Name: _____( ) Class: ____

4E/5N

KRANJI SECONDARY SCHOOL
Preliminary Examination 2
Secondary 4 Express / 5 Normal Academic

SCIENCE (PHYSICS/CHEMISTRY) **5076/01**
Paper 1 Multiple Choice

Wednesday **14 Sep 2016** **1 hour**

INSTRUCTIONS TO CANDIDATES

There are **forty** questions in this paper. Answer **all** questions.

For each question there are four possible answers, **A**, **B**, **C** and **D**.

Choose the one you consider to be correct and record your choice in **soft pencil** on the OMR provided.

INFORMATION FOR CANDIDATES

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

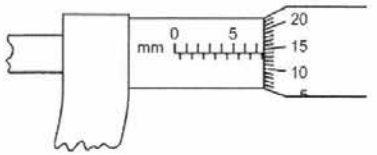
A copy of the Periodic Table is provided on page 13.

Set by: Mr Guay Hansen/ Mr Kat Kar Sien

This question paper consists of 13 printed pages.

[Turn over

1 The diagram below shows a micrometer screw gauge.



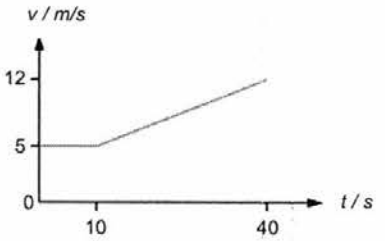
What is the reading shown?

A 5.64 mm **B** 7.14 mm **C** 7.16 mm **D** 7.64 mm

2 Which of the following is NOT a vector quantity?

A acceleration **B** displacement **C** speed **D** weight

3 John is driving along a straight road at a uniform velocity. At time t = 10 s, he steps on the accelerator pedal and his car accelerates uniformly. The graph below shows how the velocity of the car *v* varies with time *t*.



Which of the following shows the acceleration and distance travelled by the car from time *t* = 10 to 40 s?

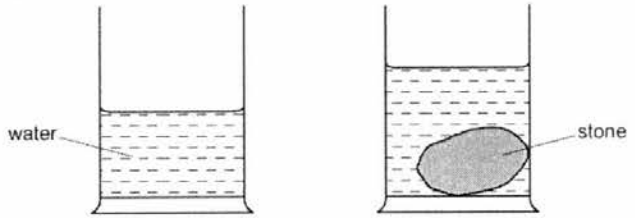
	distance travelled	acceleration
A	255 m	0.233 m/s^2
B	305 m	0.175 m/s^2
C	360 m	0.233 m/s^2
D	360 m	0.175 m/s^2

4 A stone is released from rest and falls freely due to gravity.

If the acceleration of free fall is 10 m/s² and air resistance is negligible, which of the following is true?

A After 2.0 s, the acceleration is 20 m/s².
B After the first second, the speed is 10 m/s.
C The stone takes the same time to fall through the same distances.
D The time taken to fall through the first 10 m is 1.0 s.

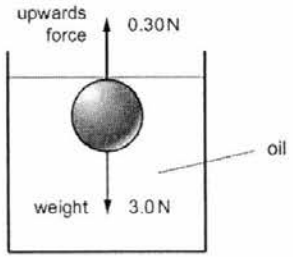
5 During an experiment to find the density of a stone, the stone is lowered into a measuring cylinder partly filled with water as shown in the diagram below.



Which of the following statements is correct?

A The difference between the readings gives the density of the stone.
B The difference between the readings gives the volume of the stone.
C The final reading gives the density of the stone.
D The final reading gives the volume of the stone.

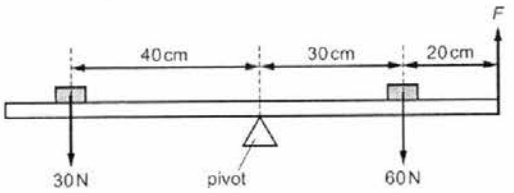
6 A metal ball of mass 0.30 kg and weight 3.0 N is held so that it is below the surface of oil. It experiences an upwards force of 0.30 N.



When the ball is released, what is its initial acceleration?

A 1.0 m/s² B 9.0 m/s² C 10 m/s² D 11 m/s²

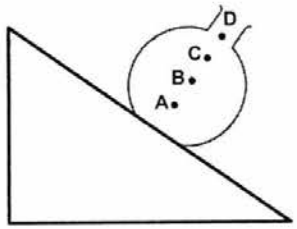
7 A uniform beam is pivoted at its centre. Two weights are placed on the beam in the positions shown and the beam is balanced by an upward force F.



What is the value of force F?

