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# FAJAR SECONDARY SCHOOL
# 2019 END OF YEAR EXAMINATIONS
# SECONDARY 3 EXPRESS

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE (Physics) 5076 / 01

**Paper 1**
Setter: Koh K C
Additional Materials: OTAS

Date: 4 October 2019
Duration: 1 hour

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name and index number on the Question Paper and OTAS Sheet in the spaces provided.

There are **twenty** questions on 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 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.
The use of an approved scientific calculator is expected, where appropriate.

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This document consists of **10** printed pages and **0** blank pages.

1 The diagram shows the reading on a micrometer screw gauge.

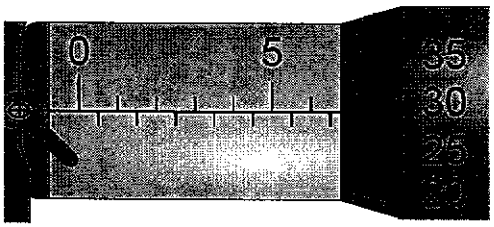
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2




What is the reading shown?

**A** 5.29 mm **B** 6.29 mm

**C** 6.79 mm **D** 8.29 mm

**2** The data of three pendulums X, Y and Z, is recorded in the table.

| pendulum | mass of pendulum bob / g | length of pendulum / cm |
|---|---|---|
| X | 150 | 100 |
| Y | 100 | 30 |
| Z | 50 | 50 |

Which statement about their periods is correct?

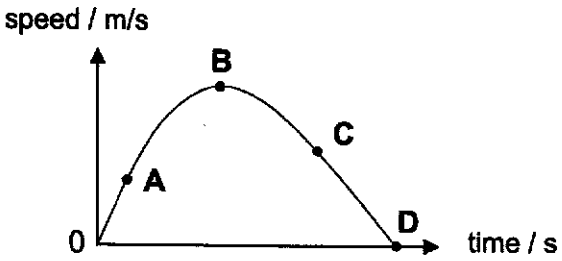
**A** All three pendulums have the same period as it is not dependant on mass and length.

**B** The period of X is longer than that of Y as X has a longer length.

**C** The period of X is shorter than that of Y as X has a greater mass.

**D** The period of Y is longer than that of Z as Y has a shorter length.

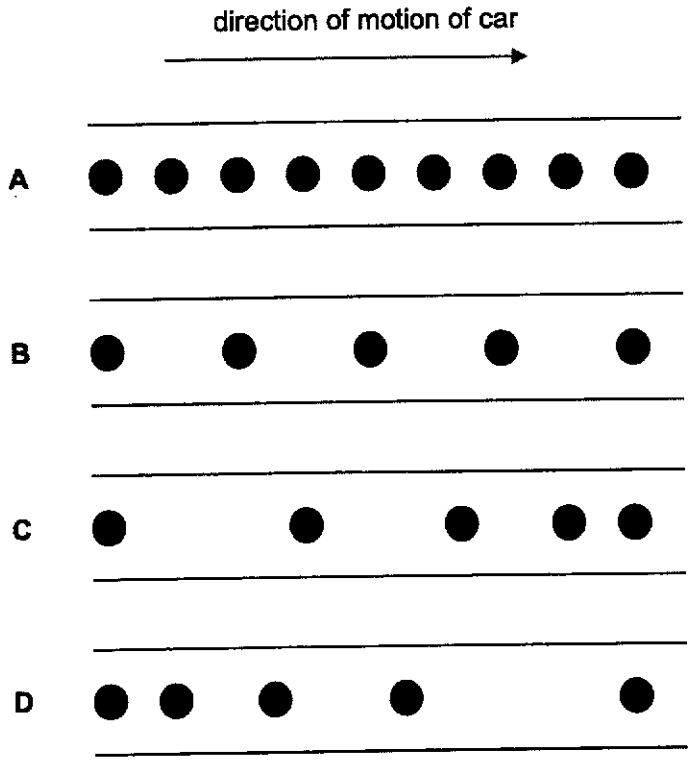
**3** The speed-time graph of an object is shown.



