BEDOK SOUTH SECONDARY SCHOOL PRELIMINARY EXAMINATION 2017

4E5N

CANDIDATE NAME

CLASS

REGISTER NUMBER

Science (Physics/~~Chemistry~~)
Paper 1

5076
02 Aug 2017

1 hour

Additional Material: OMR form

READ THESE INSTRUCTIONS FIRST

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

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

For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct and record your choice in **soft pencil** on the separate answer sheet.

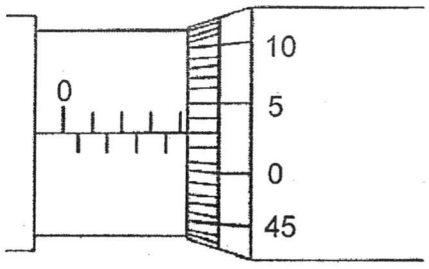
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page ___.

Setter: Mr Sean Goh

This document consists of ___ printed pages including the cover page

1 When a micrometer screw gauge is used to measure the thickness of a disc, it is as shown below.



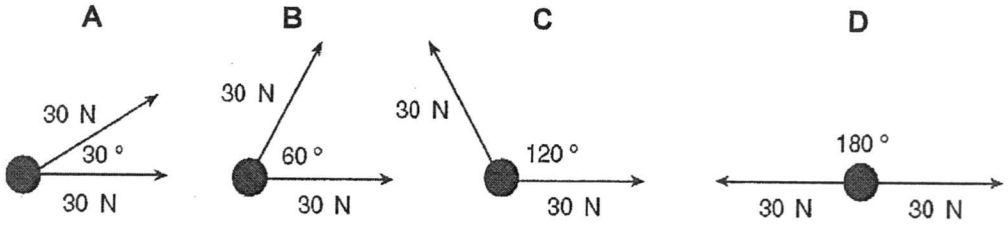
What is the thickness of the disc?

A 4.03 mm **B** 4.53 mm **C** 8.03 mm **D** 8.53 mm

2 A vehicle decelerates uniformly from a speed of 20 m/s to rest within a duration of 3.0 s. What is the distance covered during the deceleration?

A 6.7 m **B** 20 m **C** 30 m **D** 60 m

3 Two 30 N forces act concurrently on an object. In which diagram would the forces produce a resultant with a magnitude of 30 N?



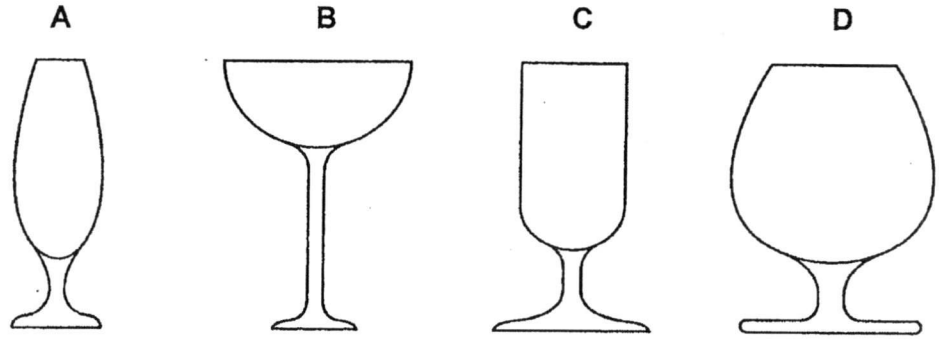
4 A box weighs 500 N on Earth. Given that the gravitational field strength is 10 N/kg on Earth and 1.7 N/kg on the Moon. Determine the mass and weight of the box on the Moon.

	Mass on Moon	Weight on Moon
A	50 kg	85 N
B	50 kg	850 N
C	500 kg	850 N
D	500 kg	8500 N

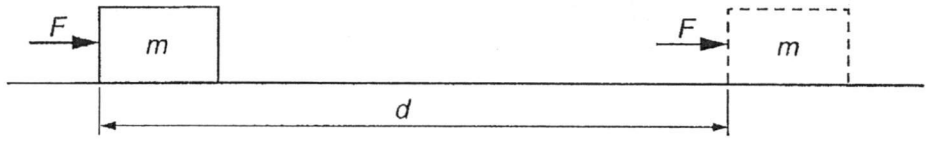
5 A girl pour 32 g of sugar of density 1.6 g/cm^3 into 100 cm^3 of water to make sugar solution. If the density of water is 1.0 g/cm^3, what is the density of the sugar solution?

A 1.0 g/cm^3 **B** 1.1 g/cm^3 **C** 1.3 g/cm^3 **D** 1.6 g.cm^3

6 The diagrams show the cross-sections of different glasses. Which one is the **least** stable when filled with water to the brim?



7 Mass *m* is pushed a distance *d* along a horizontal surface by a constant force *F*.



What quantities must be known in order to calculate the work done by the force?

A *d* and *F* only
B *d* and *m* only
C *F* and *m* only
D *d*, *F* and *m*

8 The table below shows the description of the motion of particles in their various states.

Physical State	X	Y	Z
Motion of particles	Move freely and randomly in all directions at high speed	Vibrate about fixed positions	Move about and slide past each other

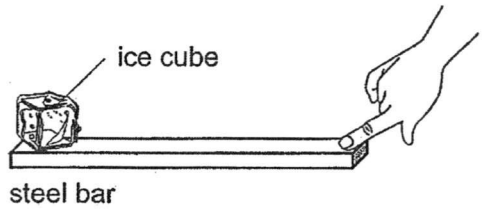
Which of the following correctly gives the states of the matter?