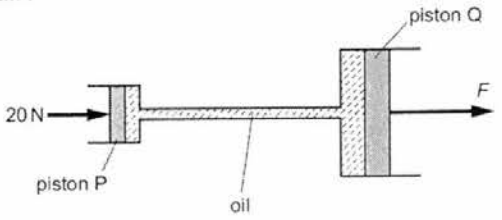
A 6.0 N B 12 N C 30 N D 60 N

8 A vase is position on a sloping surface as shown below. The vase remains stationary and do not slide nor topple.



Where is the centre of gravity of the vase?

9 The diagram shows a simple model of the braking system of a car. A force of 20 N is applied to piston P. As a result, there is a force F on piston Q. Piston P has an area of 5.0 cm² and piston Q has an area of 25 cm².

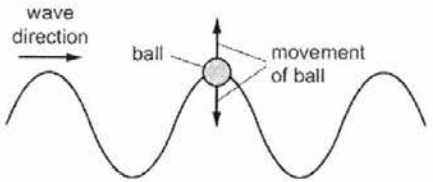


The pressure at piston P and Q are the same.

What is the magnitude of force F?

A 4.0 N B 20 N C 100 N D 500 N

10 A ball floating in a ripple tank begins to move vertically up and down as a wave passes beneath it. The ball does not move horizontally.



Which of the following statements is correct?

A Both energy and water are transferred in the wave direction.
B Energy is not transferred in the wave direction but water is.
C Energy is transferred in the wave direction but water is not.
D Neither energy nor water is transferred in the wave direction.

11 Some gas is trapped in a balloon. The gas is cooled and the volume of the balloon decreases.

Which of the following is correct as the gas is cooled?

I The gas molecules contracts.
II The gas molecules loses kinetic energy.
III The gas molecules becomes closer to each other.

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

12 A copper rod is cooled at one end.

Which statement describes how heat transfer occurs in the copper?

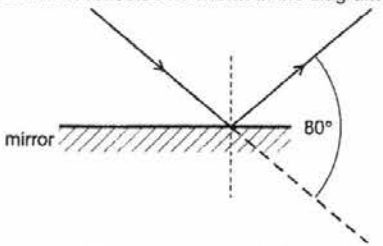
A Energetic copper molecules move from the cooler end to the hotter end.
B Energetic copper molecules move from the hotter end to the cooler end.
C Energetic free electrons move from the cooler end to the hotter end.
D Energetic free electrons move from the hotter end to the cooler end.

13 A lightning flash carries 40 C of charge and lasts for 5.0 ms.

What is the average current in the flash?

A 0.20 A **B** 8.0 A **C** 200 A **D** 8000 A

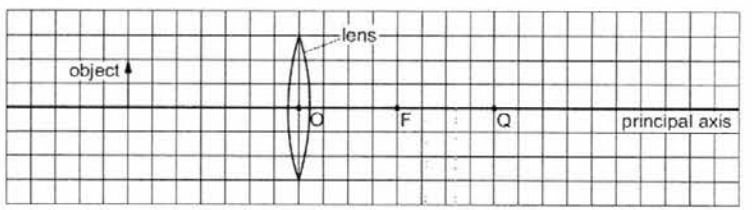
14 Light is incident on a mirror and is reflected as shown in the diagram below.



What is the angle of incidence and the angle of reflection?

	angle of incidence	angle of reflection
A	40°	40°
B	40°	50°
C	50°	40°
D	50°	50°

15 The diagram shows an object on the principal axis of a converging (convex) lens. A principal focus of the lens is at F.



Which of the following is correct?

	image size	location of image
A	diminished	between O and F
B	diminished	between F and Q
C	magnified	between F and Q
D	magnified	to the right of Q

16 Which statement about red light and blue light is correct?

A Red light has a longer wavelength than blue light.
B Red light has a greater frequency than blue light.
C Red light travels faster than blue light in vacuum.
D Red light has more energy than blue light.

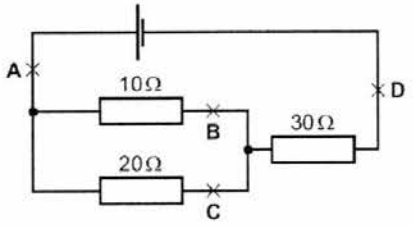
17 A star explodes in outer space.

Which wave from the exploding star does not reach the Earth?

A infrared radiation
B microwave
C sound
D x-ray

18 The diagram shows a circuit.

Where must an ammeter be connected to measure the smallest current?



19 The diagram shows the information found on an electric kettle. It is fitted with a fuse of suitable rating.

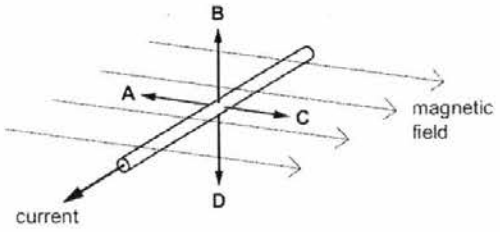
240 V	50 Hz
600 W	700 cm^3

What is the rating of the fuse?

