REGENT SECONDARY SCHOOL
PRELIMINARY EXAMINATION - 2016
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
SCIENCE (PHYSICS) PAPER 1
(5076/1)

40
Target:

Name: _____ ( ) **Date:** 26 August 2016

Class: Sec _____ **Duration:** 1 hour 15 minutes

Setter: Mrs Lau BH **Parent's Signature:** _____

INSTRUCTIONS TO CANDIDATES:

Do not turn over the pages until you are told to do so.

Write your name, index number on the answer sheet in the spaces provided above.

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 correct and record your choice in **soft pencil** on the separate answer sheet.

Read carefully the instructions on the answer sheet.

Hand in the OMR Answer Sheet and the Question paper separately.

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 table showing colours of some metal hydroxides is printed on page 19.
A copy of the Periodic table is printed on page 20.

Take g = 10 m/s^2 or 10 N/kg for this paper

This paper consists of 20 questions on 8 printed pages.

Multiple Choice Questions [40 marks]
Choose the correct answers and shade the corresponding oval in the OMR provided.

1 Which of the following correctly identifies a scalar quantity and a vector quantity?

	Scalar Quantity	Vector Quantity
A	force	speed
B	acceleration	velocity
C	temperature	mass
D	time	displacement

2 In an experiment, the time taken by a simple pendulum to complete 50 oscillations was measured and recorded as shown in the table below.

Trial number	Time for 50 oscillations / s
1	70.7
2	70.1
3	69.2

What is the period of the pendulum?

A 1.4 s **B** 69.2 s **C** 70.0 s **D** 70.7 s

3 Forces X and Y act on an object in the directions shown in **Fig a**.

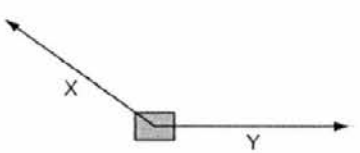


Fig. a

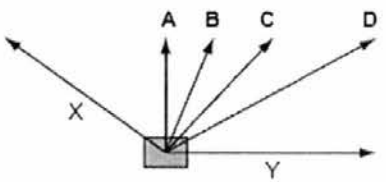
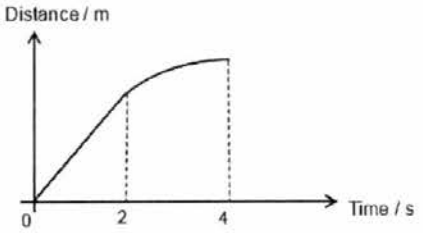


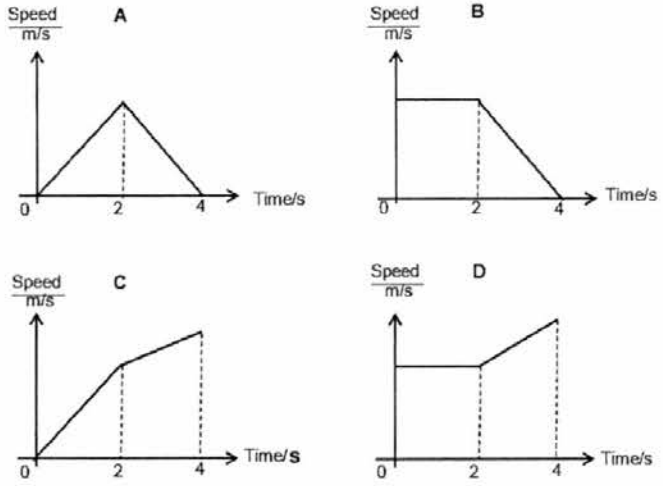
Fig. b

Which arrow in **Fig. b** shows the direction of the resultant force on the object? B

4 The distance-time graph of a toy car is as shown below.



Which of the following speed-time graphs represents the motion of the toy car?



5 A force of 30 N pushes an object of mass 2.0 kg along a rough horizontal surface with an acceleration of 7.5 m/s^2.

What is the friction acting on the object?

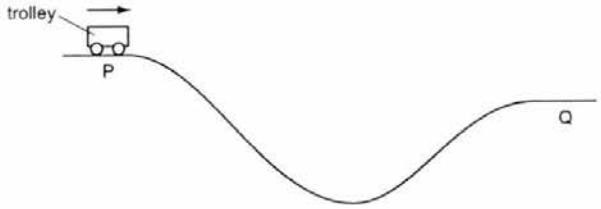
A 5 N **B** 10 N

C 15 N **D** 20 N

6 When a car turns a corner at high speed, it risks toppling over. Two factors affecting the stability of a car are the height of its centre of gravity and the distance between its front wheels. Which factors make the car most stable?

	position of centre of gravity	distance between front wheels
A	high	small
B	high	large
C	low	small
D	low	large

7 A trolley runs from P to Q along a smooth track.



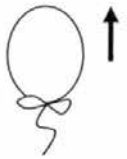
At P, the kinetic energy of the trolley is 5 kJ.

At Q its potential energy is 40 kJ less than that at P.

What is the kinetic energy of the trolley at Q?

A 50 kJ
B 45 kJ
C 40 kJ
D 35 kJ

8 A balloon is released and rises up into the sky, as shown in the diagram below. The temperature of the balloon increases as it rises higher.



Assuming the volume of the balloon remains constant, which of the following statements about the air molecules in the balloon is correct?

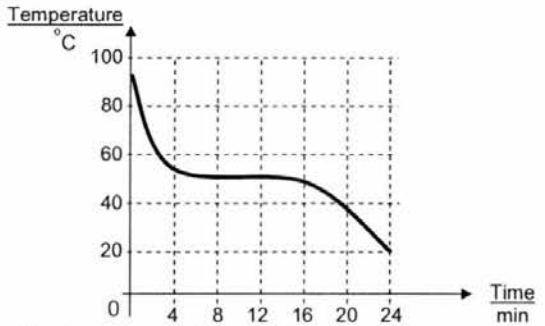
A The air molecules move at the same speed and expand to cause an increase in pressure.

