O

GAN ENG SENG SCHOOL
Preliminary 2 Examination 2016

G.E.S.S

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE (PHYSICS, CHEMISTRY) **5076/01**
FOUR NORMAL ACADEMIC(O) / FOUR EXPRESS/ **30 August 2016**
FIVE NORMAL ACADEMIC **1 hour**
Paper 1 Multiple Choice
Additional Materials: OTAS

Calculators are allowed in the examination.

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the cover page and shade in your index number on OTAS.

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 OTAS.

Read the instructions on the OTAS very carefully.

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 periodic table is printed on page __ **XX**__.

Total Marks
40

This paper consists of **XX** printed pages including the cover page.

1 A spring was loaded with a mass as shown in Fig. 1a. The loaded spring is being pulled by a vertical displacement of ***X*** cm as shown in Fig. 1b.

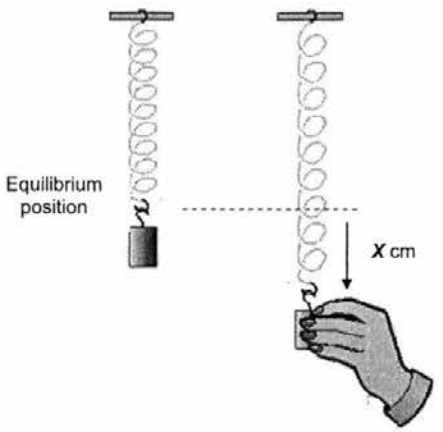


Fig. 1a **Fig. 1b**

What was the total distance covered by the mass after it had moved for 2 oscillations?

A 1 ***X*** **B** 2 ***X***
C 4 ***X*** **D** 8 ***X***

2 A car was moving from rest with a forward force of 1000 N as shown in Fig. 2.
The car had a mass of 500 kg and gravitational field strength is 10 N/kg. Ignore all frictional forces.

Fig. 2

What was the acceleration of the car after 2 s?

A 0.5 m/s^2 **B** 2.0 m/s^2
C 4.0 m/s^2 **D** 8.0 m/s^2

3 An unknown mass of 50 g is placed in three different liquids as shown in Fig. 3.

The new liquid level in each measuring cylinder is as shown below and the initial volume of liquid in each measuring cylinder is 50 cm^3.

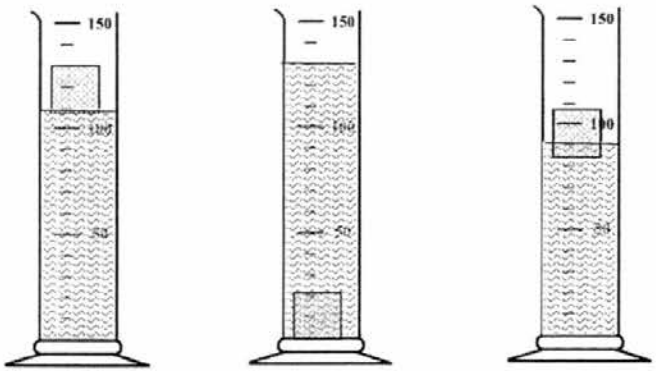


Fig. 3

What is the density of the unknown material?

A 0.625 g/cm^3 **B** 0.833 g/cm^3
C 1.25 g/cm^3 **D** insufficient data given

4 What is the resultant moment exerted on the 'L' shape object as shown in Fig. 4?

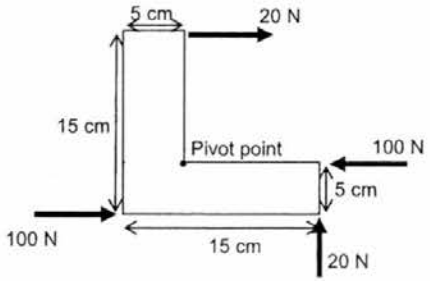
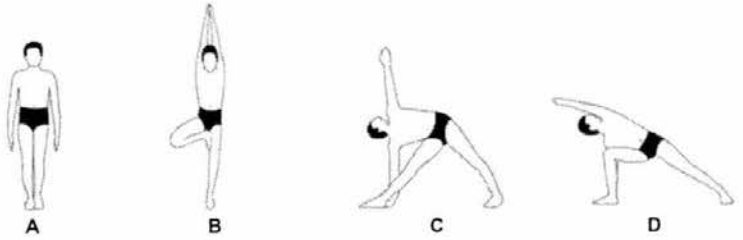


Fig. 4

A 5 N m anticlockwise **B** 5 N m clockwise
C 6 N m anticlockwise **D** 6 N m clockwise

5 Which of the following positions will bring about the largest pressure exerted on the ground?



6 A 1 kg ball is rolling off a slope with a velocity of 2 m/s as shown in Fig. 6.

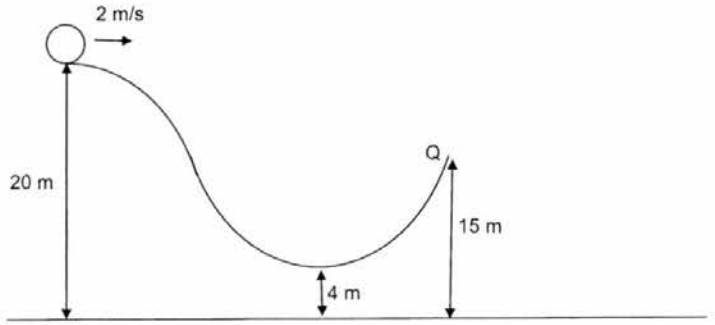


Fig. 6

What is the velocity of the ball as it reaches Q as shown in Fig. 6?

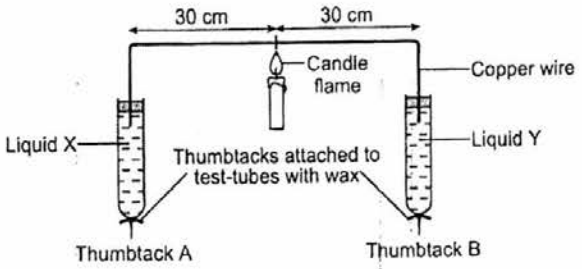
A 10.0 m/s **B** 17.3 m/s
C 10.2 m/s **D** 3.16 m/s

7 A beaker of water is being heated up from 40 °C to its boiling point.

Which of the following statements is true?