A 2.0 A **B** 2.5 A **C** 5.0 A **D** 10 A

20 The diagram shows a current-carrying wire in a horizontal magnetic field.

Which arrow shows the direction of the force experienced by the wire?



Name: _____ ( ) Class: _____

4E/5N

KRANJI SECONDARY SCHOOL
Preliminary Examination 2
Secondary 4 Express / 5 Normal Academic

SCIENCE (PHYSICS)
Paper 2

5076/02

Monday **29 Aug 2016** 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

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

Write your name, index number and class in the spaces at the top of this page.
This paper is divided into two sections.

Section A (45 marks):
Answer ***all*** the questions in the spaces provided in the question paper.

Section B (20 marks):
Answer any ***two*** questions. Write your answers in the spaces provided on the question paper.

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

Take the acceleration due to gravity, g, to be 10 ms^{-2}.

FOR EXAMINER'S USE	
TOTAL	/65

Set by : Mr Guay Hansen

This question paper consists of 16 printed pages.

[Turn over

Section A [45 marks]

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

1 Fig. 1.1 shows the speed-time graph of a 1.5 kg object that was released from a great height and eventually impacting on the ground.

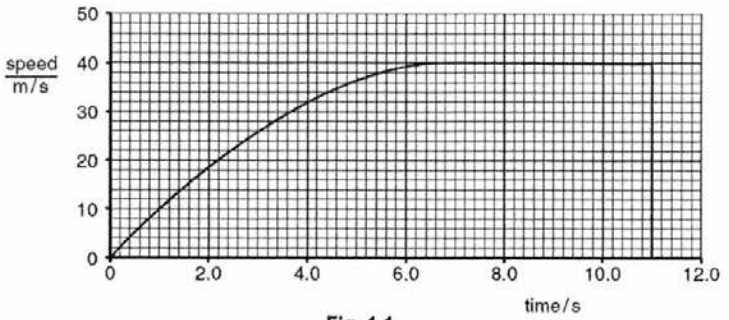


Fig. 1.1

(a) State the time when the object experienced the greatest downward acceleration. State the magnitude of this acceleration.

time = ... [1]

magnitude of greatest acceleration = ... m/s^2 [1]

(b) **(i)** Calculate the weight of the object.

weight = ... [1]

(ii) Describe and explain the motion of the object in the first 6.0 s of the journey.

.....

.....

..... [2]

(iii) State the magnitude of the air resistance experienced by the object at 8.0 s of the motion. Explain how you arrived at your answer.

.....

.....

..... [2]

2 Fig. 2.1 shows two tugboats towing a ship to its dock. The two tugboats exert a force of 120 kN and 160 kN on the ship.

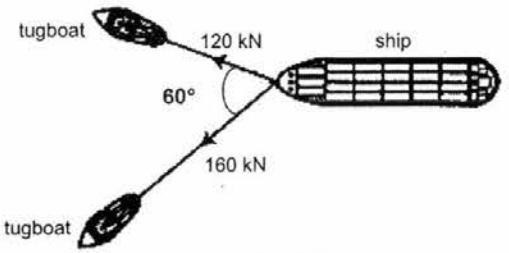


Fig. 2.1

(a) In the space below, draw a suitable scale diagram to determine the magnitude of the resultant force exerted on the ship by the two tugboats. State the scale used clearly.

resultant force = ... [3]

(b) The ship has a mass of 2,500,000 kg. If the average resistive forces due to the water is 20 kN, determine the acceleration of the ship when it is pulled by the two tugboats.

acceleration = ... [2]

3 A bungee jumper falls from a bridge above a river, as shown in Fig. 3.1.

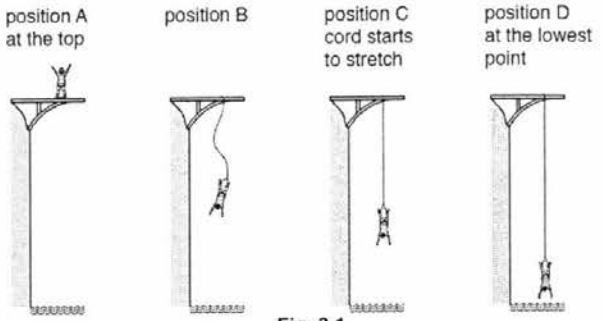


Fig. 3.1

(a) Describe the energy changes as the man moves from

(i) position A to position B

.....

..... [1]

(ii) position C to position D

.....

..... [1]

(b) At position C, the man achieves his greatest speed of 25 m/s. Assuming negligible energy loss due to resistive forces, determine the distance between position A and position C.

distance = ... [2]

(c) After reaching D, the man accelerates upwards but is unable to travel back to the starting point at the top. Explain why the man is unable to return to the top from position D.

.....