	X	Y	Z
A	Solid	Liquid	Gas
B	Liquid	Gas	Solid
C	Gas	Liquid	Solid
D	Gas	Solid	Liquid

9 Which of the following will occur when a gas is heated?

A The particles in the gas will expand and become bigger.
B The distance between particles in the gas will become smaller.
C The particles in the gas will move faster.
D The particles in the gas will stop moving.

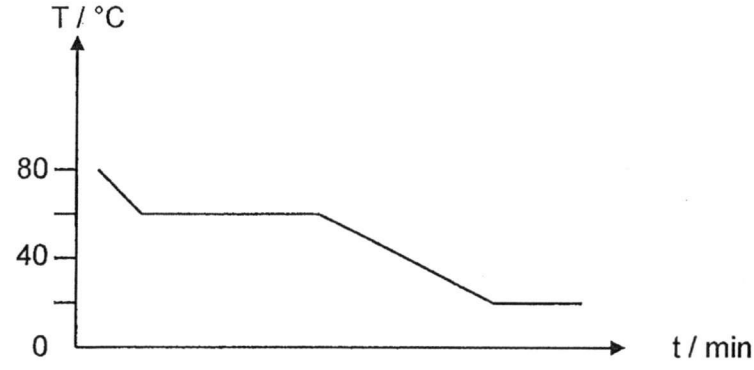
10 A boy left an ice cube on a steel bar as shown below. After a while he touched the opposite end of the steel bar and found that it was cold.



Which of the following statements explains why the steel bar felt cold to his touch?

A The ice cube lost heat to the steel bar, making the bar cold.
B The boy's finger lost coldness to the steel bar.
C The steel bar gained heat from the boy's finger.
D The steel bar lost heat to the boy's finger.

11 The temperature of molten wax, **T**, is recorded at regular intervals in a laboratory of room temperature 20°C. A graph of temperature against time is made. According to the graph, what is the melting point of wax?

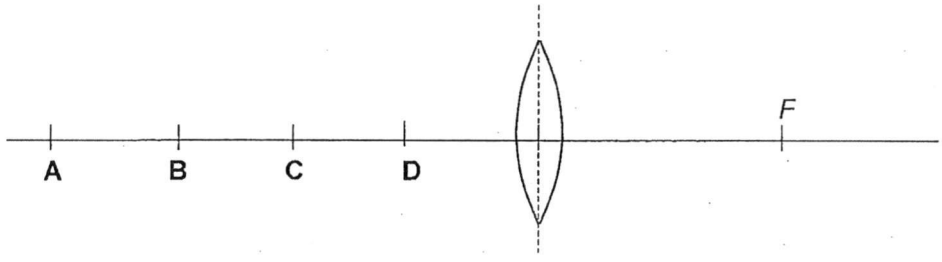


A 20 °C **B** 60 °C **C** 40 °C **D** 80 °C

12 Which of the following correctly shows the differences between boiling and evaporation?

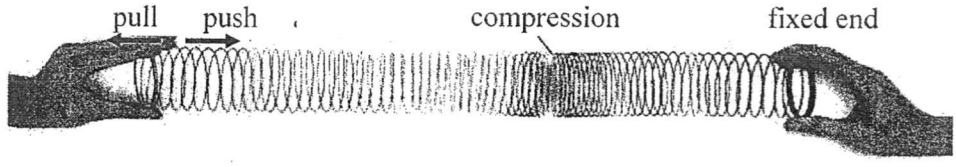
	Boiling	**Evaporation**
A	Occurs at any temperature	Occurs at fixed temperature
B	Bubbles are seen	No bubbles seen
C	A slow process	A quick process
D	Occurs at surface of liquid	Occurs throughout the liquid

13 The diagram below shows four possible positions, **A**, **B**, **C** and **D** of an object in front of a converging lens with a principal focus at *F*.



In which of the positions **A, B, C or D** would you place an object to use the lens as a magnifying lens?

14 One end of a long spring is moved backwards and forwards to produce a model of a wave.



What is this type of wave called, and what is a good example of it?

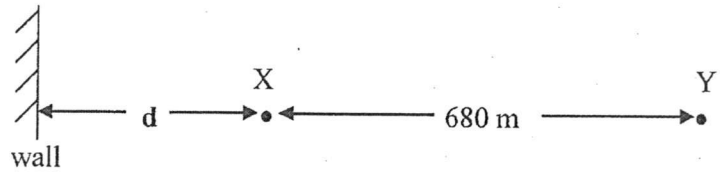
	Type of wave	Example
A	Transverse	Radio wave
B	Transverse	Sound wave
C	Longitudinal	Radio wave
D	Longitudinal	Sound wave

15 The table shows the electromagnetic spectrum of the electromagnetic waves.

Gamma Rays	**A**	**B**	**C**	**D**		Radio Waves

Which of the waves (**A**, **B**, **C** or **D**) is used in sunbeds and sterilising of medical equipment?

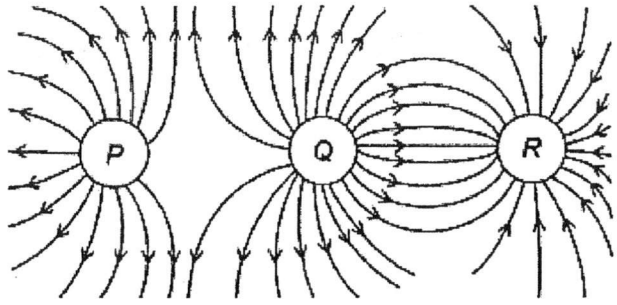
16 Two boys X and Y are standing in front of a vertical wall as shown in the diagram. Boy X fires a pistol and Y hears two sounds at time interval of 2 s.



If the speed of the sound is 340 m/s in air, what is the value of **d**?