A The water molecules gain kinetic energy and vibrates vigorously when heated.
B The water molecules expand when heated and gain kinetic energy
C The water molecules gain kinetic energy and start to gain energy to overcome the forces of attraction.
D The water molecules increase its distance from each other and move at a higher speed.

8 Gabriel set up the following experiment as shown below. He used two similar test-tubes and thumbtacks for the experiment. When the copper wire was heated for some time, Thumbtack A dropped off before Thumbtack B.



What can he conclude from the experiment?

A Liquid X and Y boils at 100 °C.
B Liquid Y is a poor conductor of heat.
C Liquid Y conducts heat better than Liquid X.
D Liquid X conducts heat better than Liquid Y.

9 Four different containers of the same size and material are used to cool a fixed amount of water. Their temperature-time graphs are plotted as shown in Fig. 9.

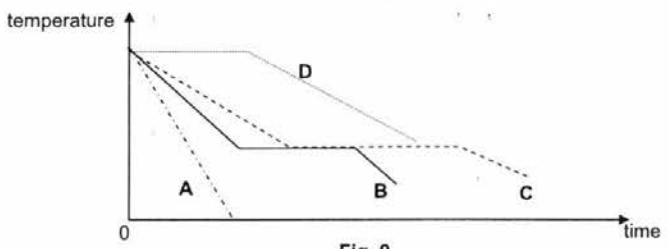


Fig. 9

Which graph shows that the container is painted white on the outside surface and smooth?

10 Radio wave of 100 μm is transmitted in the vacuum.

What is the frequency that the radio wave is having?

A 3×10^{12} Hz
B 3.33×10^{-13} Hz
C 3×10^{-3} Hz
D 0.333 Hz

11 Fig. 11a shows dipper producing circular waves in a ripple tank.

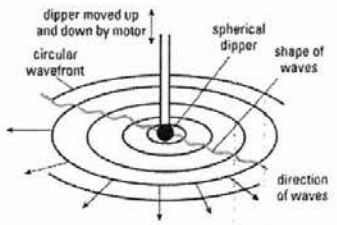


Fig. 11a

The dipper produces a waveform as shown in Fig. 11b.

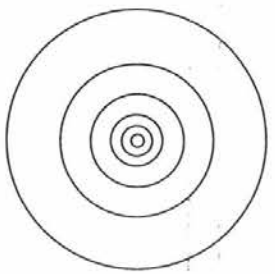


Fig. 11b

Which of the following explains why the waveform is as shown in Fig. 11b?

A The wave is increasing its speed as it travels away from the dipper.
B The wave is reducing its speed as it travels away from the dipper.
C The dipper is reducing the frequency of the vibration.
D The dipper is increasing the frequency of the vibration.

12 A ray of light is shining at 30 ° to the glass air boundary as shown in Fig. 12.

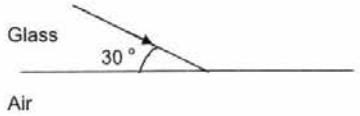
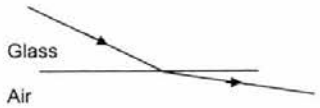


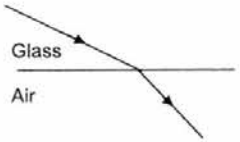
Fig. 12

Which of the following shows correctly how the ray would travel after it hits the medium boundary? The refractive index of glass is 1.5.

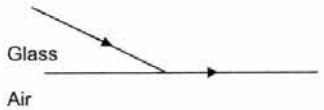
A



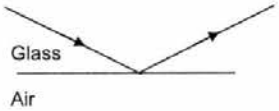
B



C



D



13 An object is observed to form a real and magnified image when using a lens.

What is the position of the object in order for the image to be formed?

A Placed at two focal length away from lens.
B Placed between one focal length and two focal length away from lens.
C Placed less than one focal length away from lens.
D Placed more than two focal length away from lens.

14 Which of the following has the shortest frequency?

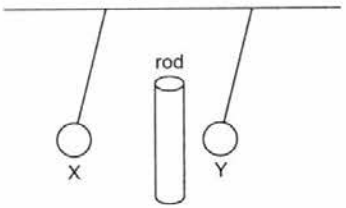
A Visible light
B X-ray
C Gamma ray
D Ultra-violet

15 A girl stroke a guitar and created a note of 500 Hz.

How will the sound change as it transmits into cold air?

A The sound will have a lower frequency as the speed of sound reduces.
B The sound will have a higher frequency as the speed of sound reduces.
C The sound will have a longer wavelength as the speed of sound reduces.
D The sound will have a shorter wavelength as the speed of sound reduces.

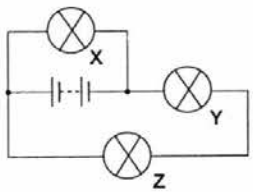
16 Two light metal spheres X and Y are suspended by nylon threads. A charged rod is placed between spheres X and Y. Sphere X is repelled by the rod while sphere Y is attracted to the rod, as shown.



Which of the following indicates the correct charge on sphere X, sphere Y and the rod?

	X	rod	Y
A	positive	negative	negative
B	negative	neutral	positive
C	neutral	positive	negative
D	negative	negative	neutral

17 Three identical bulbs **X**, **Y** and **Z** are connected to a battery as shown in the diagram.

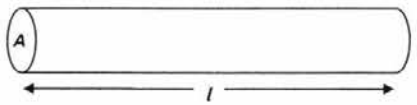


Which of the following statements is/are correct?

I **X** is the brightest.
II **Y** is brighter than **Z**.
III If **Y** blows, **Z** will become brighter.

A I only
B III only
C I and II only
D II and III only

18 The diagram shows a segment of a uniform copper wire with length *l* and area *A*.



Which one of the following changes will cause the resistance of the wire to increase by four times?

A Increase the area to 2 ***A*** and increase the length to 4 ***l***.
B Increase the area to 2 ***A*** and decrease the length to ***l***/2.
C Decrease the area to ***A***/2 and decrease the length to ***l***/2.
D Decrease the area to ***A***/2 and increase the length to 2 ***l***.