B The air molecules move at slower speeds and contract to cause an decrease in pressure.

C The air molecules move at greater speeds and collide against the walls of the balloon more frequently.

D The air molecules move at slower speeds and collide against the walls of the balloon less frequently.

9 The graph shows the change in temperature as a liquid is cooled until it reaches room temperature.

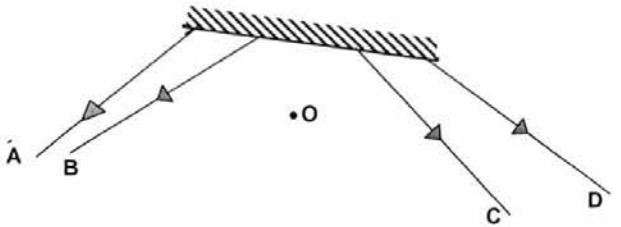


Which one of the following row is correct?

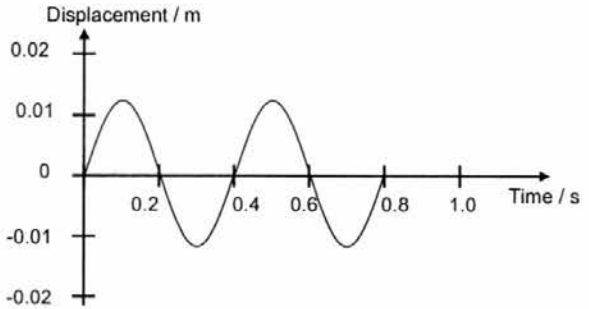
	change in states	duration for change	temperature for change of states
A	condensation	24 minutes	90 °C
B	evaporation	24 minutes	20 °C
C	freezing	12 minutes	50 °C
D	melting	12 minutes	50 °C

10 The diagram shows an object **O** in front of a plane mirror.

Which of the reflected light appears to come from the image of **O**?



11 A displacement-time graph of a wave is shown below.



What is the frequency of this wave?

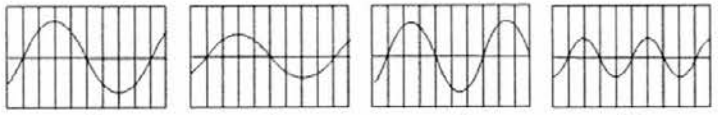
A 0.20 Hz
B 0.40 Hz
C 1.25 Hz
D 2.50 Hz

12 Which statement about the electromagnetic spectrum is incorrect?

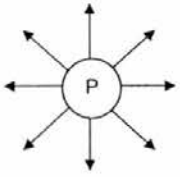
A Infrared rays is used in remote controls.
B Visible light has a longer wavelength than ultraviolet ray.
C All electromagnetic waves travel at the same speed in all mediums.
D X-rays have lower frequency than gamma rays.

13 The diagrams show traces of sounds picked up by microphones.

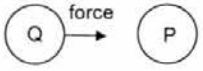
Which trace shows the loudest sound with the lowest pitch?



14 The diagram shows the direction of electric field lines around an isolated point charge P.



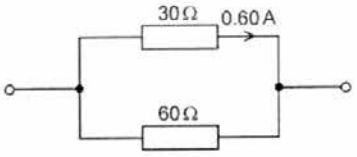
If a charged object Q is placed in the position shown, it experiences a force to the right.



What are the charges on P and Q?

	P	Q
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

15 Two resistors of resistances 30 Ω and 60 Ω are arranged in parallel. The current in the 30 Ω resistor is 0.60 A.



What is the potential difference across the 60 Ω resistor?

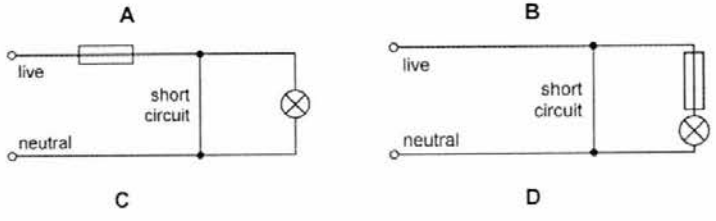
A 9.0 V B 18 V C 36 V D 54 V

16 An electric oven is connected to the mains supply using insulated copper wires. The wires become very warm.

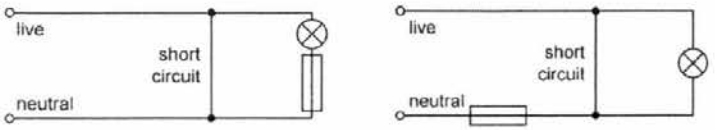
What can be done to prevent so much heat being produced in the connecting wires?

A Use thicker insulation.
B Use thinner insulation.
C Use thicker copper wires.
D Use thinner copper wires.

17 In each of the circuits below, a short circuit occurs. In which circuit would the fuse blow and make the circuit safe to repair?



C D



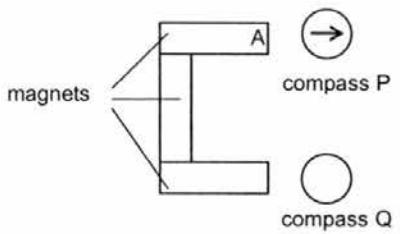
18 A heater marked "120 V, 3 A" is switched on for 90 min. The cost of electricity is 26 cents per kWh. What is the cost of usage?

A $0.14
B $1.04
C $8.42
D $140.40

19 A plug connected to a table lamp contains a 13 A fuse. Why is the fuse needed?

A To increase the resistance of the circuit.
B To make it easier for the current to flow.
C To prevent the lamp from getting too dim.
D To protect the wiring from the overheating.

20 A student set up three bar magnets and two compasses as shown below. He then brought compass P towards pole A of a bar magnet as shown in the diagram below.



Which of the following represents the direction compass Q will point to?