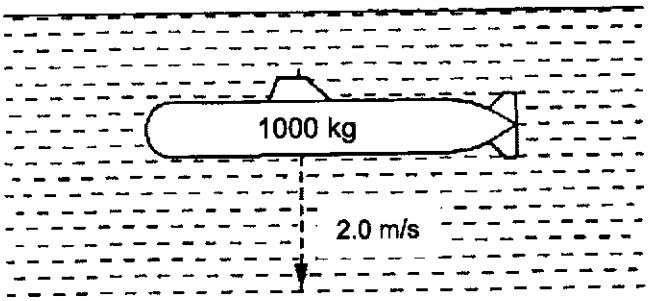

At which point on the graph is the object experiencing zero acceleration?


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4 A moving truck is leaking oil drops as it travels.
Which diagram shows that the speed of the truck is increasing?




5 A small submarine of mass 1000 kg sinks in water with a uniform speed of 2.0 m/s.




What is the resultant force acting on the submarine?

A 0 N

B 500 N downwards

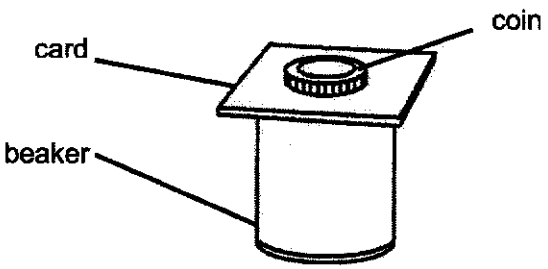
C 2000 N downwards

D 10 000 N downwards



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6 The diagram shows a coin lying on a card on top of a beaker. If the card is pulled away quickly, the coin does not shift sideways but falls into the beaker.

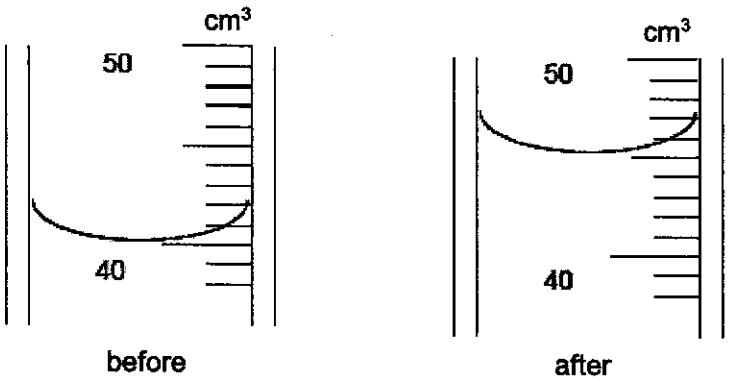



Which property of the coin makes this possible?

**A** acceleration **B** force

**C** inertia **D** pressure

7 The diagrams show the difference in water level before and after a solid is submerged into a measuring cylinder, which measures in units of $cm^3$.




Given that the mass of solid is 20 g, what is its density?

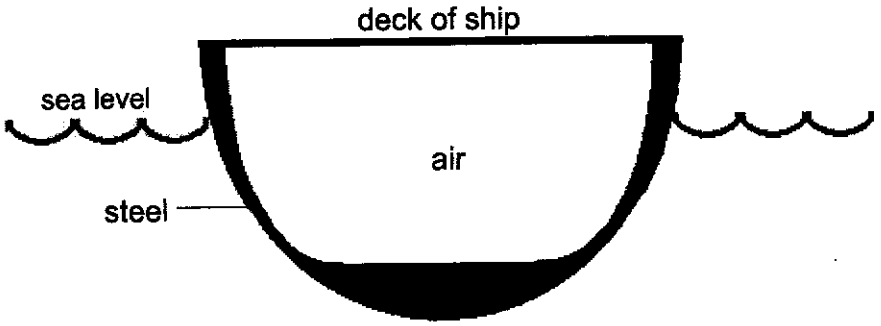
**A** 0.30 $g/cm^3$ **B** 0.50 $g/cm^3$

**C** 2.0 $g/cm^3$ **D** 4.0 $g/cm^3$



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8 Steel is used to build a ship. The cross-section of the ship's body is as shown. A large portion of the interior of the ship is hollow and contains air.