19 Electric bill is charged based on the consumption of ..... .

A current **B** energy
C power **D** voltage

20 Two wires are placed close to each other. Currents in different directions are passed along the wires as shown in Fig. 20

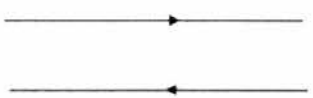


Fig. 20

Which of the following statements is correct?

A The wires move closer as the electric field they generate are of opposite charges.
B The wires move away from each other as the magnetic fields they generate interact with each other.
C The wires move away from each other as both wires start to become the same type of magnetic pole.
D The wires move closer to each other as forces are induced when a current flows in a magnetic field.

Answer for 2016 Sec 4Na4Ex5Na SciPhy Prelim2 P1 Ans

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

1	To form an oscillation, the loaded spring will have to move 2***X*** cm upwards and 2***X*** cm downwards that gives a total distance of 4 ***X*** cm. So 2 oscillation will be 8 ***X*** cm.	D
2	Using the formula F = ma 1000 = (500) a a = 2 m/s^2	B
3	Only liquid Q can be used to measure density of unknown mass. This is because the mass is fully submerged in liquid Q	A
4	Both 20 N forces will have the same magnitude of moment to counter each other so net moment due to 20 N is zero. The 100 N exerted towards the left does not create a moment as it is exerted towards the pivot point. Thus only 100 N to the right create a moment which is 5 Nm anticlockwise	A
5	The largest pressure occur with the same amount of mass but smallest contact area with the ground	B
6	Assume no energy loss, Total Energy initially = Total Energy at Q PE + KE = PE + KE mg(20) + ½ m(2)^2 = mg (15) + ½ mv^2 v = 10.2 m/s	C
7	The molecules will not expand when heated and water molecules do not vibrate vigorously when heated. They gain kinetic energy and move at a higher speed.	C
8	Liquid X is a better conductor thus heat is transfer faster through the liquid bringing about the thumbtack A dropping earlier	D
9	The freezing point of water is 0°C. There is no change of state for any temperature above 0°C.	A
10	100 μm = 100 x 10^{-6} m v = f λ ➔f = 3 x 10^8 / 100 x 10^{-6} = 3 x 10^{12} Hz	A
11	The waveform shows that the wavelength is getting further as it moves away from the dipper. Thus the shorter wavelength near to the dipper indicates that the frequency is higher for the speed of wave remains unchanged in the tank	D
12	As the angle of incidence in glass is 60° it is larger than the critical angle thus total internal reflection occurs	D
13	For real and magnified image to be formed, the object must be placed between one focal length and two focal length away	B
14	Visible light has the lowest frequency	A
15	Frequency of sound do not change with medium.	D
16	Like charges repel and unlike charges attract. A neutral body can be induced with a charge opposite from the foreign body.	D
17	X is brightest as it has the highest p.d. Y and Z should have the same brightness since both have the same current and p.d. When Y blows, Z would not light up as well	A
18	Increase length by 2 times and decrease the area by 2 times increases the resistance by 4 times	D
19	kWh is a unit used for kWh	B
20	Forces are produced when magnetic field lines interact with each other	B

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GAN ENG SENG SCHOOL
Preliminary 2 Examination 2016

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE (PHYSICS)
FOUR NORMAL ACADEMIC/ FOUR EXPRESS/ FIVE NORMAL ACADEMIC

Paper 2

Candidates answer on the Question Paper.
Calculators are allowed in the examination.

5076/02
26 August 2016
1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** 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.

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

For Examiner's Use	
Section A	/45
Section B	/20
.....	
.....	
Total	/65

SECTION A [45 marks]

Answer all the questions.

Write your answers in the spaces provided on the question paper.

For Examiner's Use

1 A trolley was attached to a ticker tape as shown below. It was moving at a speed of 4 cm/s along a flat road in Fig. 1a. The ticker timer creates dots on the ticker tape as shown in Fig. 1b at a frequency of 2 Hz to indicate the movement of the trolley.

(a) What is meant by moving at a speed of 4 cm/s? [1]

.....

.....

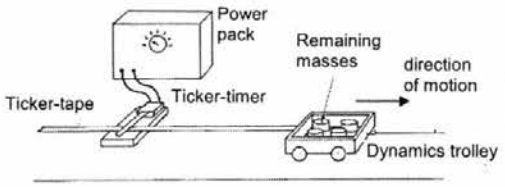

Fig. 1a

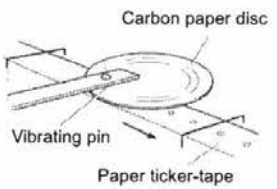

Fig 1b

(b) In Fig. 1c below, draw to scale how the dots will be arranged after the trolley travelled for 3 s? Mark the dots with a cross. The first dot has been drawn for you. [2]

Fig. 1c

(c) In Fig. 1d below, draw additional 4 crosses to show how the ticker tape will look like if the trolley was accelerating. The first dot has been drawn for you. [2]

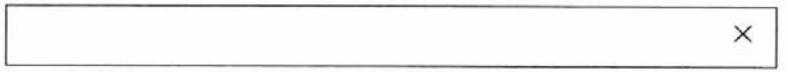

Fig. 1d

2 A trolley as shown in Fig. 2 was being pulled backwards with a spring balance. The spring balance showed 2 N as the trolley stretched the middle of the elastic band.

For Examiner's Use

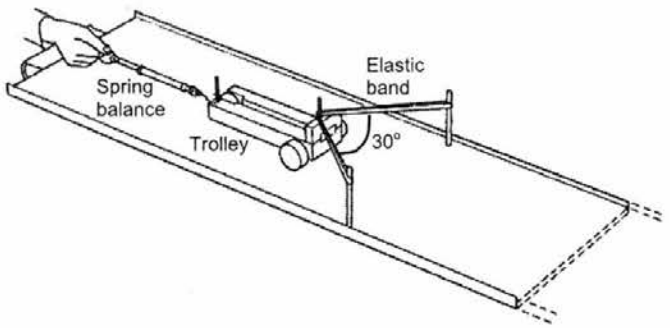

Fig. 2

(a) Draw a scaled vector diagram to determine the tension on each side of the elastic band. [4]
State the scale used.

The spring balance was then released and the trolley was set moving at an acceleration of 5 m/s^2.