A 
B 
C 
D 

END OF PAPER-

REGENT SECONDARY SCHOOL
PRELIMINARY EXAMINATION - 2016
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
SCIENCE (PHYSICS) PAPER 2
(5076/2)

65
Target:

Name: _____ ( ) **Date:** 29 August 2016

Class: Sec _____ **Duration:** 1 hour 15 minutes

Setter: Mrs Lau BH **Parent's Signature:** _____

INSTRUCTIONS TO CANDIDATES:

Do not turn over the pages until you are told to do so.

Section A

Answer **all** the questions. Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions. Write your answers in the spaces provided on the question paper.
Enter the numbers of the Section B questions you have answered in the grid below.

INFORMATION FOR CANDIDATES

The number of marks is given in bracket [ ] at the end of each question or part of a question.
Scientific calculators are allowed to be used.
Take g = 10 N/kg or 10 ms^{-2}

	For Examiner's Use
Section A	
Section B	
Total	

This paper consists of 12 questions on 19 printed pages.

Section A [45 marks]

Answer **all** questions. Write your answers in the spaces provided on the question

1 Water is transported to a village in a tank pulled by a tractor.
Fig. 1.1 shows the tank being pulled by a tractor.

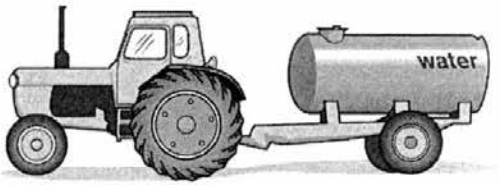


Fig. 1.1

The combined mass of the tractor and the tank is 4100 kg when the tank is empty and 6500 kg when the tank is full of water.

(a) The density of water is 1000 kg/m^3.
Calculate the volume of water in the tank when it is full. [2]

Volume = ... m^3

(b) At the start of the journey, the tractor and tank accelerate from rest along a straight, horizontal road. As their speed increases, one form of energy is decreasing.

(i) State the name of the form of energy that is decreasing. [1]

.....

(ii) Explain what happens to this energy. [2]

.....

.....

2 **Fig. 2.1** shows a hydraulic lift in a car repair shop used to raise a stationary car at constant speed. The hydraulic fluid pressure transmitted by piston *A* is transmitted by the fluid to the four pistons.
Piston *A* has a cross-sectional area of 0.01 m^2 while each of the pistons have a cross-sectional area of 0.02 m^2.

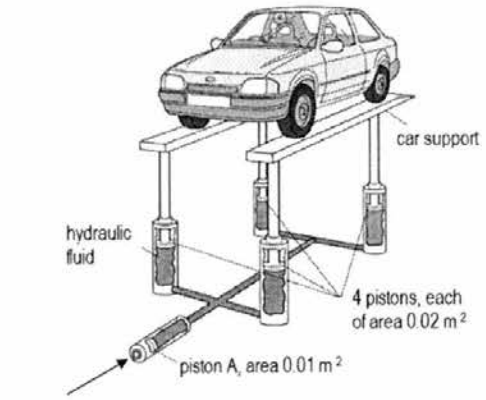


Fig. 2.1

The magnitude of force *F* applied on piston A is 1200 N.

(a) Calculate the pressure produced by piston *A* when force *F* is exerted. [2]

Pressure = ...Pa

The pressure produced by piston *A* is transmitted to each of the other four pistons. In other words, the pressure that the fluid exerts on **each piston** is the **same as** the pressure produced by piston *A*.

(b) Calculate the force produced in each of the four pistons as a result of this pressure transmitted from piston *A*. [2]

Force = ... N

2(c) If the car is raised at constant speed, state the resultant force acting on the car. [1]

Resultant force = ... N

3 A water-wheel has eight buckets equally spaced around its circumference, as illustrated illustrated in **Fig. 3.1**. The distance between the centre of each bucket and the centre centre of the wheel is 2.5 m. When a bucket is at its highest point, the bucket is filled with a mass of 150 kg of water. The moment of the weight of the bucket about the centre of the wheel causes the wheel to rotate. The bucket is then emptied at its lowest point.

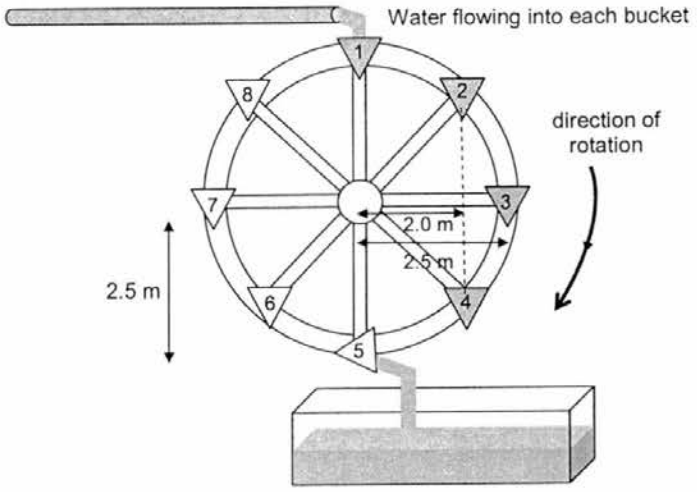


Fig. 3.1

(a) State what is meant by the moment of a force. [1]

.....

.....

3(b) State and explain which bucket number provides the largest moment about the centre of the wheel. [2]

.....

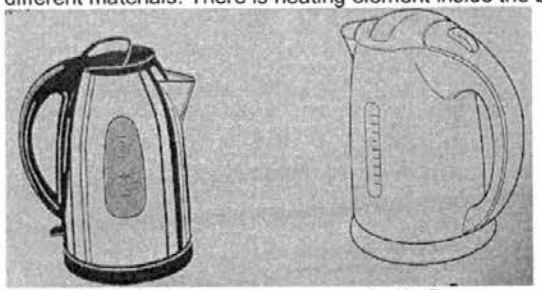
.....