.....

..... [1]

4 Fig. 4.1 shows a device for punching holes in a piece of paper. A person applies a force F at the end of the arm. Just before the hole is made in the paper, the arm is at rest.

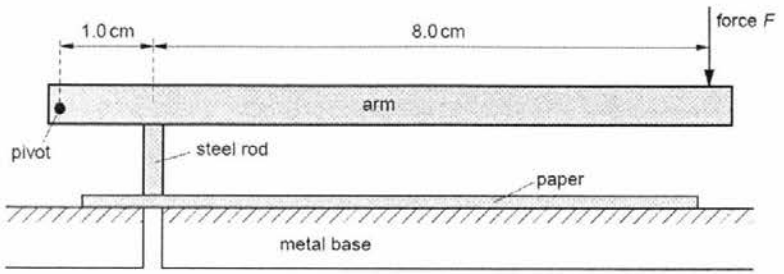


Fig. 4.1

(a) To punch a hole in the paper, a pressure of 30 N/cm^2 is required. Determine the minimum force that is required to be exerted by the steel rod, given that cross-sectional area of the steel rod is 0.40 cm^2.

force = ... [2]

(b) Hence, determine the size of force F needed to produce the pressure in **(a)**.

F = ... [2]

5 When a balloon is rubbed on hair, the balloon becomes positively-charged. The balloon is shown in Fig. 5.1.

Fig. 5.1

(a) Explain how the balloon became positively-charged

.....

.....

.....

..... [2]

(b) Explain why the hair is pulled towards the balloon.

.....

.....

.....

..... [2]

6 A substance in a boiling tube is allowed to cool down from 100°C. Fig. 6.1 shows the graph of temperature against time. The room temperature is 20°C.

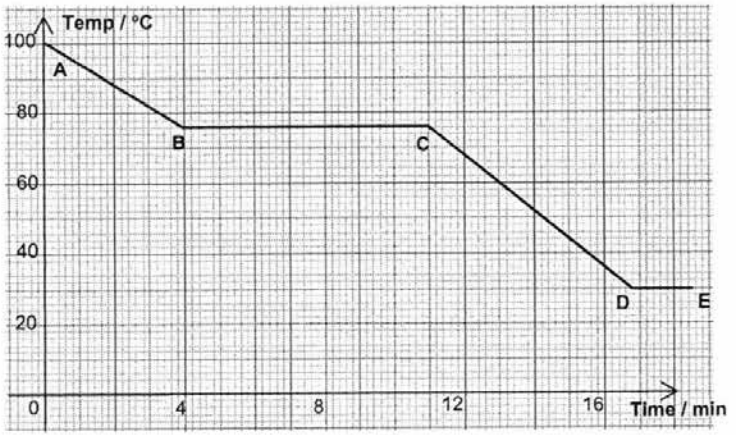


Fig. 6.1

(a) Describe the differences between the particles of the substance during time t = 2.0 min and t = 14 min. State the state of the substance clearly.

.....

.....

.....

.....

..... [3]

(b) Explain why the thermal energy lost to the surroundings during BC did not bring about a change in temperature.

.....

.....

..... [2]

7 Ultrasound may be used to measure the depth of the sea. Fig. 7.1 shows a pulse of ultrasound sent down to the sea bed and the reflected pulse returning to the ship.

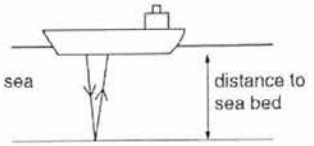


Fig. 7.1

(a) What is meant by ultrasound?

.....

..... [1]

(b) The transmitted ultrasound and its echo is recorded on a display shown in Fig. 7.2. Each division on the display is equal to 10 milliseconds.

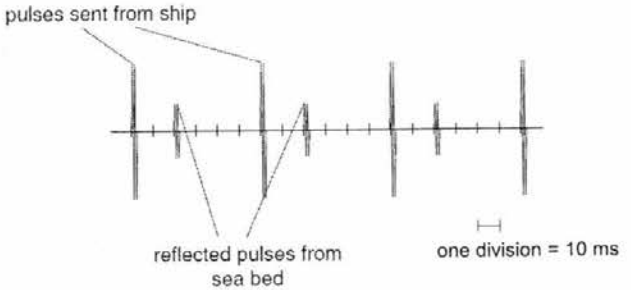


Fig. 7.2

The speed of ultrasound in water is 1500 m/s and the wavelength of the ultrasound wave is 3.0 cm.