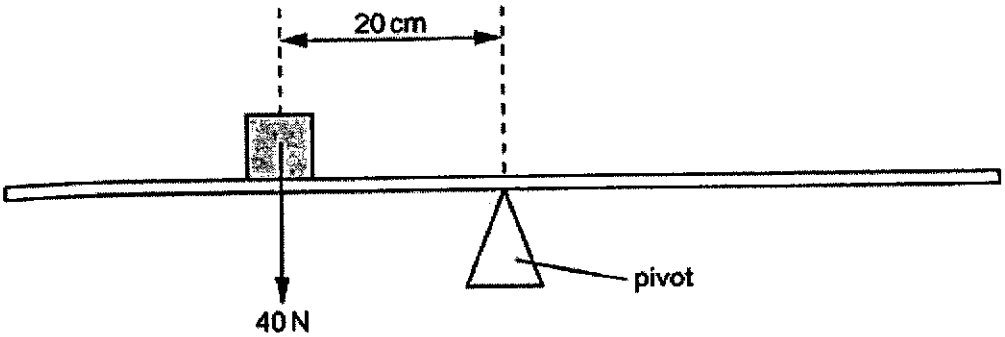



The densities of air, seawater and steel are 0.00123 g/cm$^3$, 1.03 g/cm$^3$ and 8.05 g/cm$^3$ respectively. Which value is a possible density of the ship?

**A** 0.00123 g/cm$^3$ **B** 0.85000 g/cm$^3$

**C** 4.0256 g/cm$^3$ **D** 8.05123 g/cm$^3$

9 A uniform beam is pivoted at its midpoint. An object is placed on the beam as shown.




Which force will re-balance the system?

**A** 16 N acting downwards, 40 cm to the right of the pivot

**B** 16 N acting upwards, 50 cm to the left of the pivot

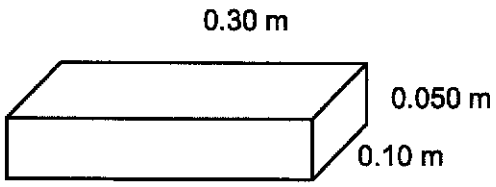
**C** 50 N acting downwards, 16 cm to the left of the pivot

**D** 50 N acting upwards, 10 cm to the right of the pivot



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**10** A rectangular block has dimensions of 0.30 m x 0.10 m x 0.05 m and has a weight of 12 000 N.




What is the maximum possible pressure that can be exerted on the ground by the block?

**A** 400 000 Pa

**B** 800 000 Pa

**C** 2 400 000 Pa

**D** 8 000 000 Pa

**11** An 8.0 W LED bulb is switched on for 30 minutes.

How much energy does the bulb use?

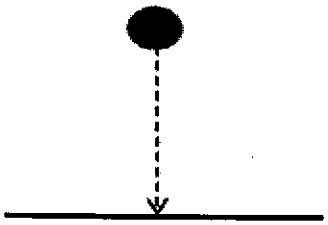
**A** $8 \times 30$ J

**B** $8 \times 30 \times 60$ J

**C** $\frac{8}{30}$ J

**D** $\frac{8}{30 \times 60}$ J

**12** A ball is released from a height of 10 m. It falls on to a smooth concrete ground and bounces up.



Which row shows the correct order of the energy conversions?

**A** chemical energy → elastic energy → kinetic energy → gravitational potential energy

**B** chemical energy → kinetic energy → elastic energy → gravitational potential energy

**C** gravitational potential energy → elastic energy → kinetic energy → chemical energy

**D** gravitational potential energy → kinetic energy → elastic energy → kinetic energy



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13 A gas expands as it is being heated up. Which statement about the expansion is true?

A The distance between the particles increases.

B The kinetic energy of the particles remains constant.

C The particles expand in size and move faster.

D The particles start to slide over one another.