(b) What was the weight of the trolley assuming the surface was frictionless? [2]

3 Gabriel was trying to pull a box of mass 70 kg up a slope as shown in Fig. 3. He exerted a force of 900 N on the rope while pulling the box.

For Examiner's Use

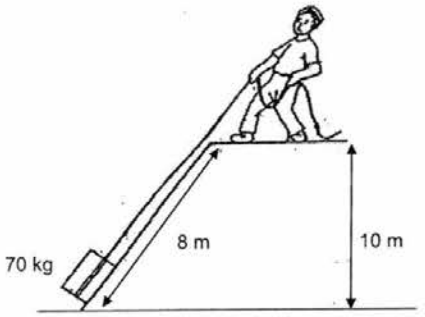

Fig. 3

(a) What was useful work done by Gabriel? [2]

(b) What was the total work done by Gabriel? [2]

(c) What was the work done against friction? [1]

(d) What was the frictional force on the slope? [1]

4 A ball was being dropped off from rest at a height of 0.04 km above ground as shown in Fig. 4.

For Examiner's Use

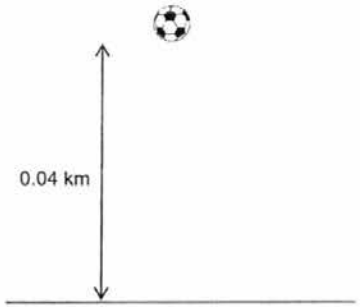

Fig. 4

(a) State the law of conservation of energy. [1]

.....

.....

.....

(b) What was the height at which the ball would attain half of its maximum kinetic energy? [1]

.....

(c) What was the velocity that the ball was having at the height in **(b)**? [2]

5 In Terminal 3 of Singapore Changi Airport, outlets for cold air were observed to be positioned at a height 6 metres above ground as shown in Fig. 5 to bring about convection current in the terminal.

For Examiner's Use

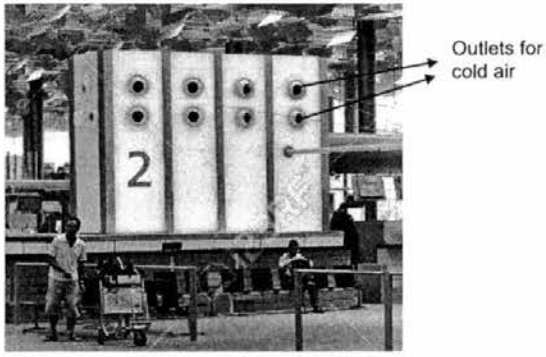

Fig. 5

(a) What is convection current? [1]

.....

.....

(b) State 2 reasons why the outlet for cold air was positioned 2 metres above the human height. [2]

.....

.....

.....

(c) Suggest, with reason, one feature that could be found in the roof that could help to cool down the terminal faster on a sunny day. [2]

.....

.....

6 (a) The wavelength of X-rays is roughly the size of an atom.

(i) Estimate the wavelength of X-rays. [1]

.....

(ii) Calculate the frequency of the X-rays in (i). [3]

State the value of any constants used.

(b) State one application of X-rays in our daily lives. [1]

.....

7 An object formed a magnified image on a screen after light was passed through the lens as shown in Fig. 7

Fig. 7

(a) State 2 other characteristics of the image formed. [2]

.....

.....

(b) In Fig. 7, draw a ray to find the position of the lens and label it as L. [1]

(c) In Fig. 7, draw another ray to show the position of the focal point and label it as **F**. [1]

(d) State one change to the sharp image formed when the lens is shifted further away from the object. [1]

.....

.....

8 The circuit in Fig. 8 was completed with 1 e.m.f. source, E and 3 resistors placed as shown. Potential difference across X and Y is 18 V.

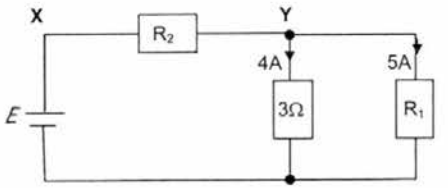

Fig. 8

(a) What is the resistance, R_1 ? [2]

(b) What is the resistance R_2? [2]

(c) What is the e.m.f., E? [2]

9 A current is flowing in a wire as shown in Fig. 9. The wire is placed in between an electromagnet and was observed to move to the right.

For Examiner's Use

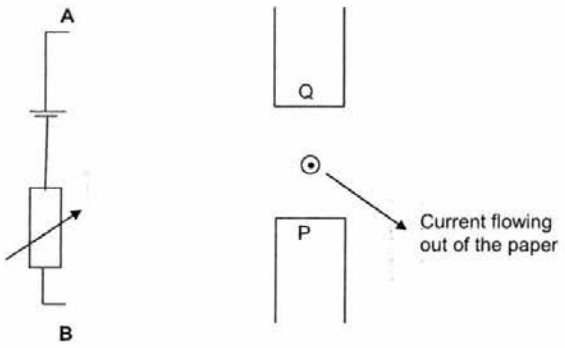

Fig. 9

(a) State the polarity of Q and P that will cause the wire to move to the right. [1]

.....

(b) In Fig. 9, complete the wiring from A and B on the electromagnet so that the wire will move to the right. [2]

Section B [20 marks]
Answer any **two** questions.

For Examiner's Use

10 (a) Fig. 10.1 shows a water heater rated at 2.3 kW which operates from 240 V a.c. supply.

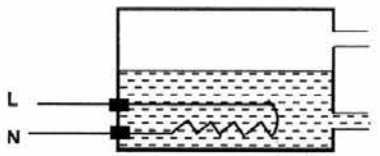

Fig. 10.1

(i) Calculate the current in the heating element. [2]

(ii) Suggest the rating of a fuse that can be used to protect the heater. [1]

.....

(iii) Explain how the earth wire protects the user from electrocution. [2]

.....

.....

.....

(iv) The heater takes 5 minutes to boil one container of water. Calculate the cost of electricity used for boiling 100 containers of water if the cost of electricity is $0.28 per kWh. [2]

10 (b) Electrons can move easily through metals. Fig.10.1 shows a metal rod with a strip of metal foil attached to it. The rod and strip have no charge.