(i) Determine the depth of the seabed.

depth = ... [2]

(ii) Determine the frequency of the ultrasound.

frequency = ... [2]

8 Fig. 8.1 shows a computer chip fitted with a heat sink with black metal fins.

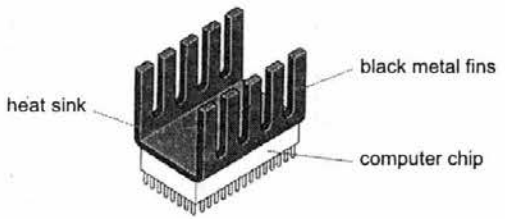


Fig. 8.1

(a) The main function of the heat sink is to keep the computer chip cool.
Explain the features of the heat sink that allow thermal energy to be transferred easily away from the chip.

.....

.....

.....

.....

..... [3]

(b) As the temperature of the heat sink increases, it emits a greater amount of electromagnetic radiation X.

State the name of electromagnetic radiation X and describe one application for it.

.....

..... [1]

9 An electric hairdryer and an electric heater are connected to the mains supply, as shown in Fig. 9.1.

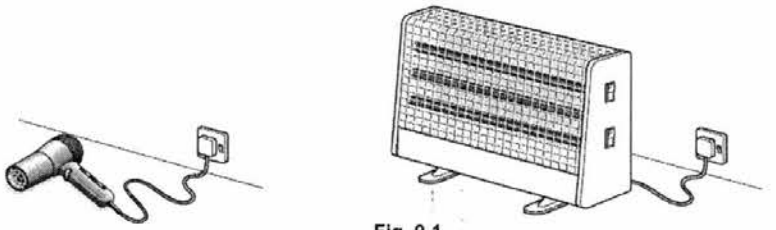


Fig. 9.1

The cable from the heater to the mains supply has a live, a neutral and an earth wire.

(a) The live wire in the electric heater touches the outer metal case.
Explain how the earth and the fuse together protect the user from electric shock.

.....

.....

.....

.....

..... [2]

(b) The electric heater is rated 1200 W, 230 V. If one unit of electricity cost $0.20, determine the cost of using the heater continuously for 30 days.

cost = ... [2]

(c) The hairdryer does not have an earth wire. Explain why this hairdryer is still safe to use.

.....

..... [2]

Section B [20 marks]

Answer any **two** questions from this section.

10 (a) Fig. 10.1 shows a wave on a string. The wave is travelling towards the right.

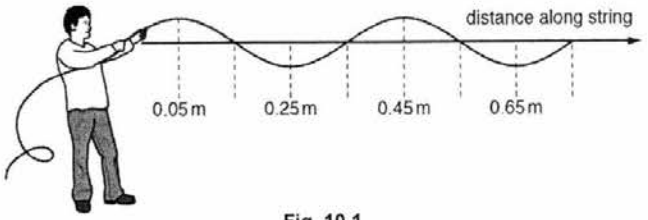


Fig. 10.1

(i) Describe the movement of the particles of the string.

.....

..... [1]

(ii) The speed of the wave is 2.0 m/s. Determine the frequency of the wave.

frequency = ... [2]

(iii) On Fig. 10.1, draw the string at a time 0.10 s later than the time in Fig. 10.1. [1]

(b) Light enters a rectangular glass block at A. The angle between the side of the block and the ray of light in air is 35°.
The light then strikes the edge of the block at B. Fig. 10.2 shows the ray of light and the glass block. The angle of refraction in the glass at A is 33°.

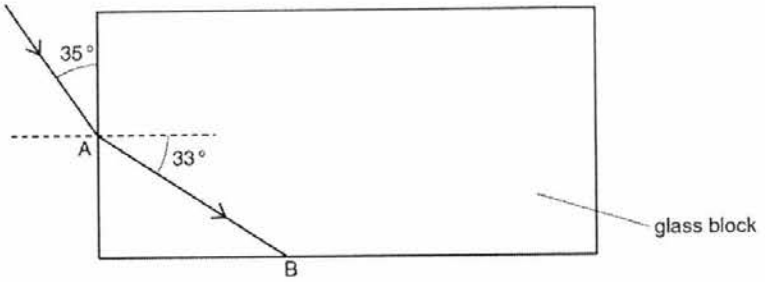


Fig. 9.2

(i) Calculate the refractive index for light in the glass.

refractive index = ... [2]

(ii) Calculate the critical angle of the glass block.

critical angle = ... [1]

(iii) State the conditions for total internal reflection.

.....

.....