14 An ice cube at 0 °C is removed from the freezer and placed in a room with a room temperature of 30 °C.

What is the immediate change to the internal energy of the ice cube?

A the internal kinetic energy decreases

B the internal kinetic energy increases

C the internal potential energy decreases

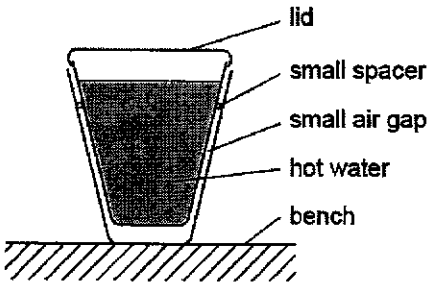
D the internal potential energy increases

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15 Two plastic cups are placed one inside the other. Hot water is poured into the inner cup and a lip is placed on top as shown.




Which statement is correct?

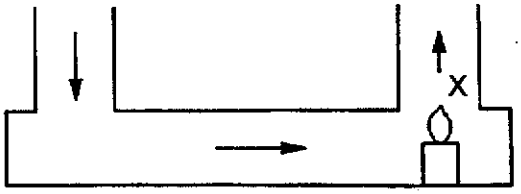
**A** Heat loss by radiation is prevented by the small air gap.

**B** No heat passes through the sides of either cup.

**C** The bench is heated by convection from the bottom of the outer cup.

**D** The lid is used to reduce heat loss by convection.

16 The diagram shows a model of a convection system.



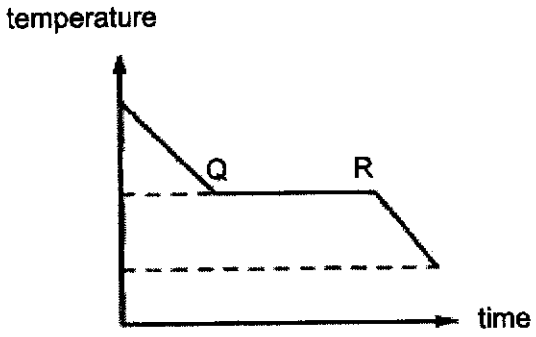

What happens to the volume and density of a fixed mass of air at X to make it rise?

| | volume | density |
|---|---|---|
| **A** | increases | decreases |
| **B** | increases | increases |
| **C** | unchanged | decreases |
| **D** | unchanged | increases |



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17 The diagram shows the cooling curve of a substance initially in its liquid state.




Which option correctly describes the state(s) of the substance along QR?

A gaseous state only

B liquid and gaseous state

C liquid and solid state

D solid state only

18 Which group shows electromagnetic waves in the correct order of increasing wavelengths?

A infrared, gamma rays, visible light and radio waves

B microwaves, radio waves, X-rays and gamma rays

C ultraviolet, radio waves, gamma rays and X-rays

D X-rays, ultraviolet, visible light and radio waves

19 Which statement is correct about electromagnetic waves?

A All electromagnetic waves travel at the same speed in a vacuum and in water.

B Radio waves are longitudinal waves.

C The frequency of infra-red radiation is lower than that of ultraviolet radiation.

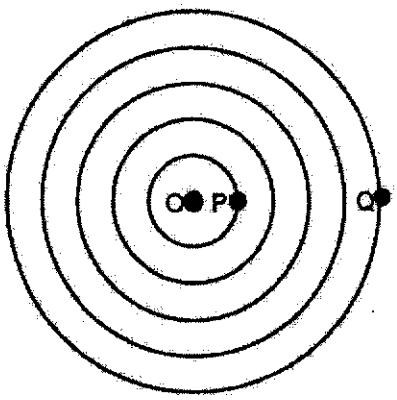
D Ultraviolet travels faster than radio waves.

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20 The diagram shows circular wave fronts with a point source O, moving radially outwards.