.....

(c) Sand is poured into bucket 7 in order to stop the rotation of the wheel. Bucket 2 and 4 are at a horizontal distance of 2.0 m from the centre of the wheel. By ignoring the mass of the empty buckets, calculate the weight of sand needed to stop the rotation at the point in time seen in **Fig. 3.1.** Buckets 1, 2, 3 and 4 are filled with water at this point in time. (Use Principle of Moments) [2]

Weight = ...N

4 **Fig. 4.1** shows two different kettles. The bodies of the kettles are made from different materials. There is heating element inside the bottom of each kettle.



kettle A kettle B

Fig. 4.1

Kettle A is made from shiny silver-coloured metal.
Kettle B is made from white plastic.

(a) Justify with reasons why kettle B is preferred to be used in reducing heat losses from the kettle when both are used to boil water. [4]

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(b) Kettle B has a power of 2800 W and is used to boil 1.0 kg of water. It takes 4.5 minutes to boil the water.

(i) Calculate the electrical energy produced to boil the water. [2]

Electrical energy = ...kJ

(ii) Describe the process by which all the water in the kettle gets heated evenly and quickly. [2]

.....

.....

.....

4 (c) The body of kettle A is earthed. Explain why the earthing is necessary. [2]

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.....

(d) When boiling occurs, it is found that the temperature of the water remains constant even though the switch is still on.

(i) State if the average kinetic energy of the water molecules increases, decreases or remains unchanged. [1]

.....

(ii) Explain why the temperature of the water remains constant even though the water is still being heated. [1]

.....

.....

5 **Fig. 5.1** shows a young boy lying on his back on the bottom of a swimming pool. He is holding his breath and his eyes are open. A red light is positioned on the ground at **Q**.
At first the boy's head is touching the pool wall. He notices that, as he slides away from the pool wall, his eye reaches a point P where he first sees the light at **Q**. **Fig. 5.1** shows the boy in this position.

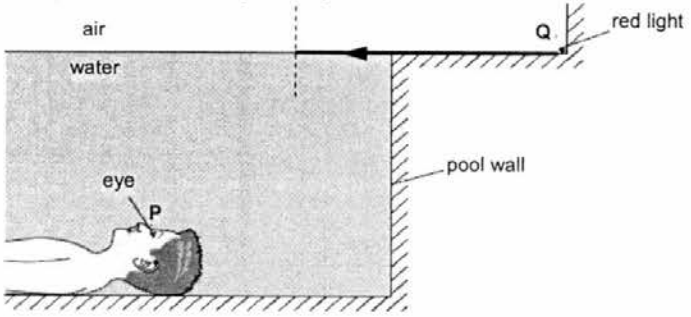

Fig. 5.1

5 (a) On **Fig. 5.1**, complete the path of a light ray travelling **from Q to P**. Mark the critical angle for light in water and label it **c**. [2]

(b) Explain why the boy is unable to see the red light at **Q** when his eye is closer to the pool wall than **P**. [2]

.....

.....

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(c) The critical angle for light in the water is 50°, calculate the refractive index of water. [2]

Refractive index = ...

6 **Fig. 6.1** shows the lens of a simple camera being used to photograph an object.

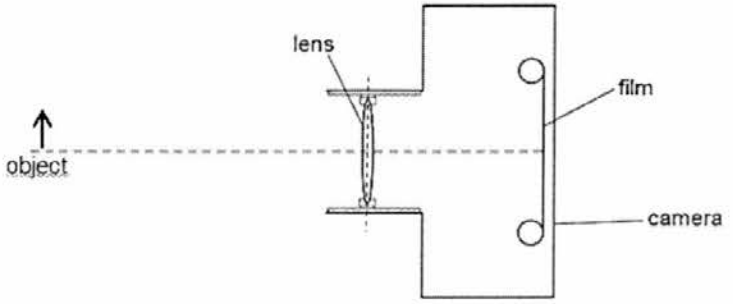


Fig 6.1

The lens forms a focused image of the object on the film.

(a) Draw two rays from the top of the object to show how the lens forms its image, **I** on the film. [2]

(b) Besides the size, state another property of the image. [1]

.....

6(c) The same camera is used to photograph another object far away.
State an adjustment to the position of the lens to form a focused image on the film. [1]

.....

7 **Fig. 7.1** shows a wiring diagram for two different lamps A and B.

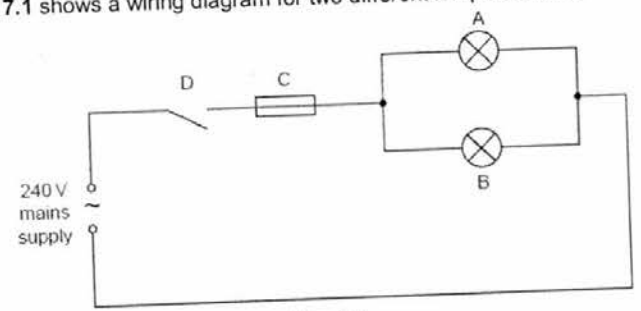


Fig. 7.1

When both lamps are working correctly, the current in C is 0.42 A.
Lamp A is marked 240 V, 60 W. Calculate

(a) the current in lamp A, [2]

Current = ... A

(b) the current in lamp B, [1]

Current = ...A

(c) the resistance of lamp A. [2]

Resistance = ...Ω

8 **(a)** On **Fig. 8.1**, indicate the polarities on the ends of the magnets when a downward force is produced on the current-carrying wire that is placed in a magnetic field. [1]

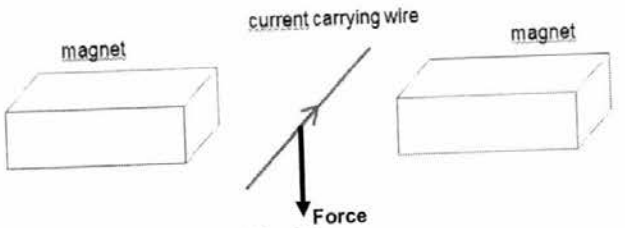


Fig. 8.1

(b) Other than increasing the magnitude of the current flowing through the wire, suggest a way to increase the magnitude of the force acting on this wire. [1]

.....