..... [2]

(iv) On Fig. 10.1, continue the ray to show the path of the light after point B and until it leaves the block. [1]

11 Fig 11.1 shows the I-V characteristics of a filament lamp.

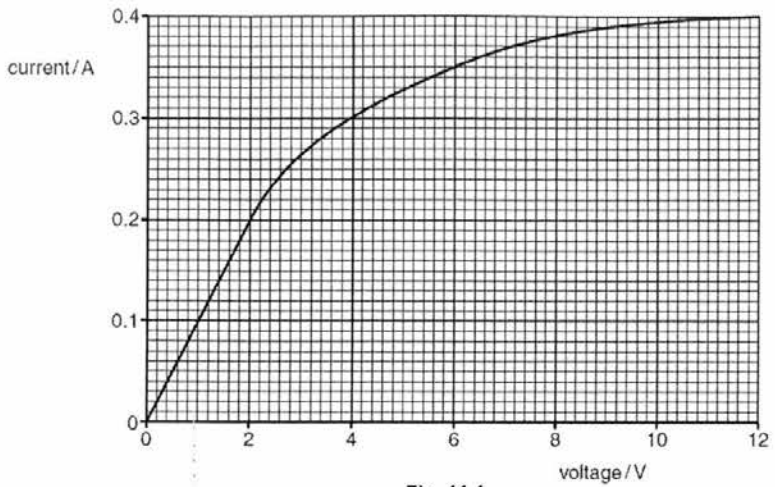


Fig. 11.1

(a) **(i)** What is meant by resistance?

.....

..... [1]

(ii) State how the resistance of the lamp varies when the potential difference across it is

1. between 0 V to 2.0 V

..... [1]

2. greater than 2.0 V

..... [1]

(b) The lamp is now connected in series to a variable resistor P and a 9.0 V battery as shown in Fig. 11.2. The reading on the voltmeter is 6.0 V.

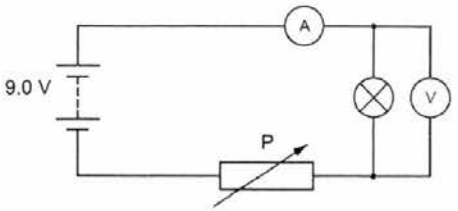


Fig. 11.2

(i) Using data from Fig. 11.1, state the reading on the ammeter and determine the resistance of the lamp.

ammeter reading = ... [1]

resistance = ... [2]

(ii) Calculate the resistance of P when the voltmeter shows a reading of 6.0 V.

resistance= ..... [2]

(iii) State and explain what changes should be applied to the resistance of P so as to decrease the brightness of the lamp in the circuit.

.....

.....

.....

.....

..... [2]

12 (a) Fig. 12.1 shows a permanent magnet placed near an electromagnet.

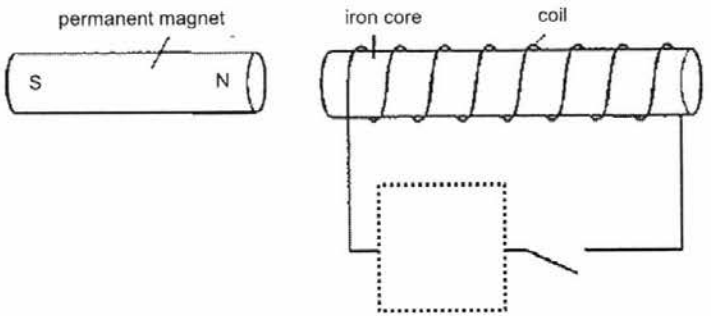


Fig. 12.1

(i) The magnet moves towards the iron core when the switch is open. Explain why.

.....

.....

..... [2]

(ii) When the switch is closed, the magnet moves away from the iron core.

In the dotted box on Fig. 12.1, draw how a battery should be connected to the electromagnet so that the magnet moves away from the iron core when the switch is closed. [1]

(iii) The battery of the electromagnet is replaced with a low frequency alternating current (a.c.) supply. Describe and explain what happens when the switch is closed.

.....

.....

..... [2]

(b) Fig. 12.2 shows a coil of wire connected by flexible leads to a switch and a battery.

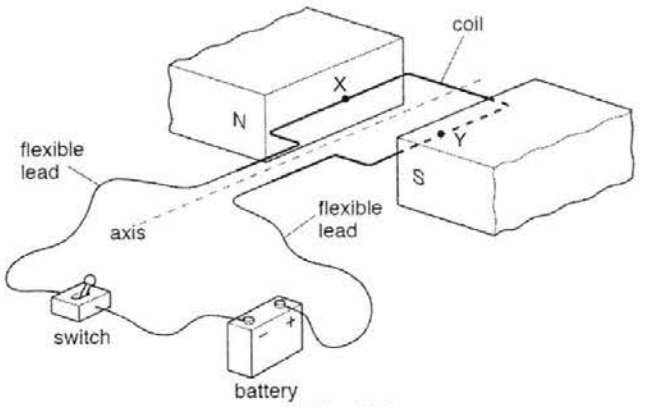


Fig. 12.2

Point X and Y are two points on the coil.
When the switch is closed, the coil of wire experiences forces.

(i) Explain why the coil will experience a force when the switch is closed.

.....

.....

..... [1]

(ii) Draw an arrow on the coil to show the direction of current flow. [1]

(iii) Draw two arrows to show the direction of the forces experienced by the coil of wire at X and Y. [2]

(iv) Hence, state what happens to the coil of wire when the switch is closed.