A 170 m **B** 340 m **C** 680 m **D** 850 m

17 The figure below shows the pattern of electric field produced by three charged spheres.

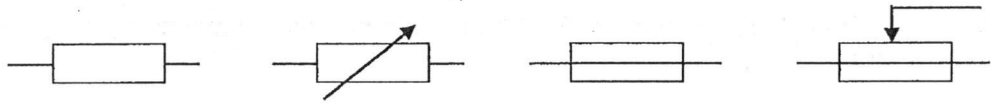


Which of the following correctly shows the charge on each sphere?

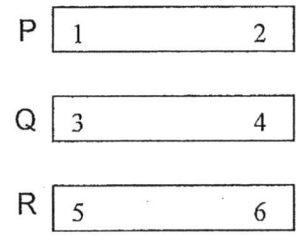
	P	Q	R
A	+	+	-
B	-	-	+
C	-	+	-
D	+	-	+

18 Which of the following is the circuit symbol of a fuse?

A B C D



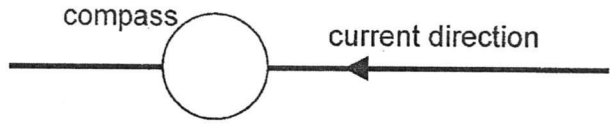
19 Three metal bars P, Q and R are identical in size and shape. They are suspected to be magnets. Tests are carried out and it is found that there is attraction between poles 1 and 6, between 2 and 4, and between 2 and 6. However, there is repulsion between 2 and 3.



Without making any further tests, which of these statements is correct?

A Only P and Q are magnets.
B Only P and R are magnets.
C Only Q and R are magnets.
D All three metal bars are magnets.

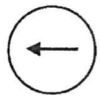
20 A plotting compass is placed on top of a current-carrying wire as shown below. Which of the following shows the compass needle's direction?



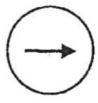
A

B

C



D



BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2017

4E5N

CANDIDATE NAME

CLASS

REGISTER NUMBER

Science (Physics)
Paper 2

5076
31 July 2017
1 h 15 min

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name on the cover page.
Do not use paper clips, highlighters, glue or correction fluid.
Write in dark blue or black ink. You may use a soft pencil for any diagrams, graphs or rough working.

Section A [45 marks]
Answer **all** questions. Write your answers in the spaces provided on the question paper.

Section B [20 marks]
Answer any **two** questions and write your answers in the spaces provided.

Candidates are reminded that all quantitative answers should include appropriate units.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of physics than for correct answers.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Paper 1	20
Paper 2 Section A	45
Paper 2 Section B	20
TOTAL	85

Setter: Mr Sean Goh

This document consists of **16** printed pages including the cover page

Section A (45 Marks)

Answer **all** questions. Write your answer on the spaces provided.

1 A cyclist starts from rest. He accelerates and then travels at a constant speed. Photographs are taken of the cyclist at 4.0 s intervals. Fig. 1.1 shows the results.

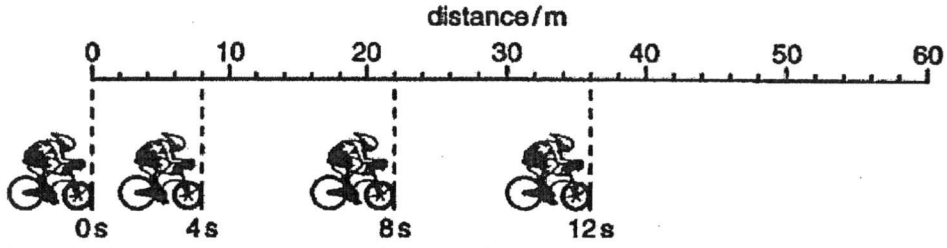


Fig. 1.1

(a) On Fig. 1.1, draw a possible position of the front wheel of the cycle at 16 s. [1]

(b) On Fig. 1.2, plot a distance-time graph of the cyclist for the first 12 s. [2]

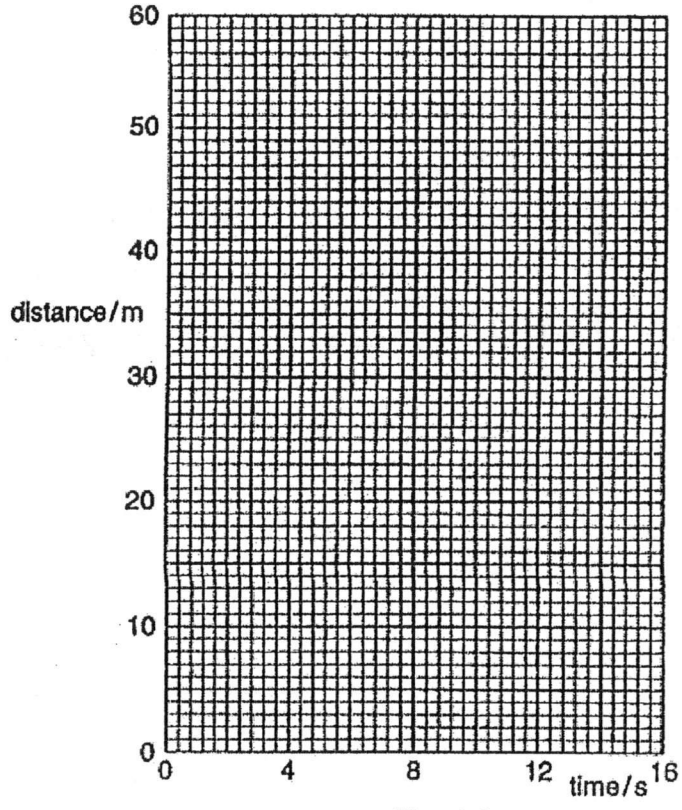


Fig. 1.2

(c) Calculate the average speed of the cyclist during the first 12 s.

average speed = ... m/s [2]

2 A hovercraft moves on a cushion of air which is trapped underneath it, as shown in Fig. 2. The trapped air reduces friction.