9 A coil of wire is wrapped around an iron core and connected to a d.c power Supply **P**. An iron rod is suspended close to one end of the iron core and a small bar magnet is suspended close to the other end, as shown in **Fig. 9.1**.

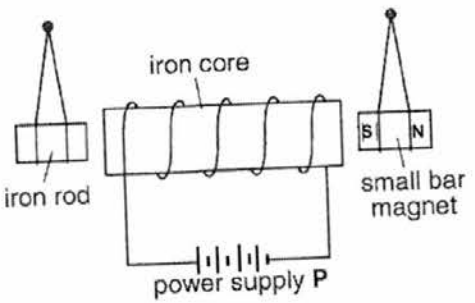


Fig. 9.1

Power supply **P** is switched on. Explain why the iron rod moves towards the iron core but the small bar magnet moves away from the iron core. [2]

.....

.....

Section B (20 marks)

Answer any **TWO** the questions on the space provided.

10(a) A student releases a book of mass 0.154 kg from rest under a motion sensor which captures the velocity of the book as time passes, as shown in **Fig. 10.1**. The velocity-time graph is recorded in **Fig. 10.2**.

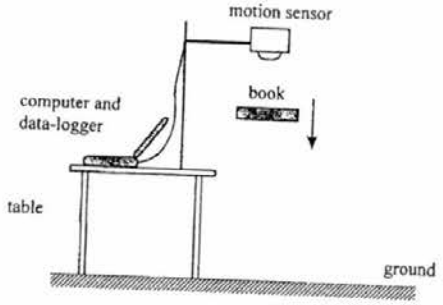


Fig. 10.1

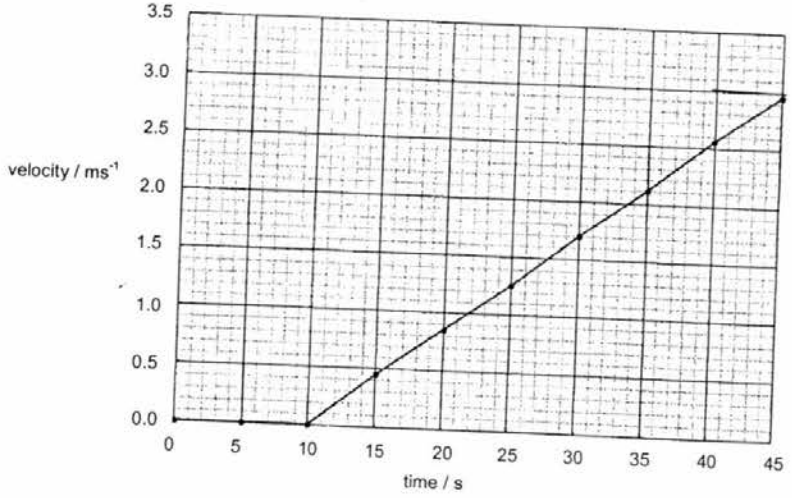


Fig. 10.2

10(a) (i) From the graph in **Figure 10.2**, estimate the distance travelled by the book. [1]

distance = ... m

(ii) Calculate the loss in gravitational potential energy of the book during the journey in **(a)(i)**. [1]

Loss in gravitational potential energy = ... J

(iii) From the graph in **Fig. 10.2**, find the maximum kinetic energy of the book. [1]

Maximum kinetic energy = ... J

(iv) Account for the difference in the values obtained in **(a)(ii)** and **(a)(iii)**. [1]

.....

.....

10(b) A skier slides down a slope, as shown in **Fig. 10.3**. The values of the time t when the skier passes points A, B, C and D are marked on **Fig. 10.4**.

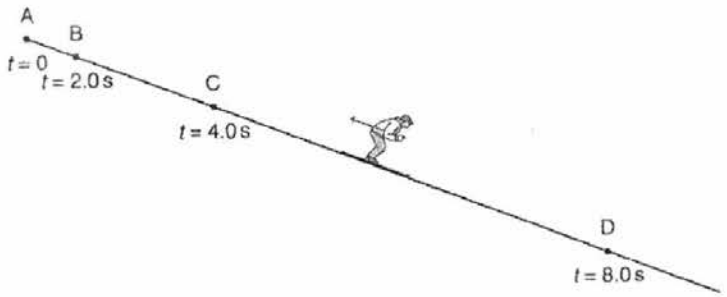


Fig. 10.3 (not to scale)

Fig. 10.4 shows the velocity-time graph of the motion with four points plotted.

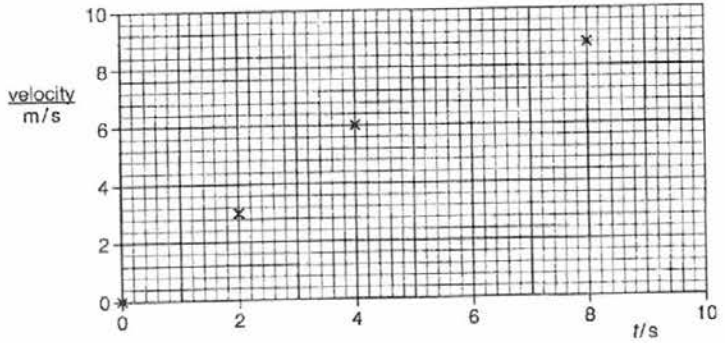


Fig. 10.4

Between A and C, the acceleration is uniform. Between C and D, the skier moves with decreasing acceleration. After D, the velocity of the skier is constant.