The wavelength is 6.0 m and the time taken for a wave front to travel from P to Q is 8.0 s.
What is the speed and the frequency of the wave?

| | speed / $ms^{-1}$ | frequency / Hz |
|---|---|---|
| **A** | 0.75 | 0.50 |
| **B** | 0.75 | 2.0 |
| **C** | 3.0 | 0.50 |
| **D** | 3.0 | 2.0 |

**End Of Paper**


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# FAJAR SECONDARY SCHOOL
# 2019 END OF YEAR EXAMINATIONS
# SECONDARY 3 EXPRESS

CANDIDATE NAME

CLASS

INDEX NUMBER

## SCIENCE (PHYSICS)
**Paper 2**

5076 / 02

Date: 30 Sept 2019
Duration: 1 hour 15 minutes

Setter: Koh K C
Additional Materials: NIL

**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.
You may use pencil for any diagrams, graphs, tables or rough working.
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.

In calculations, you should show all steps in your working, giving your answer at each stage.
Electronic calculators can be used in this paper.
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 |

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## Section A [45 marks]

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

1 **(a)** Complete the physical property measured by the instruments listed in Table 1.1. State the SI unit.

| instrument | physical property measured | SI unit |
|---|---|---|
| thermometer | | |
| stopwatch | | |

**Table 1.1**

[2]

**(b)** State the difference between a scalar quantity and a vector quantity.

.....

..... [1]

**(c)** Fig. 1.2 shows a method that can be used to estimate the diameter of a wire by winding 30 rounds tightly on a pencil.

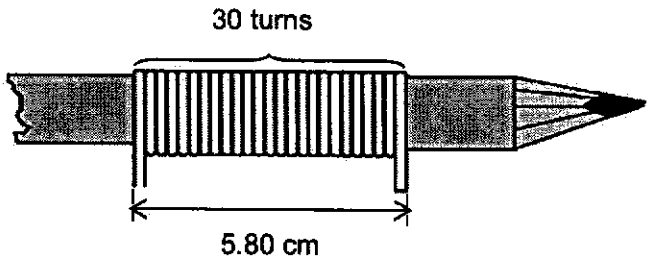



**Fig.1.2**

**(i)** Calculate the estimated diameter of the wire.

diameter = ..... cm [2]

**(ii)** Name a suitable instrument used to measure the diameter of the wire at a higher precision. State the unit.

instrument : .....

unit : ..... [1]

[Total: 6]



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**2** Fig. 2.1 shows the speed-time graph of a taxi travelling around the neighbourhood. The mass of the taxi is 1200 kg. The initial drive force from the engine is 1500 N.

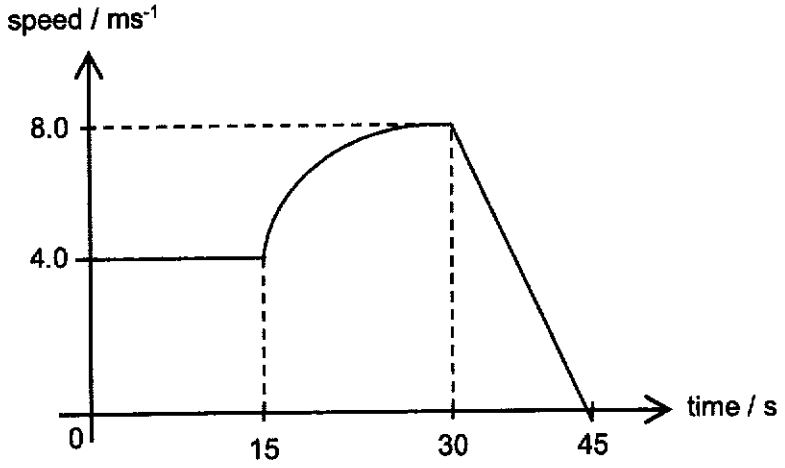



**Fig. 2.1**

**(a)** Describe the motion of the taxi between

t = 0 and t = 15 s,

.....

t = 15 and t = 30 s and

.....

t = 30 and t = 45 s.

..... [3]

**(b)** Determine

**(i)** the frictional force experienced by the taxi for the first 15 seconds,

frictional force: ..... N [1]

**(ii)** the braking force on the taxi at t = 30 s.

braking force: ..... N [2]

[Total: 6]



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3 A rock X of mass 3.0 kg is brought from the planet Mars to Earth. On the surface of Mars, rock X weighs 11.1 N and its volume is 4.0 $m^3$.