.....

..... [1]

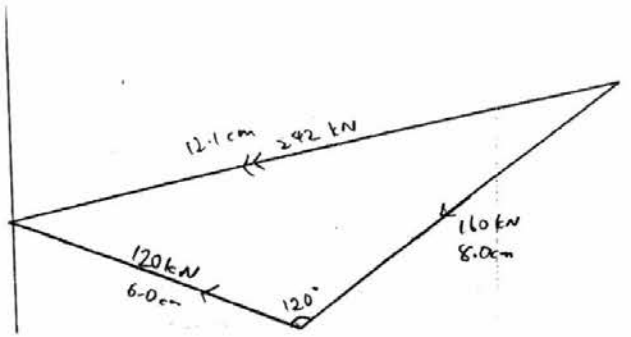
End of Paper

2016 Prelim 2 - 4E5N Sci(Physics) P1 - Answer

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

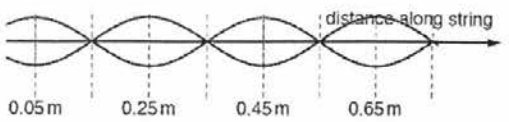
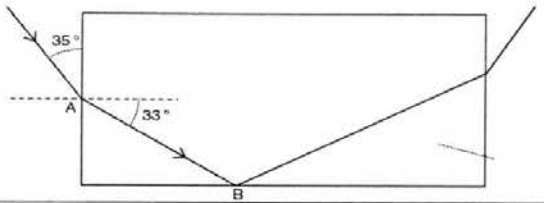
2016 Prelim 2 - 4E5N Sci(Physics) P2 - Answer

	Answer	Remarks
1a	time = 0 seconds acceleration = 10 m/s^2	[1] each
1bi	W = mg = 1.5 x 10 = 15 N	[1]
1bii	Moving with decreasing acceleration. As the speed increase, air resistance increases. This results in a decreasing resultant force and hence decreasing acceleration as F = ma.	[1] [1]
1biii	air resistance = 15 N. Since object is travelling at constant speed, acceleration and hence resultant force = zero. Thus air resistance = weight.	[1] [1]
	Comments *1a - Many students are unaware of this fact, even though some of these students are able to correctly describe that acceleration is decreasing. Students who understood that the maximum acceleration = acceleration due to gravity (10m/s^2) is unable to state that the time this occurs was when the object is first released.* *1bi – generally ok, although some students convert it to grams or thought weight = mass and its unit is newton.* *1bii – poorly done. Many students did not realise acceleration is decreasing. And even less students explain this is due to increasing air resistance (and hence decreasing resultant force)* *1biii – better than b(ii), shows that students are more familiar with falling at constant velocity. However, a few students did not state the value (15 N) or did not state that resultant force = zero.*	

2a	Scale 1.0cm = 20 kN  resultant force: 242 kN (accept 238 to 246 kN)	[1] for good scale AND correct shape [1] for arrows, labels and orientation [1] for accuracy
2b	resultant force = 242 – 20 = 222 kN a = F/m = 222000 / 2500000 = 0.0888 m/s^2	[1 – ecf from (a)] [1 – ecf from (a)]
	comments: *2a - Not well done. Many students obtain zero credit, due to poor choice of scale, orientation and diagram that are not proportionate to the scale and forces. Students that manage to draw a reasonable diagram will usually get the correct answer.* *2b – many students find acceleration using either the frictional force or the resultant force in 2(a), instead of calculating the new resultant force. A large number of students incorrectly thought the force is due to the weight of the object.*	
3ai	gravitational potential energy to kinetic energy	[1]
3aii	kinetic and gravitational potential energy to elastic potential energy	[1]
3b	loss in GPE = gain in KE mgh = ½ mv^2 gh = ½ v^2 h = 0.5 x 25^2 / 10 = 31.25 m ≈ 31.3 m ALTERNATE h = area under graph h = ½ x 25 x 2.5 h = 31.25 ≈ 31.3 m	[1] [1 – don't penalize for 3sf]]
3c	Some energy is lost as thermal energy when the cord is stretched, therefore the man does not have enough energy to reach the top.	[1] accept similar answer based on friction
	Comments *3ai – almost all students got it correct.* *3aii – no students got it correct, with very confusing conversion between KE and GPE.* *3b – Quite a number of students is able to understand that they must equate loss in GPE to the gain in KE and solve it. However, more than half the level do not know this or did not show proper working.*	