For Examiner's Use

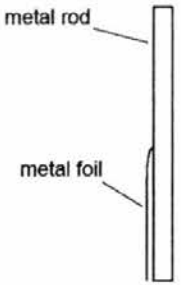

Fig. 10.1

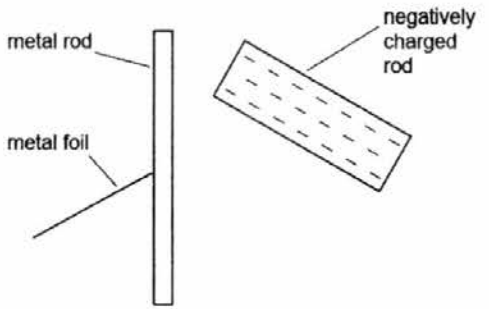

Fig. 10.2

A negatively charged rod is brought towards the top of the metal rod. The foil moves away from the metal rod as shown in Fig. 10.2.

(i) Indicate the charge distribution on metal foil in Fig. 10.2 as the negatively charged rod is brought towards the top of the metal rod. [1]

(ii) Explain why the foil moves as shown in Fig. 10.2 [2]

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11 A longitudinal wave passes through the air so that each air particle vibrates sideways. For example, particle **P** moves back and forth between positions **X** and **Y** repeatedly.

For Examiner's Use

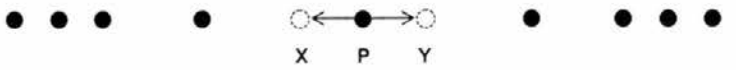

Fig. 11.1

At time t = 0 s, some air particles are at positions shown in Fig. 11.1 and then at time t = 2.5 s, these particles return to the same positions as in Fig. 11.1.

(a) On Fig. 11.1, indicate the distance of one wavelength and label it as λ. [1]

(b) Given the distance between **X** and **Y** is 8 mm and the wavelength of the wave is 40.0 cm,

(i) state the amplitude of the wave.

Amplitude = ... mm [1]

(ii) determine the frequency of the wave.

Frequency = ... [2]

(iii) calculate the speed of the wave.

Speed = ... m/s [2]

For Examiner's Use

11 (c) To investigate a layer of rock underground, an explosion is made on the surface of the earth. Fig. 11.2 shows the arrangement.

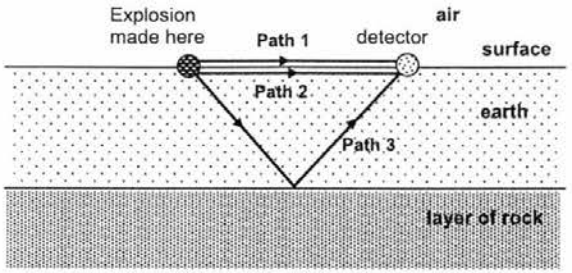

Fig. 11.2

Sound from the explosion may travel to the detector through air (Path 1), through earth (Path 2), or by reflection from a layer of rock (Path 3).

The time taken for the sound to reach the detector is shown in the table below.

	Path 1	**Path 2**	**Path 3**
Time taken for sound to travel from source to detector / s	0.100	0.020	0.300

(i) Explain why the time taken for sound to travel in Path 2 is less than that in Path 1. [2]

.....

.....

.....

(ii) Given the speed of sound in air is 320 m s^{-1}, calculate the distance between the sound source and the detector. [1]

(iii) Hence, calculate the speed of sound in earth, [1]

For Examiner's Use

12 (a) Fig. 12.1 below shows a simplified hydraulic braking system.

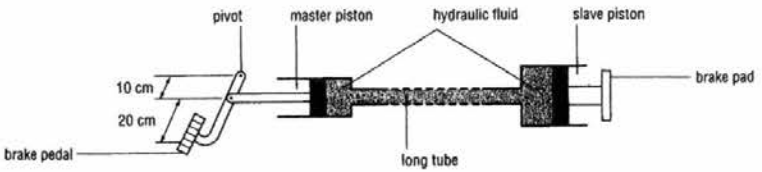

Fig. 12.1

(i) Define pressure and state its SI unit. [2]

.....

.....

(ii) If the area of contact between the master piston and the hydraulic fluid is 1.2 cm^2, what is the pressure along the fluid when a force of 1800 N is exerted by the master piston? Give your answer in Pa. [2]

(iii) Why is liquid used as the hydraulic fluid instead of gas? [1]

.....

.....

12 (b) Fig. 12.2 shows an enlarged diagram of the hydraulic braking system in Fig. 12.1

For Examiner's Use

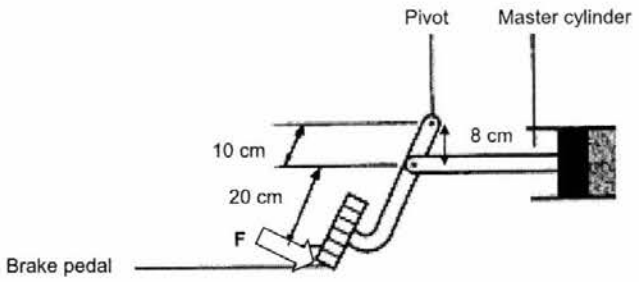

Fig. 12.2

(i) State the principle of moment [1]

.....

.....

.....

A force, F, 100 N is applied on the brake pedal as shown in Fig. 12.2

(ii) What is the amount of force that will be applied on the master cylinder? [2]

(iii) State two possible changes to be made to Fig. 12.2 such that the force applied on the master cylinder can be increased with the same 100 N force. [2]

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END OF PAPER

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GAN ENG SENG SCHOOL
Preliminary 2 Examination 2016

CANDIDATE NAME	**ANSWER**
CLASS	
INDEX NUMBER	

SCIENCE (PHYSICS)

5076/02
26 August 2016
1 hour 15 minutes

FOUR NORMAL ACADEMIC/ FOUR EXPRESS/ FIVE NORMAL ACADEMIC

Paper 2

Candidates answer on the Question Paper.
Calculators are allowed in the examination.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** 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.

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

For Examiner's Use	
Section A	45
Section B	20
.....	
.....	
Total	65

For Examiner's Use

SECTION A [45 marks]

Answer all the questions.

Write your answers in the spaces provided on the question paper.

1 A trolley was attached to a ticker tape as shown below. It was moving at a speed of 4 cm/s along a flat road in Fig. 1a. The ticker timer creates dots on the ticker tape as shown in Fig. 1b at a frequency of 2 Hz to indicate the movement of the trolley.