(i) On **Fig. 10.4**, draw the velocity-time graph to illustrate the motion of the skier from t = 0 s to t = 10 s. [1]

10(b) (ii) Calculate the acceleration of the skier between A and C. [2]

Acceleration = ...

(iii) **Fig. 10.5** shows the skier at one point in the motion after D.

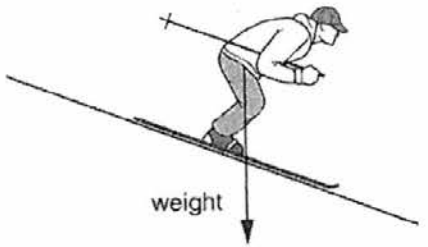


Fig. 10.5

One force, the weight of the skier, is shown on **Fig. 10.5**.

On **Fig. 10.5**, draw and label three other forces that act on the skier. [2]

Comment about the forces acting on the skier after D. [1]

.....

11 (a) **Fig. 11.1** shows one swimmer in a race starting before the signal is given.

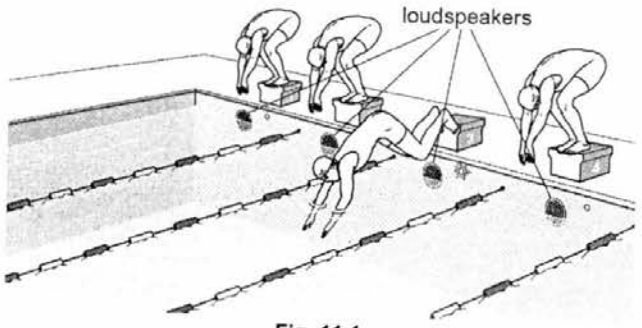


Fig. 11.1

The swimmer is called back by a loud, low-pitched sound from a loudspeaker positioned just at water level. The speed of sound in air is 330 m/s.

(i) Describe how the loudspeaker causes sound to travel through the air. [2]

.....

.....

.....

.....

(ii) Explain how the time taken differs when sound travels the same distance through air and through water. [2]

.....

.....

The loudspeaker produces sound of frequency 0.20 kHz.

(iii) Calculate the wavelength of this sound.

Wavelength =.....[2]

11(b) **Fig. 11.2** shows a simplified tsunami detection system. Sensor X on the seabed detects earthquakes below the sea which creates tsunami. It then sends an ultrasound signal to sensor Y which is floating on the surface of the sea. Sensor Y then transmits a microwave signal to a nearby satellite which relays the microwave signal to the tsunami warning centre. It is given that the speed of ultrasound in water is 1500 m/s.

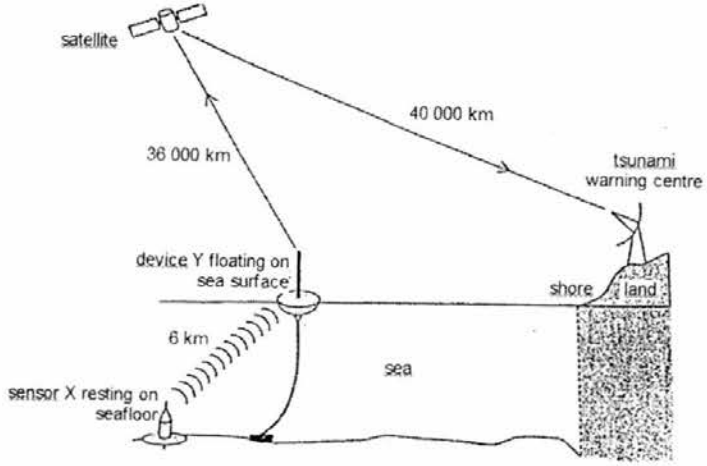


Fig. 11.2

(i) Using this tsunami warning system, calculate the total time taken for the warning signal to reach the tsunami warning centre from sensor X.

total time = ... [2]

(ii) State two differences in the properties of the ultrasound (sound with frequency less than 20 Hz) and microwave. [2]

.....

.....

.....

12 **Fig. 12.1** shows a fuel gauge found in a typical private car. It is an instrument used to indicate the level of fuel contained in a tank.

Fig. 12.1

Fig. 12.2 shows a simplified design of a fuel gauge.

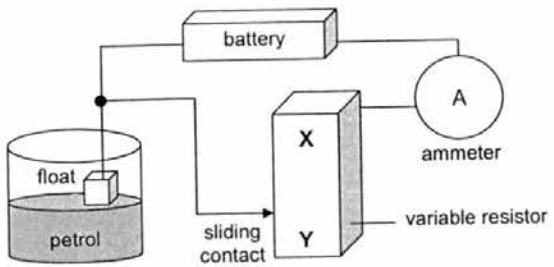


Fig. 12.2

Inside the car's fuel tank is a plastic component known as a "float". It is attached to the side of the tank using a tiny metal arm set up with a hinge which allows for the up and down movement of the "float". This ensures that the plastic "float" part remains on top of the fuel. When the car has a full tank, the float component is forced toward the top. When the fuel is being used, the float is lowered and the sliding contact moves towards **Y**. The fuel indicator located in the passenger compartment's dashboard is in fact an ammeter.

(a) Explain why the ammeter reading decrease when the sliding contact moves from **X** to **Y**. [2]

.....

.....

.....

12 (b) Explain the working principle of the fuel gauge when the fuel indicator shows 'F' which means fuel tank is full. [2]

.....

.....

.....

(c) **Fig. 12.3** and **Fig. 12.4** show two graphs that are plotted from the data obtained in the fuel gauge in **Fig. 12.2**.

Fig. 12.3 shows the relationship between the resistance of the variable resistor and the current.