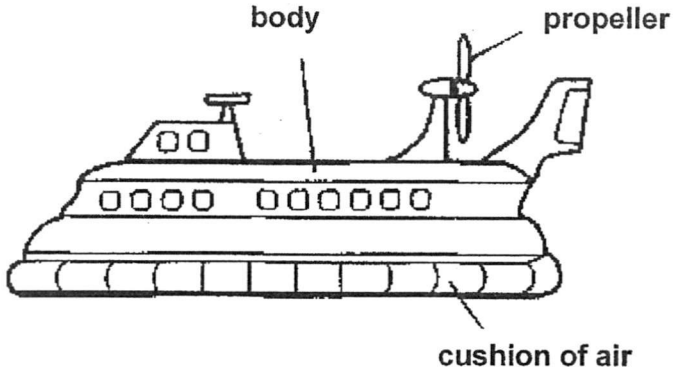


Fig. 2

(a) The hovercraft starts from rest and, as it starts, the propeller produces a forward force **F** of 22 000 N. The mass of the hovercraft is 25 000 kg.

Calculate the initial acceleration of the hovercraft. You may assume there is no friction.

acceleration = ...[2]

(b) Some time later, the hovercraft reaches a steady speed, even though the force **F** is unchanged.

Suggest in terms of the forces acting on the hovercraft, why the speed is now constant.

.....

.....

.....[2]

3 Fig. 3 shows part of a non-uniform tube filled with an incompressible liquid. The wider end is fitted with a large piston of cross-sectional area 10 cm^2 and the narrower end is fitted with a small piston of cross-sectional area 2.0 cm^2.

A force F = 40 N is exerted on the large piston. The pressure created by the large piston is equal to the pressure acting on the small piston.

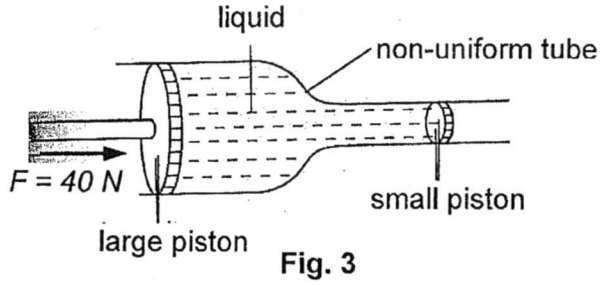


Fig. 3

(a) Calculate the pressure produced by the 40 N force.

pressure = ... N/cm^2 [2]

(b) What is the force acting on the small piston?

force = ... N [1]

(c) If the large piston is moved through a distance of 3.0 cm, calculate the distance moved by the small piston?

distance = ... cm [2]

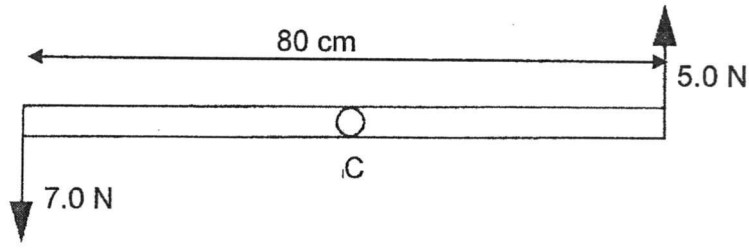
4 **(a)** State the principle of moments.

.....

.....

..... [1]

(b) A uniform rod of length 80 cm is freely pivoted about its centre of gravity *C*. Forces of 7.0 N and 5.0 N act at the ends of the rod as shown in the diagram.

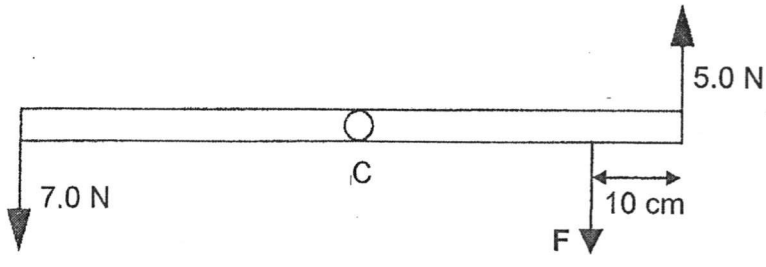


Determine

(i) the sum of the anti-clockwise moments of the forces about the point *C* in newton metre,

anti-clockwise moments = ... Nm [2]

(ii) the downward force **F** acting 10 cm away from the right-end edge to keep the rod in equilibrium.



F = ... N [2]

5 A water pump lifts 500 kg of water every minute from a well 25 m deep. The gravitational field strength is 10 N/kg.

(a) Calculate the gravitational potential energy gained by the water every minute.

gravitational potential energy = ... J [2]

(b) What power was used to lift the water from the well?

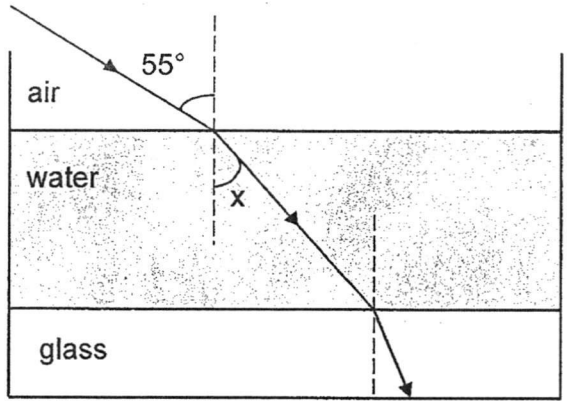
Power = ... W [2]

(c) In a practical situation, the pump needs to produce more energy per minute than the value calculated in (a) in order to lift the water. Explain why this is so.