(a) What is meant by moving at a speed of 4 cm/s? [1]
The trolley was moving at a distance of 4 cm in every second.

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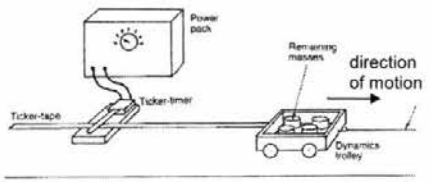


Fig. 1a

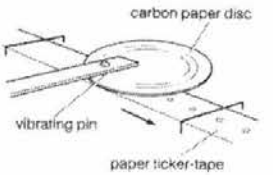


Fig 1b

(b) In Fig. 1c below, draw to scale how the dots will be arranged after the trolley travelled for 3 s? Mark the dots with a cross. The first dot has been drawn for you. [2]

[1] equally spaced crosses [1] 6 more dots drawn

Fig. 1c

(c) In Fig. 1d below, draw additional 4 crosses to show how the ticker tape will look like if the trolley was accelerating. The first dot has been drawn for you. [2]

[1] increasing spaced crosses [1] 4 more dots drawn

Fig. 1d

For Examiner's Use

2 A trolley as shown in Fig. 2 was being pulled backwards with a spring balance. The spring balance showed 2 N as the trolley stretched the middle of the elastic band.

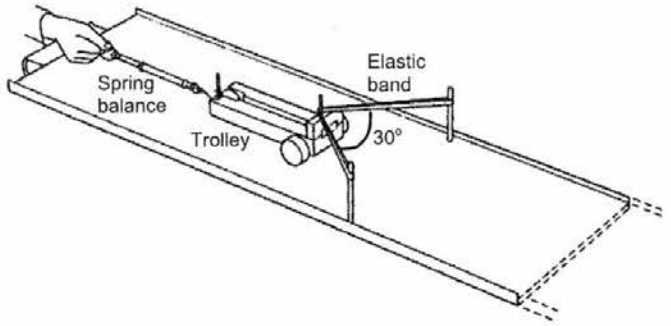


Fig. 2

(a) Draw a scaled vector diagram to determine the tension on each side of the elastic band. [4]
State the scale used.

1 cm : 0.25 N [1]

Tension : 1.03 N (0.93 N – 1.13 N) [1]

Correct vector diagram with arrows [2]

The spring balance was then released and the trolley was set moving at an acceleration of 5 m/s^2.

(b) What is the weight of the trolley assuming the surface was frictionless? [2]

F = m a
2 = m (5)
m = 0.4 kg [1]

w = mg = 0.4 x 10 = 4 N [1]

For Examiner's Use

3 Gabriel was trying to pull a box of mass 70 kg up a slope as shown in Fig. 3. He exerted a force of 900 N on the rope while pulling the box.

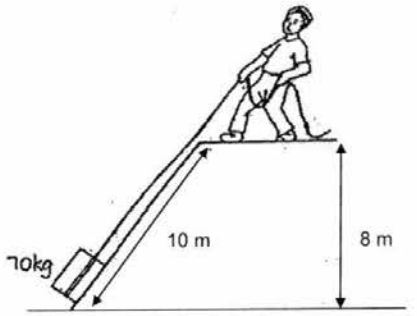


Fig. 3

(a) What is useful work done by Gabriel? [2]

Useful work done = GPE = mgh [1]
= 70 x 10 x 8 = 5 600 J [1]

(b) What is the total work done by Gabriel? [2]

Total work done = F x d
= 900 x 10 [1]
= 9 000 J [1]

(c) What is the work done against friction? [1]

Work done against friction = Total work done – useful work done
= 9000 - 5600
= 3400 J [1]

(d) What is the friction force on the slope? [1]

Work done = F x d
3400 = F x 10
F = 340 N [1]

4 An box was being dropped off from rest at a height of 0.04 km above ground as shown in Fig. 4.

For Examiner's Use

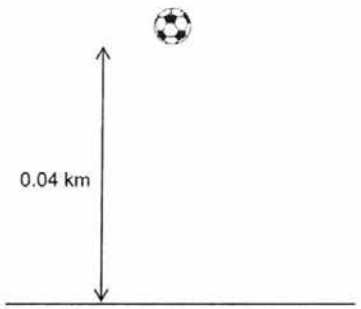


Fig. 4

(a) State the law of conservation of energy. [1]

Energy cannot be created or destroyed. It can only change from one from to another.

(b) What was the height at which the ball would attain half of his maximum kinetic energy? [1]

0.02 km OR 20 m

(c) What was the velocity that the parachutist was having at the height in (b)? [2]

By the law of conservation of energy,

Energy gained in KE = Energy lost by GPE

$\frac{1}{2} m v^2 = m g (40 - 20)$ [1]

$\frac{1}{2} v^2 = (10)(20)$

$v = 20$ m/s [1]

5 In Terminal 3 of Singapore Changi Airport, outlets for cold air were observed to be positioned at a height 6 metres above ground as shown in Fig. 5 to bring about convection current in the terminal.

For Examiner's Use

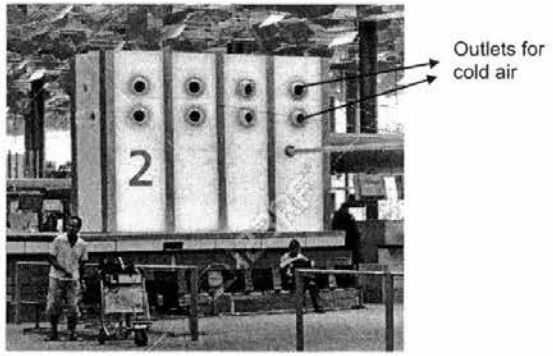


Fig. 5

(a) What is convection current? [1]

It is the movement of fluid due to a change in density [1] of fluid.

(b) State 2 reasons why the outlet for cold air was positioned 2 metres above the human height. [2]

To save cost as instead of cooling down the whole terminal it only cools down at The height where passengers are.

To bring about a convection current as cold air sinks and hot air rises.

(c) Suggest, with reason, one feature that could be found in the roof that could help to cool down the terminal faster on a sunny day. [2]

By having a shiny [1] exterior roof to reflect the heat [1] OR By having a smooth [1] exterior roof to reflect the heat [1]

6 **(a)** The wavelength of X-rays is roughly the size of an atom.