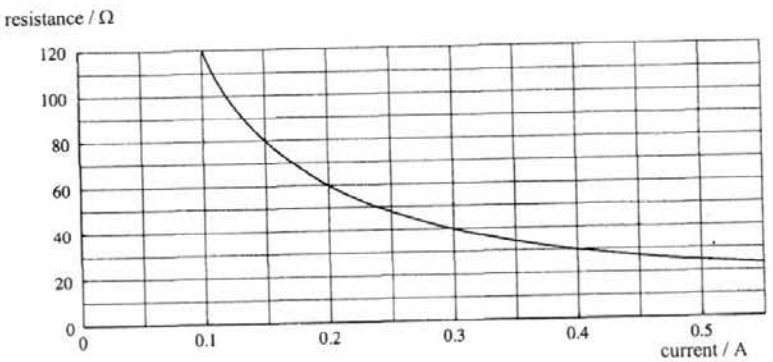


Fig. 12.3

12 (c) **Fig. 12.4** shows the resistance of the variable resistor as a function of quantity of fuel.

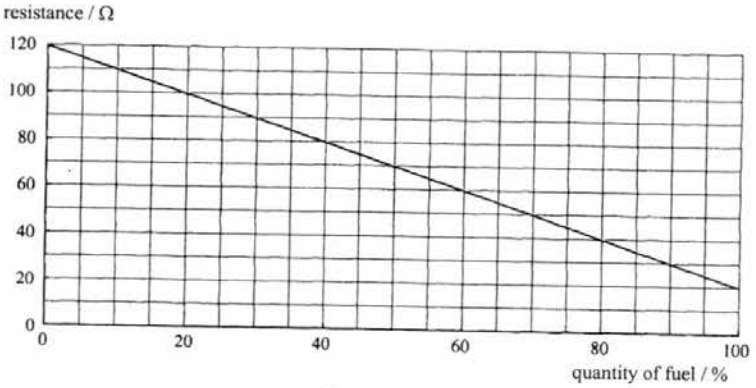


Fig. 12.4

(i) Using the two graphs, determine the ammeter reading if the fuel tank is 40% full. Show clearly how you obtained the answer. [2]

Ammeter reading = ...

(ii) Calculate the voltage of the battery. [2]

Voltage = ...

(iii) The wire in the variable resistor is replaced with one that has the same length and material as the original one but has twice the cross-sectional area.
With reference to the graph in **Fig. 12.3**, state and explain the change, if any, in the curve that is obtained would now be the same, higher or lower? [2]

.....

.....

-END OF PAPER-

REGENT SECONDARY SCHOOL

PRELIMINARY EXAMINATION (SA2) - 2016

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

SCIENCE (PHYSICS)

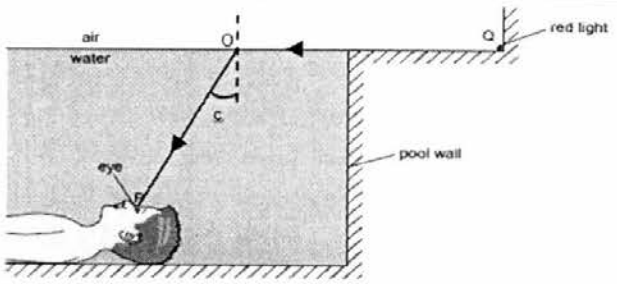
Marking Scheme

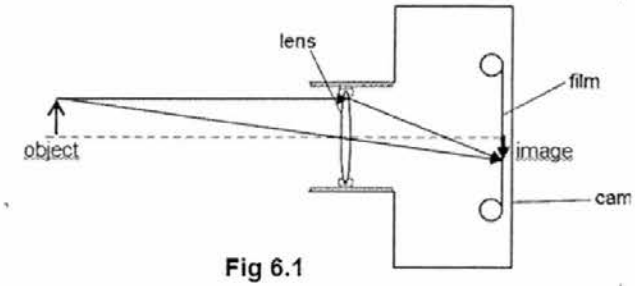
PAPER 1

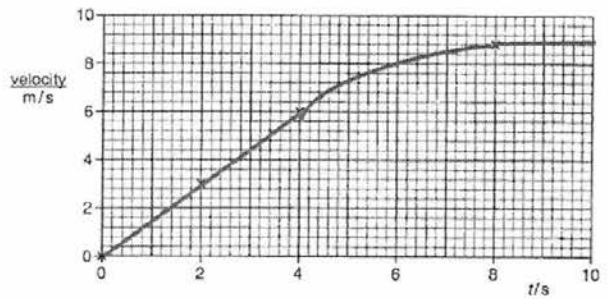
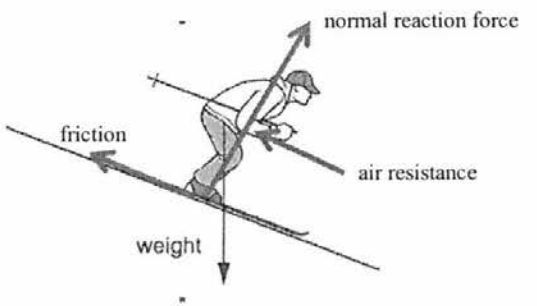
1	2	3	4	5	6	7	8	9	10
D	A	B	B	C	D	B	C	C	D
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
D	C	A	C	B	C	A	A	D	C