*For Examiner's Use*

**(a)** Determine

**(i)** the gravitational field strength of the planet Mars,

gravitational field strength = .....N/kg [1]

**(ii)** the density of rock X.

density of rock X = .....$kg/m^3$ [3]

**(b)** Another rock Y of mass 15 kg is also brought from Mars to Earth.
Both rocks X and Y are transported from the airport to the science laboratory by a van. When the driver is making a right turn at a cross road junction, one of the rocks falls off the van.

State which rock falls off the van. What is the reason?

.....

.....

.....

..... [2]

[Total: 5]



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**4** Fig. 4.1 shows a manual car park barrier balanced by a concrete block, a rope and the weight of a beam.

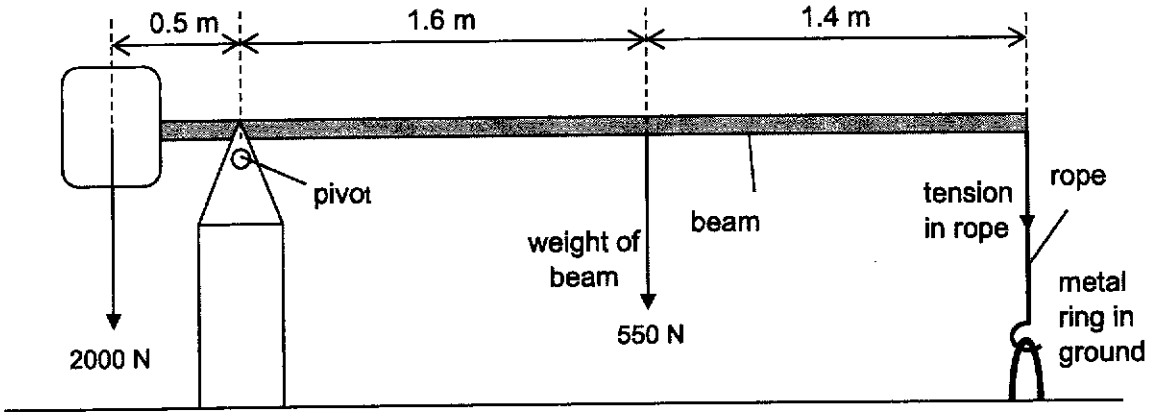



**Fig. 4.1**

**(a)** The weight of the barrier beam is 550 N and acts at 1.6 m to the right of the pivot. Calculate the tension needed in the rope in order to keep the beam horizontal.

tension = ..... N [3]

**(b)** Describe and explain what will happen if the rope is suddenly detached from the metal ring.

.....

.....

.....

..... [2]

[Total: 5]



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5 A boat of mass 150 kg is travelling across a river with a force of 180 N powered by its motor engine. The water current also exerts a force of 100 N on the boat at an angle of 50° as shown in Fig. 5.1

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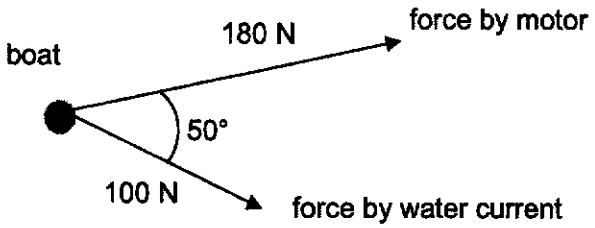



**Fig. 5.1**

Draw a suitable scale diagram to determine the magnitude of the resultant force.

resultant force = ..... N [4]



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**6** Fig. 6.1 shows a simplified form of a hydraulic press. The large piston has an area of 0.75 $m^2$. A 20 N force is exerted on the small piston of area 0.02 $m^2$.

