is cheaper.

Qn 12 Or – 10m