.....

.....[1]

6 The diagram (not drawn to scale) shows a ray of light travelling from air into water and through a piece of glass. The refractive index of water is 1.33.



(a) Determine angle x (angle of refraction in water)

angle x = ... ^{0} [2]

(b) If the speed of light in air is 3.0×10^8 ms^{-1}, what is the speed of light in water?

Speed of light in water = ... m/s [2]

(c) Which of the following, water or glass, has a higher refractive index? Explain your answer with reference to the diagram above.

.....

.....

..... [2]

7 The table below gives information about the wavelength and output power of some types of laser.

Type of laser	Wavelength/ m	Output power/ W
Excer	3.2×10^{-7}	20.0
Neon	4.9×10^{-7}	2.0
Diee	5.5×10^{-7}	0.50
Hee-lee	6.3×10^{-7}	0.0050
Yak	10.6×10^{-7}	50.0

The visible spectrum has wavelengths ranging from 4.0×10^{-7} m to 7.0×10^{-7} m. Speed of light in air is 3.0×10^{8} m/s.

(a) Which laser emits infra-red radiation?

..... [1]

(b) Which has the highest frequency? Explain how you derive your answer.

.....

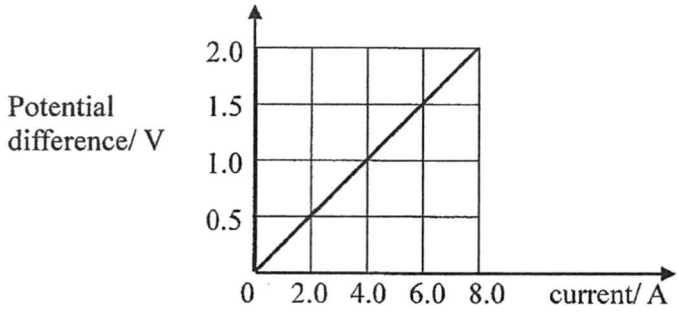
.....

.....[2]

(c) Light from a Neon laser is used to treat a patient's eye. During the treatment, the laser fires 20 short pulses of light. Each pulse lasts 0.20 s. Calculate the energy given out by the laser during treatment.

energy = ... J [2]

8 The graph shows the potential difference-current characteristics of a conductor.



If the potential difference across the conductor is 1.5 V,

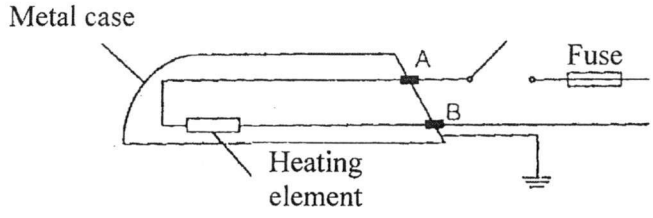
(a) how much charges flow through the conductor for 5.0 minutes?

charge = ... C [2]

(b) How much work is done in bringing the charge through the conductor in 5.0 minutes?

work = ... J [2]

9 The diagram shows the main parts of an electric iron.



If the insulation at contact point **A** is damaged so that the wire comes into contact with the metal case. When the switch is closed, state and explain:

(a) whether the fuse will blow;

.....

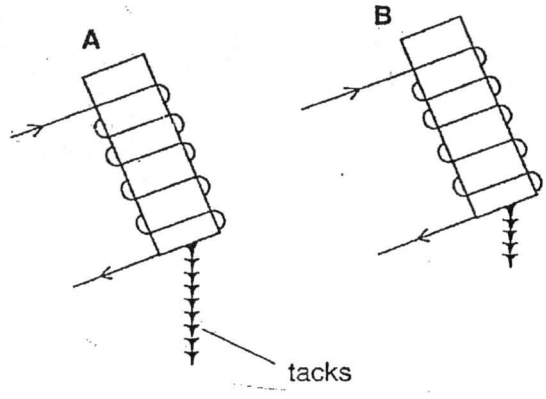
..... [1]

(b) what will happen to the user who touches the metal case.

.....

..... [1]

10 The diagram shows two identical coils A and B. Each has the same current passing through it but one of the coils has a steel rod inside it while the other coil has a soft iron rod inside.



(a) Which of the coils has the soft iron rod inside? Explain your choice

.....

.....

..... [2]

(b) What would happen to the tacks at the end of coil A if the current was switched off? Explain your answer.

.....

.....

..... [2]

Section B (20 Marks)

Answer any **two** questions. Write your answer on the spaces provided.

11 **(a)** Fig. 11.1 shows the displacement-distance graph of a wave at a particular time.

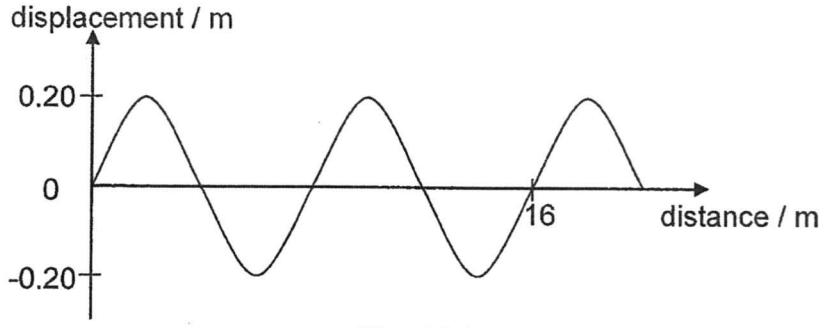


Fig. 11.1

Fig. 11.2 shows the displacement-time graph of the same wave at a particular point along the wave.