(i) Estimate the wavelength of X-rays. [1]

10^{-11} to 10^{-8} m

.....

(ii) Calculate the frequency of the X-rays in **(i)**. [3]

State the value of any constants used.

$v = f\lambda$ **[1]**

$f = v / \lambda = 3 \times 10^{8} / 10^{-11}$

$= 3 \times 10^{19}$ Hz **[1]**

Constant = speed of light = 3×10^{8} m/s [1]

(b) State one application of X-rays in our daily lives. [1]

X ray is used for medical imaging or security check.

.....

7 An object formed a magnified image on a screen after light was passed through the lens as shown in Fig. 7

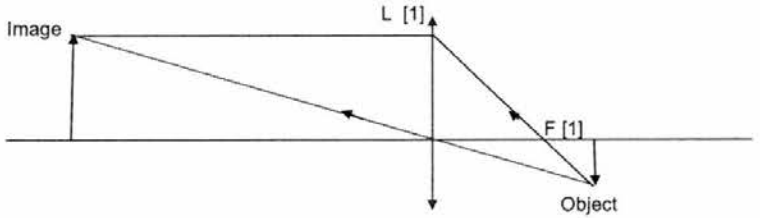


Fig. 7

(a) State 2 other characteristics of the image formed. [2]

Inverted and real . Do not accept magnified as question already stated.

.....

.....

(b) In Fig. 7, draw a ray to find the position of the lens and labelled it as L. [1]

(c) In Fig. 7, draw another ray to show the position of the focal point and labelled it as F. [1]

(d) State one change to the sharp image formed when the lens is shifted further away from the object. [1]

The image formed will be smaller OR image is nearer to lens

.....

.....

8 The circuit in Fig. 8 was completed with 1 e.m.f. source, E and 3 resistors placed as shown. Potential difference across X and Y is 18 V.

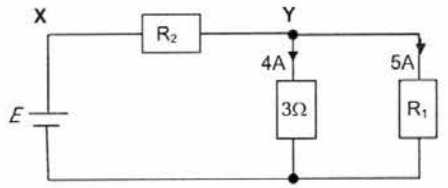


Fig. 8

(a) What is the resistance, R_1 ? [2]

Pd across 3Ω = pd across R_1 $[1]_1$

$4 \times 3 = 5 \times R_1$

$R_1 = 12/ 5 = 2.4\ \Omega$ [1]

(b) What is the resistance R_2? [2]

Total current flowing through R_2 = 9 A

R_2 = 18 / 9 = 2 Ω [1]

(c) What is the e.m.f., E? [2]

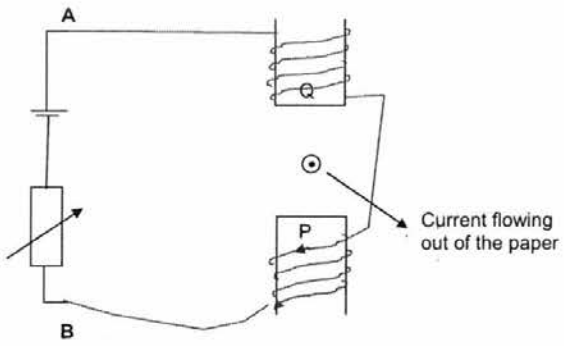
Emf = pd across XY + pd across 3Ω

= 18 V + 3 (4) **[1]**

= 30 V [1]

For Examiner's Use

9 A current is flowing in a wire as shown in Fig. 9. The wire is placed in between an electromagnet and was observed to move to the right.



[1] correct wiring at P **[1] correct wiring at Q**

Fig. 9

(a) State the polarity of Q and P that will cause the wire to move to the right. [1]
P (S) and Q (N) [1]

.....

(b) In Fig. 9, complete the wiring from A and B on the electromagnet so that the wire will move to the right. [2]

For Examiner's Use

Section B [20 marks]
Answer any **two** questions.

10 (a) Fig. 10.1 shows a water heater rated at 2.3 kW which operates from 240 V a.c. supply.

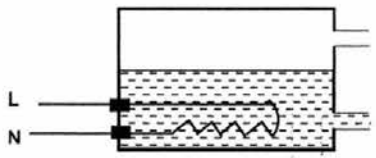


Fig. 10.1

(i) Calculate the current in the heating element. [2]

P = IV
I = 2300 / 240 [1]
= 9.58 A (3 sf) [1]

(ii) Suggest the rating of a fuse that can be used to protect the heater. [1]
Suggest to use a fuse of 10A. [1] Accept any fuse rating above 9.58 A

.....

(iii) Explain how the earth wire protects the user from electrocution. [2]
It provides a low resistance [1] conducting path for large current to flow to the earth

.....
should the metal case suddenly become 'live'[1]

.....

.....

(iv) The heater takes 5 minutes to boil one container of water. Calculate the cost of electricity used for boiling 100 containers of water if the cost of electricity is $0.28 per kWh. [2]

Total energy used = P x t = 2.3 x (5/60) x 100 = 19.17 kWh [1]

Total cost of electricity used = 19.17 x 0.28 = $5.37 [1]

10 (b) Electrons can move easily through metals. Fig.10.1 shows a metal rod with a strip of metal foil attached to it. The rod and strip have no charge.

For Examiner's Use

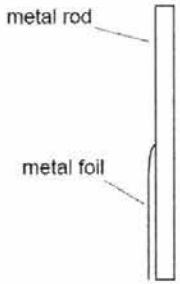


Fig. 10.1

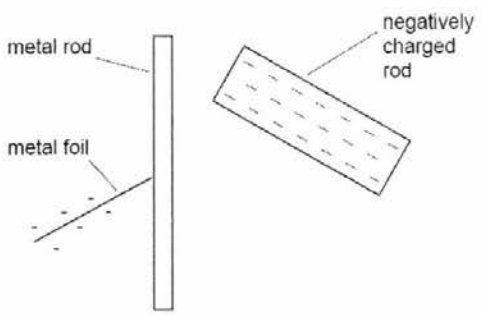


Fig. 10.2

A negatively charged rod is brought towards the top of the metal rod. The foil moves away from the metal rod as shown in Fig. 10.2.