	3c – poorly done. While many understood that some energy is lost, they are unable to describe how the energy is lost and to what form is it converted to..	
4a	F = PA = 30 x 0.4 = 12 N	
4b	ACW = CM 12 x 1 = F x 9 F = 1.33 N	
	Comments *4a – generally well done* *4b – many use F x 8 instead of F x 9 (shows poor understanding of distance from pivot). Some simply calculate moments without balancing it.*	
5a	Negatively charged electrons are transferred from the balloon to the hair. As there are excess positive charges on the balloon, the balloon is positively charged.	[1] [1] accept 'less electrons'
5b	The hair becomes negatively charged after rubbing with the balloon. Since unlike charges attract, the hair is attracted to the balloon.	[1] [1]
	Comments: *5a and 5b - Generally quite ok, although there are still a significant number of very bad mistakes:* *balloon or hair originally charged, movement of positive charges/ions/electrons, unlike poles attract instead of unlike charges attract, unlike force attract* *Some students did not understand that transfer of electrons is due to friction and NOT because unlike charges attract.*	
6a	At t= 2.0 min, substance is in gaseous state. The particles are moving at high speed in random direction. They are arranged randomly and far apart from one another. At t = 14 min, substance is in liquid state. The particles are sliding about each other. They are closely-packed and in disorderly arrangement.	[1] for 2 correct states [1] for comparing motion [1] for comparing arrangement
6b	Energy loss during BC is due to the formation of intermolecular bonds between particles, causing a change of state from gas to liquid This decreases the potential energy of the particles. The kinetic energy of the particles remains constant hence temperature did not change.	[1] for creating bond [1] for increase in PE and no increase in KE.
	comments: *6a was generally well answered although a small minority of students did not state the state of the substance.* *6b was poorly done. Many students assumed it was a heating curve and gave answers on absorbing of energy to overcome bonds. The concept of constant KE of particles relating to constant temperature was not shown as well.*	
7a	Sound of frequency above 20000 Hz, beyond the upper limit of the audible range of humans.	[1]
7bi	2d = s x t = 1500 x 0.01 d = 15 m	[1 – ignore units] [1]
7bii	f = v/λ = f = 1500 / 0.03 f = 50000 Hz	 [1 – ignore units] [1]
	comments: *7a and 7bi is very poorly done, showing the lack of understanding of using data (cro) to calculate questions based on echo.*	

	7bii was generally ok except for a significant number of students who did not convert 3.0 cm to metres. Some students attempt to use f - 1/T, which proves futile.	
8a	metal is a good conductor of heat, increases the rate of thermal energy loss by conduction. black surface is a good emitter of infrared radiation. This increase the rate of thermal energy loss by radiation. the fins increases surface area, which increases rate of thermal energy loss by radiation.	[1] [1] [1]
8b	Infrared radiation. Used to send data in infrared remote control OR to detect intruders in intruder alarms OR thermal imaging	[1]
9a	When a fault occurs and the live wire contacts the metal casing, a large current flows along live wire, metal casing and to earth. This larger current cause the fuse wire to melt and disconnect the device from the high voltage supply.	[1] [1]
9b	E = Pt E = 1.2kw x 30 x 24 E = 864 kWh cost = 864 x 0.20 = $172.80	 [1] [1]
9c	The hairdryer is double insulated: casing is an insulator while the internal wires are also insulated.	[1]
10ai	Particles of string vibrate perpendicular to the direction of travel of the string.	[1]
10aii	f = v/λ f = 2 / 0.4 f = 5.0 Hz	 [1] [1]

10aiii		[1]
10bi	n = sin i / sin r n = sin 55 / sin 33 n = 1.50	[1] [1]
10bii	$c = \sin^{-1}(1/n) = 41.8°$	
10biii	Total internal reflection occurs when light is passing from optically more dense to less dense medium and the angle of incidence is greater than the critical angle.	
10biv		[1]
11ai	ratio of the pd across the resistor and the current flowing through it.	[1]
11aii	1. resistance is constant 2. resistance is increasing	
11bi	ammeter reading: 0.35 A R = V/I R = 6 / 0.35 R = 17.1 Ω	[1] [1] [1]
11bii	pd across P = 12 – 9 = 3.0 V R = V/I R = 3 / 0.35 R = 8.57 Ω	
11biii	Increase resistance of P This will result in greater effective resistance of circuit, and since V = IR, current through bulb will decrease and it will become dimmer	[1] [1]
12ai	The N-pole of the magnet induces a S-pole on the end of the iron core nearest to it. Since unlike poles attract, the magnet is attracted and move towards the iron core.	[1] [1]
12aii	battery with positive side on the left side	
12aiii	The magnet will oscillate/ vibrate / move to and fro from the iron core. When the current in the electromagnet reverses direction, the poles on the iron core reverse as well, attracting and repelling the magnet periodically.	[1] [1]
12bi	Interaction of the magnetic field of the magnet and the magnetic field of the current produce a force	[1]
12bii	correct direction anywhere along the circuit	[1]
12biii	X – upwards; Y – downwards	[1 each]
12biv	The coil will experience a clockwise moment and rotate (clockwise)	[1]