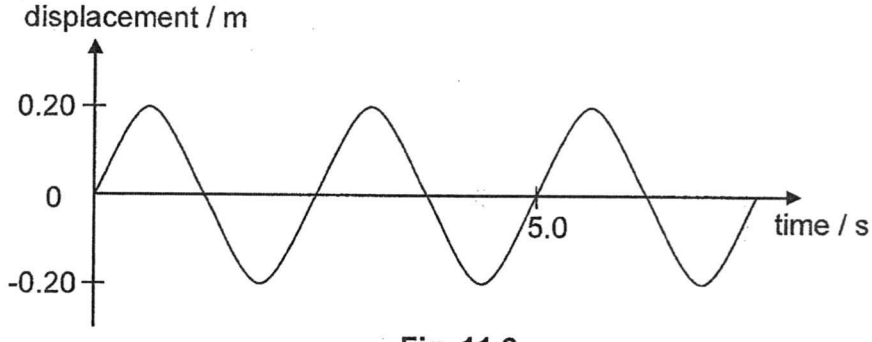


Fig. 11.2

Determine,

(i) the amplitude of the wave.

amplitude = ... [1]

(ii) the wavelength of the wave.

wavelength = ... [1]

(iii) the frequency of the wave.

frequency = ... [2]

(iv) the speed of the wave.

Speed = ... [2]

(b)(i) A particular sound wave is shown on Fig. 11.3. On Fig. 11.3, draw a sound wave which is louder but of the same pitch. [2]

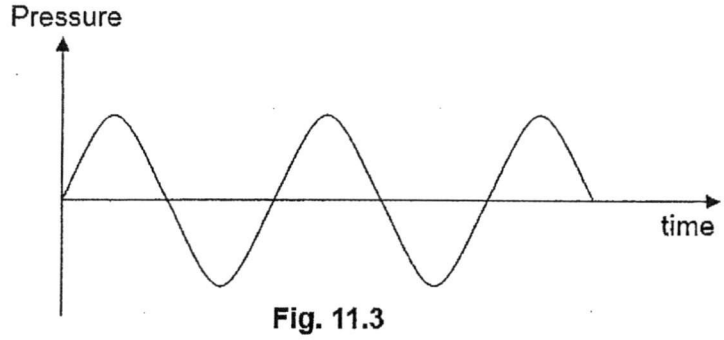


Fig. 11.3

(ii) Another sound wave is shown on Fig. 11.4. On Fig. 11.4, draw a sound wave which is softer and of a lower pitch. [2]

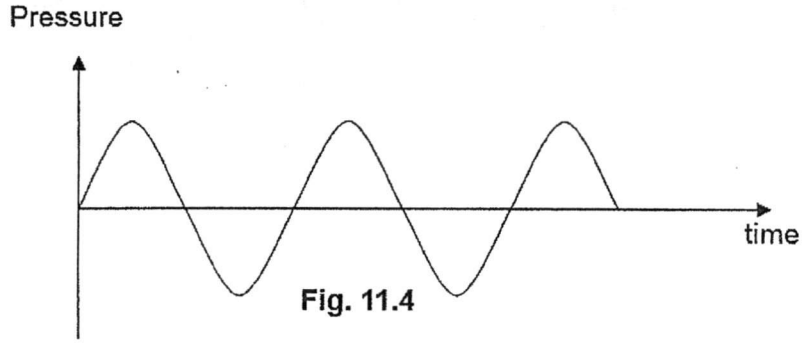


Fig. 11.4

12 Fig. 12.1 shows how the current in the filament of a lamp depends on the potential difference across it.

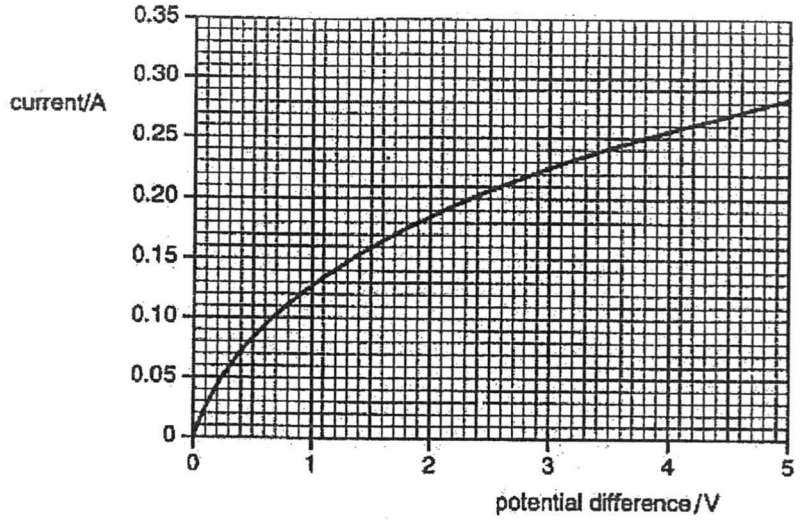


Fig. 12.1

(a) Calculate the resistance of the filament when the current is 0.25 A.

Resistance = ... [2]

(b) Explain how Fig. 12.1 shows that the resistance of the filament increases with temperature rise.

.....

.....

..... [2]

(c) The lamp in Fig. 12.1 is connected in a circuit shown in Fig. 12.2.