(i) Indicate the charge distribution on metal foil in Fig. 10.2 as the negatively charged rod is brought towards the top of the metal rod. [1]

(ii) Explain why the foil moves as shown in Fig. 10.2 [2]

As negatively charged rod is brought towards the top of the metal rod, the electrons from
.....
the top of the metal rod will be repelled downwards into the metal foil and rod. [1]
.....
Both the metal foil and rod would be negatively charged. [1] and as like charges repel
.....
thus the metal foil moves away from the rod.
.....

11 A longitudinal wave passes through the air so that each air particle vibrates sideways. For example, particle **P** moves back and forth between positions **X** and **Y** repeatedly.

For Examiner's Use

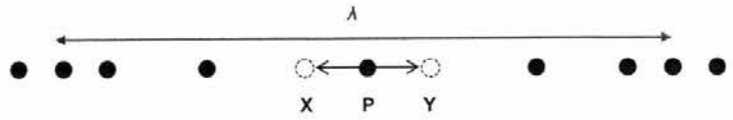


Fig. 11.1

At time t = 0 s, some air particles are at positions shown in **Fig. 11.1** and then at time t = 2.5 s, these particles return to the same positions as in **Fig. 11.1**.

(a) On **Fig. 11.1**, indicate the distance of one wavelength and label it as **λ**. [1]

(b) Given the distance between **X** and **Y** is 8 mm and the wavelength of the wave is 40.0 cm,

(i) state the amplitude of the wave.

4 mm

Amplitude = ... mm [1]

(ii) determine the frequency of the wave.

f = 1/T = 1/ 2.5 [1]
= 0.4 Hz [1]

Frequency = ... [2]

(iii) calculate the speed of the wave.

v = f λ = 0.4 x 40 [1]
= 16 cm /s = 0.16 m/s [1]

Speed = ... m/s [2]

11 **(c)** To investigate a layer of rock underground, an explosion is made on the surface of the earth. Fig. 11.2 shows the arrangement.

For Examiner's Use

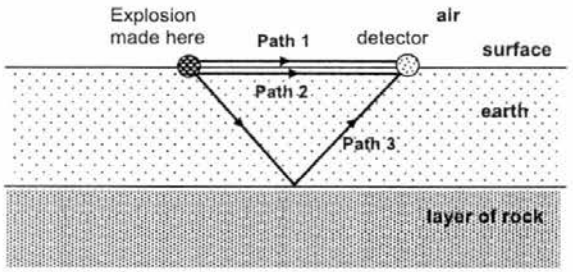


Fig. 11.2

Sound from the explosion may travel to the detector through air (Path 1), through earth (Path 2), or by reflection from a layer of rock (Path 3).

The time taken for the sound to reach the detector is shown in the table below.

	Path 1	Path 2	Path 3
Time taken for sound to travel from source to detector / s	0.100	0.020	0.300

(i) Explain why the time taken for sound to travel in Path 2 is less than that in Path 1. [2]

The time taken to travel is lesser in path 2 is because the sound is travelling

in the earth which is solid [1] as solid particles are closely packed [1] so sound

can travel at a shorter time

(ii) Given the speed of sound in air is 320 ms^{-1}, calculate the distance between the sound source and the detector. [1]

Speed = dist / time

320 = dist / 0.1

Dist = 32 m [1]

(iii) Hence, calculate the speed of sound in earth, **[1]**

Speed = dist / time
= 32 / 0.02 = 1600 m/s [1]

12 **(a)** Fig. 12.1 below shows a simplified hydraulic braking system.

For Examiner's Use

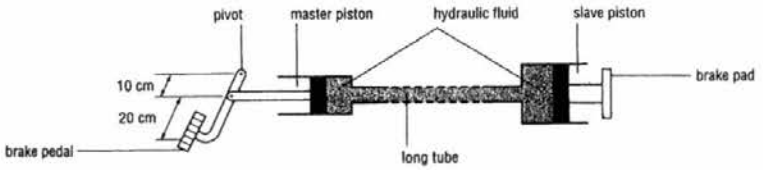


Fig. 12.1

(i) Define pressure and state its SI unit. [2]

Pressure is defined as force per unit area [1]

Unit for pressure is Pa [1]

(ii) If the area of contact between the master piston and the hydraulic fluid is 1.2 cm^2, what is the pressure along the fluid when a force of 1800 N is exerted by the master piston? Give your answer in Pa. [2]

Area = 1.2 cm^2 = 1.2 cm x 1 cm
= 0.012 m x 0.01
= 1.2 x 10^{-4} m^2 = 0.00012 m^2 [1]

Pressure = 1800 / 1.2 x10^{-4} = 15 000 000 Pa [1]

(iii) Why is liquid used as the hydraulic fluid instead of gas? [1]

Liquid is incompressible unlike gas

12 (b) Fig. 12.2 shows an enlarged diagram of the hydraulic braking system in Fig. 12.1

For Examiner's Use

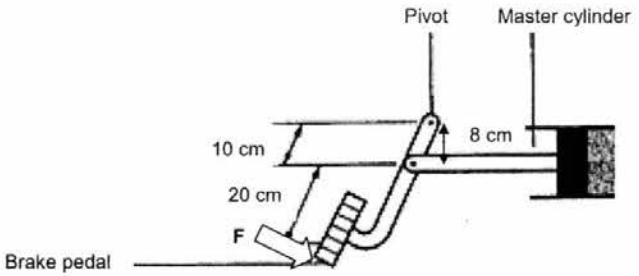


Fig. 12.2

(i) State the principle of moment [1]

When an object is in equilibrium, the sum of clockwise moment about a pivot point

.....

is equal to the sum of anticlockwise moment about the same pivot point

.....

.....

A force, F, 100 N is applied on the brake pedal as shown in Fig. 12.2

(ii) What is the amount of force that will be applied on the master cylinder? [2]

Sum of anticlockwise moment due to F = 100 x 0.3 = 30 N m

The same moment will be transmitted to the master cylinder

30 = F x 0.08 [1]

F = 375 N [1]

(iii) State two possible changes to be made to Fig. 12.2 such that the force applied on the master cylinder can be increased with the same 100 N force. [2]

Increase the distance of the force applied to pivot point [1]

.....

Shorter the distance of the master cylinder from the pivot point. [1]

.....

.....

END OF PAPER