PAPER 2

QN NO	ANSWERS	MARKS
SECTION A [45 MARKS]		
1(a)	D = M / V	1
	V = (6500-4100) / (1000)	
	V = 2.4 m^3	1
(b)(i)	chemical potential energy or chemical energy	1
(ii)	Some is converted to heat/thermal energy [due to friction]	1
	Some to kinetic energy of the tractor	1
2(a)	Pressure = F/ A	
	= 1200 N / (0.01 m^2)	1
	= 120 000 N/m^2 or 120 000 Pa	1
(b)	$P_1 = P_2$	
	120 000 = F / 0.02	1
	F = 2400 N	1
(c)	Resultant force = 0 N	1
3(a)	Moment of a force is the turning effect of a force.	1
	Or	
	Moment of a force is the product of the force and its perpendicular distance from the pivot.	
(b)	Bucket 3 as	1
	Its perpendicular distance from the centre of the wheel is the	½
	greatest and it's filled with water, so maximum weight/force acting.	½
(c)	CM = ACM	1
	$(150\times10)(2)+(150\times10)(2.5)+(150\times10)(2)=2.5\ W$	1
	$9750=2.5\ W$	
	$W=3900\,N$	
4(a)	The shiny surface of kettle A and white surface of kettle B are	1
	poor emitters of heat, so reduce heat loss by radiation.	½
	However, kettle A is made of metal which is a good conductor	1
	of heat and heat will be lost to the surrounding by conduction	½
	at a faster rate. Kettle B is made of plastic which s an insulator	1
	of heat, so water that has been boiled can be kept warm for a longe period of time. Thus, kettle B is preferred.	
(b)(i)	E = P x t	
	= 2800 W x (4.5 x 60) s	1
	= 756 000 J = 756 kJ	1
(ii)	The water near the heating element gains heat energy / is	½
	heated and expands , resulting in a decrease in density /	½
	becomes less dense and thus it rises .	
	The surrounding cooler and denser water sinks to take its	½
	place and a convection current is set up.	½

4(c)	When the metal case of kettle A is connected to the earth, it will not become 'live' when the live wire accidentally touches the metal case. Anyone touches the metal case will not be electrocuted. or When the live wire accidentally touches the metal casing of the kettle A, the current will leak safety via the Earth wire, to the ground. Thus protecting the user from getting electric shock.	1 1
(d)(i)	remains the same	1
(ii)	When boiling occurs, the <u>heat energy is absorbed</u> by the water molecules and used to <u>overcome the intermolecular</u> <u>forces of attraction</u> between them / to boil the water.	½ ½
5(a)	 Fig. 7.1 Deduct 1 mark for any missing item below • One light ray from O to P . • Critical angel marked out as shown (direction of arrow to show from O to P)	1 1
(b)	When the eye is closer to the pool wall, the angle of incidence in the water is less than the critical angle, so the light ray refracts into the air (not along the water surface where Q is)	1 1
(c)	η = sin 90/sin 50 = 1.3	1 1

6(a)	 **Fig 6.1** ½ m for each light ray intersecting at the film, ½ m arrow, ½ m for image I.	1 1
(b)	Shift lens closer to the film (to the right).	1
(c)	It is a real / inverted image.	1
7(a)	I in lamp A= P/ V = 60 W / 240 V = 0.25 A	1 1
(b)	I in lamp B = 0.42 A – 0.25 A (parallel circuit) = 0.17 A	1
(c)	R = V / I = 240 V / 0.25 A = 960 Ω	1 1
8(a)	N on the magnet (left side), S on the magnet (right side).	1
(b)	Use a stronger magnet. Or Introduce a stronger magnetic field. Or place the magnets close to the wire.	1
9	When current flows in the circuit, the iron core is magnetized to become an electromagnet, with North pole on its left end. The electromagnet induces opposite polarirty/ South pole on the nearer end of the iron rod. Since unlike poles attract, the iron rod will move towards the electromagnet. /The iron rod is attracted to the electromagnet due to magnetic induction. (because iron rod is magnetic is not accepted) Since the South pole of the permanent magnet and South pole of the electromagnet on the right side are like poles facing each other, thus the magnet repel away / move away from the electromagnet.	½ ½ ½ , ½

	Section B [20 marks]	
10(a)(i)	Distance traveled = area under graph = ½ x (35 s) x 2.95 = 51.6 m (3 s.f.) (as qn state estimate, so accept value of speed as 2.9 or 3.0)	1
(ii)	Loss in GPE = mgh = 0.154 kg x 10 N/kg x 51.6 m = 79.5 J (3 s.f.)	1
(iii)	Max kinetic energy = ½ mv^2 = ½ x 0.154 kg x $(2.95)^2$ = 67.9 J (3 s.f.)	1
(iv)	There is **energy loss** to **heat due to air resistance.**	1
(b)(i)		1
(ii)	a = 6/ 4 = 1.5 m/s^2	1 1
(iii)		1 ½ , ½
	Since after D is constant speed, all the forces should be balanced. Accept resultant/net force is zero.	1

11(a)(i)	The vibration of the source (loudspeaker) causes the nearby **air particles to vibrate** which is in a direction parallel to the sound wave motion/ as longitudinal wave A series of compression and rarefaction of the air layers is produced, transferring sound energy to other parts in air.	½ ½ ½ ½
(ii)	v = f λ 330 = (0.20 × 10^3) × λ λ = 1.65 m	1 1
(iii)	The time taken for sound to travel through water is shorter than in air as sound travels faster in a denser medium (water) than in air.	1 1
(b)(i)	From X to Y (ultrasound): V = d/t T1 = 6000 / 1500 = 4.0 s From Y to satellite and to warning centre (microwave): T2 = (36000 + 40000) x 10^3 / 3 x 10^8 = 0.253 s Total time = 4 + 0.253 = 4.25 s (3 sig. fig)	½ ½ 1
(ii)	Ultrasound is a longitudinal wave but microwave is a transverse wave. Ultrasound cannot travel in vacuum but microwave can travel in vacuum.	1 1
12(a)	When the contact moves from X to Y, the resistance of the variable resistor increases. Thus the current in the circuit decreases (I = V/R), and the ammeter reading decreases.	1 1
(b)	When the fuel tank is full, the float is at a high position. The resistance of the variable resistor is low. A large current flows and thus the ammeter shows a high reading, which indicates a 'F' on the fuel indicator.	½ ½ ½ , , ½
(c)(i)	From Fig 12.4, when tank is 40% full, R = 80 Ω From Fig 12.3, when R = 80 Ω, I = 0.15 A	1 1
(ii)	V = I R = 0.15 x 80 = 12 V	1 1
(iii)	The curve would be lower because the resistance of the variable resistor would now be halved.	1 1