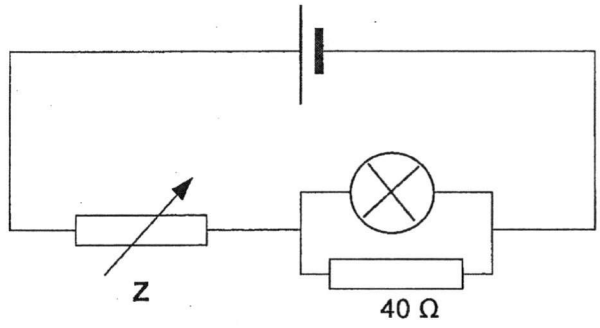


Fig. 12.2

The current in the lamp is maintained at 0.25 A. Determine

(i) the potential difference across the 40 Ω resistor,

Potential difference = ... [1]

(ii) the current in the 40 Ω resistor,

Current = ... A [2]

(iii) the current in the variable resistor, **Z**.

current = ... A [1]

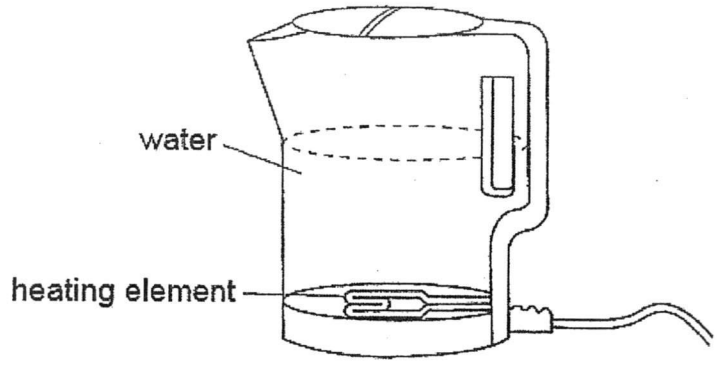
(d) If the lamp blows (spoilt), explain how will the current flowing through the circuit change.

.....

.....

..... [2]

13 The figure below shows an electric kettle connected to the mains supply.



(a) Explain, using the concept of density changes, how the water in the kettle is heated by convection.

.....

.....

.....

.....

.....

..... [3]

(b) Suggest a reason why the body of the kettle is made of plastic instead of metal.

.....

..... [1]

(c) Should the body of the kettle be painted black or white? Give reason for your answer.

.....

.....

..... [2]

(d) Given that the potential difference of the mains supply is 240 V and the current in the heating element of the kettle is 8.0 A, calculate the resistance of the heating element.

Resistance = ... [1]

(e) The kettle is switched on for a period of 20 min per day. Calculate the cost of using this kettle for 25 days if the cost of electricity is 30¢ per kWh.

Cost = ... [3]

End of paper

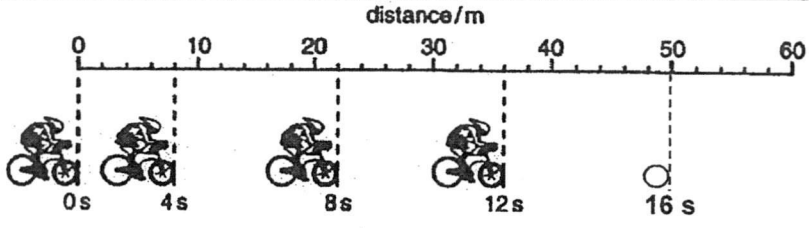
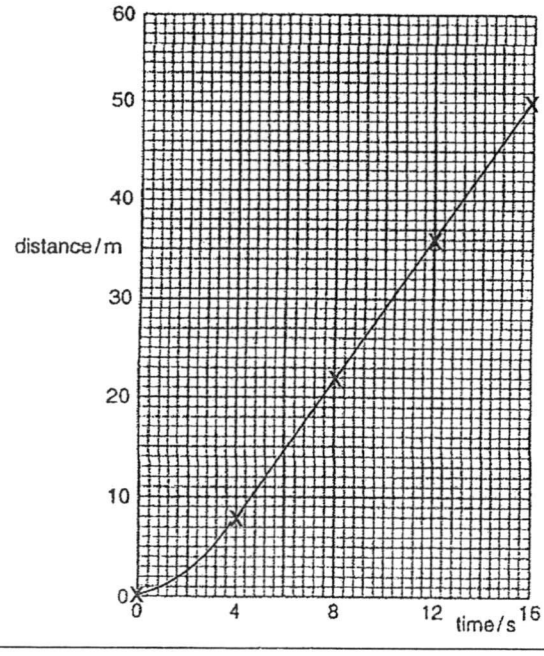
Bedok South Secondary School
Sec 4Exp/ 5NA Science (Physics) Prelim Exam 2017
Marking scheme

Paper 1

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

Paper 2

Section A

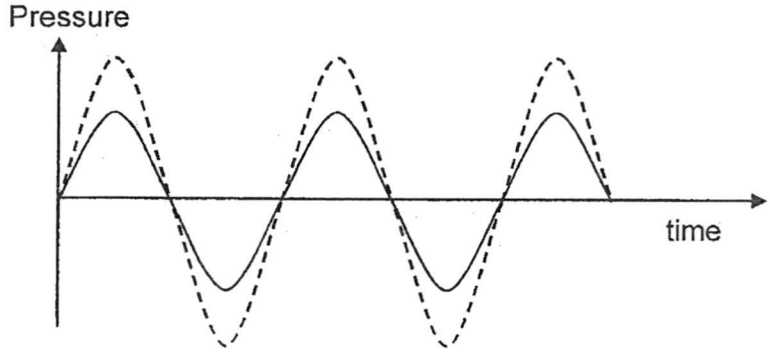
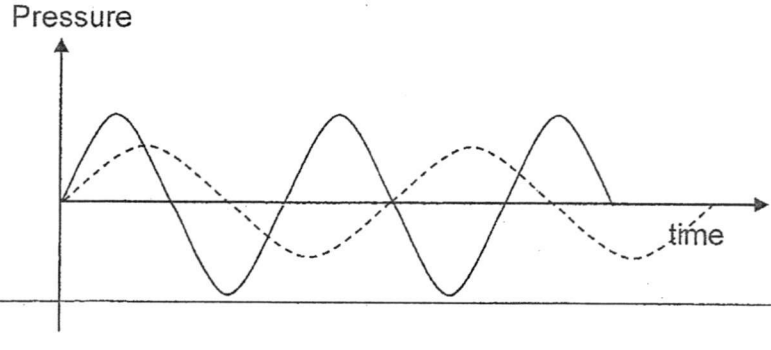
No.	Answers	Marks
1(a)		[1]
(b)		Correct Points plotted [1] Best fit line [1]

(c)	Average speed = $\frac{total\_distance}{total\_time} = \frac{36}{12}$ = 3.0 m/s	[1] [1]
2(a)	F = ma 22 000 = 25 000 x a a = 0.88 m/s^2	[1] [1]
(b)	As the speed of the hovercraft increases, the air resistance also increases. When the magnitude of the air resistance is equal to the applied force, there will be no resultant force acting on the hovercraft and it will move with constant speed.	[1] [1]
3(a)	P = $\frac{F}{A} = \frac{40}{10}$ = 4.0 N/cm^2	[1] [1]
(b)	P = $\frac{F}{A}$ 4.0 = $\frac{F}{2.0}$ F = 8.0 N	 [1]
(c)	Liquid volume is incompressible: 2 x d = 10 x 3 d = 15 cm	[1] [1]
4(a)	The principle of moment states that when a body is in equilibrium, the sum of clockwise moments about a pivot is equal to the sum of anti-clockwise moments about the same pivot.	[1]
(b)(i)	Sum of anti-clockwise moments = 5 x 0.4 + 7 x 0.4 = 4.8 Nm	[1] [1]
(ii)	F x 0.3 = 4.8 F = 16 N	[1] [1]
5(a)	Gain in G.P.E, E_p = m g h = 500 x 10 x 25 = 125 000 J or 130 000 J = 125 kJ or 130 kJ	[1] [1]
(b)	Power, P = $\frac{E}{t}$	

	$= \frac{125000}{60}$ = 2080 W or 2100 W	[1] [1]
(c)	There is energy losses due to friction in the operation of the pump.	[1]
6(a)	Refractive index, n = $\frac{\sin i}{\sin r}$ $1.33 = \frac{\sin 55}{\sin x}$ $x = 38.0^0$	 [1] [1]
(b)	Refractive index, n = $\frac{C}{v}$ $1.33 = \frac{3.0x10^8}{v}$ V = 2.26 x 10^8 m/s or 2.3 x 10^8 m/s	 [1] [1]
(c)	Glass has a higher refractive index than water. This is can be seen when light ray travels from water to glass, the ray bends towards the normal.	[1] [1]
7(a)	Yak	[1]
(b)	Excer. Since all travelling at same speed in air/vacuum, the wave with the shortest wavelength will have the highest frequency.	[1] [1]
(c)	Energy = power x time = 2.0 x 0.2 x 20 = 8.0 J	 [1] [1]
8(a)	Charge, Q = I x t = 6.0 x (5 x 60) = 1 800 C	 [1] [1]
(b)	Work = V x Q = 1.5 x 1800 = 2 700 J	 [1] [1]
9(a)	When this happens, a large current will flow through the casing and down to the earth it is a low resistance path.	

	This will cause the fuse to blow.	[1]
(b)	Since the fuse has blown, nothing will happen to the user when he/she touches the casing.	[1]
10(a)	Coil A has a soft iron inside as it is more strongly magnetized than B	[1] [1]
(b)	All the tacks will dropped off when the current is switched off as iron loses its magnetism easily.	[1] [1]

Section B

No.	**Answers**	**Marks**
11(a)(i)	Amplitude = 0.20 m	[1]
(ii)	Wavelength = 16 / 2 = 8.0 m	[1]
(iii)	Period, T = 5 / 2 = 2.5 s Frequency , f = 1/T = 1 / 2.5 = 0.40 Hz	[1] [1]
(iv)	Speed, v = f λ = 0.40 x 8.0 = 3.2 m/s	 [1] [1]
(b)(i)		Amplitude larger [1] Same period [1]
(b)(ii)		Amplitude smaller [1] Period longer [1]

12(a)	When current, I = 0.25 A, V = 3.7 V (from the graph) Therefore, Resistance, R = V / I = 3.7 / 0.25 = 14.8 Ω	[1] [1]
(b)	For each unit of current increase, the potential difference increases at a larger amount. Thus the resistance increases as current increases. Since higher current produces greater heat, resistance increases s temperature increases.	 [1] [1]
(c)(i)	Potential difference across 40 Ω resistor = potential difference across the lamp = 3.7 V (parallel connection)	[1]
(ii)	Current, I = V/R = 3.7 / 40 = 0.0925 A or 0.093 A	 [1] [1]
(iii)	Current through Z = 0.0925 + 0.25 = 0.363 A or 0.36 A	 [1]
(d)	When the lamp blows, the effective resistance of the circuit increases. The current in the circuit will thus reduce.	 [1] [1]
13(a)	When the water near the heating element gets heated, it becomes less dense and rises to the top. The cooler water near the top, being denser, will sink and in turns gets heated and rises. This process continues and a convection current is set up, causing all the water to be heated.	 [1] [1] [1]
(b)	Plastic is a poor conductor of heat. It will reduce heat loss by conduction.	 [1]
(c)	It should be painted white to reduce heat loss by radiation as a white surface is a poor emitter of heat radiation.	[1] [1]
(d)	Resistance, R = V/I = 240 / 8 = 30 Ω	 [1]

(e)	Power, P = V I = 240 x 8 = 1920 W = 1.92 kW	[1]
	Energy, E = P t = 1.92 kW x $\frac{20}{60}$ h x 25 = 16 kWh	[1]
	Cost = 16 x 0.30 = \$4.80	[1]