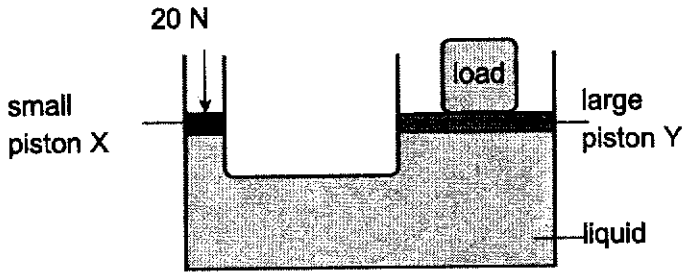



**Fig. 6.1**

**(a)** Calculate the pressure exerted on the liquid by the small piston X.

pressure = ..... Pa [2]

**(b)** Determine the force exerted by the load on the large piston Y.

force by large piston Y = ..... N [2]

**(c)** Suggest with explanation, how the distance moved by piston Y compares with the distance moved by X.

.....

.....

.....

..... [2]

[Total: 6]



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7 A marble of mass 0.50 kg is released from rest from the top of a smooth track at A as shown in Fig. 7.1. The marble continues with a loop BCD to end the rolling process. The gravitational field strength on the Earth is 10 N/kg.

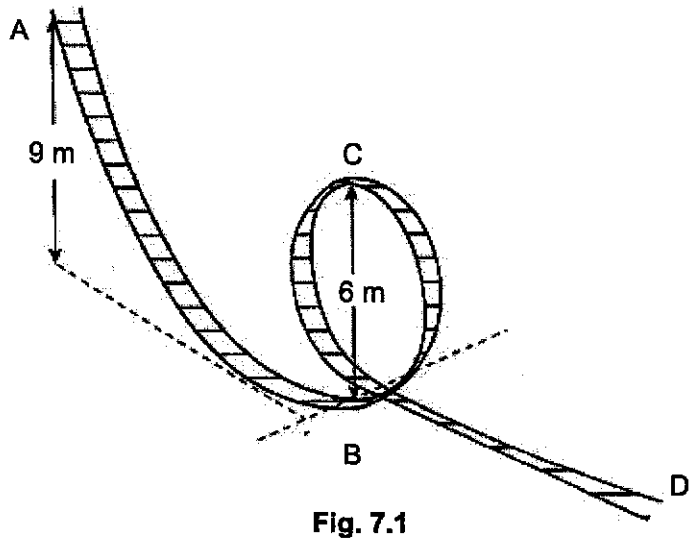



Fig. 7.1

**(a)** Calculate the gravitational potential energy of the marble at A.

gravitational potential energy at A = ..... J [2]

**(b)** Calculate the kinetic energy of the marble at C.

kinetic energy at C = ..... J [2]

**(c)** Calculate the speed of the marble at C.

speed at C = ..... m/s [2]

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(d) Speed sensors are installed at positions B and D to monitor the speed of the marble along the track. Describe and explain what causes the speed at B to be different from D.

.....

.....

.....

..... [2]

[Total: 8]

8 In a ripple tank, an oscillating dipper produced plane waves on the surface of the water, as shown in Fig. 8.1.

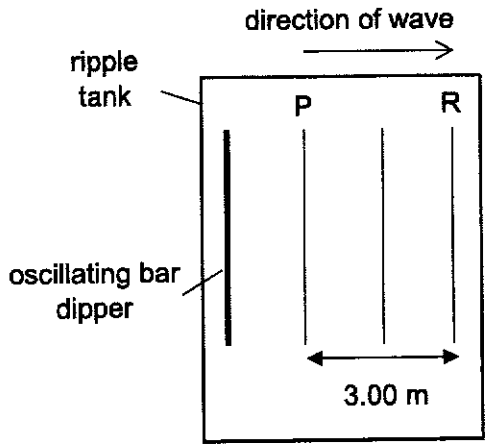



**Fig. 8.1**

The distance between wave fronts P and R is 3.00 m. The period of the water wave is 1.50 s.

**(a)** Calculate

**(i)** the frequency of the water wave.

frequency = ..... Hz [2]

**(ii)** the speed of the wave,

speed of wave = ..... m/s [2]



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**(b)** State what is meant by *frequency* in **(a)(i)**?

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.....

..... [1]

[Total: 5]

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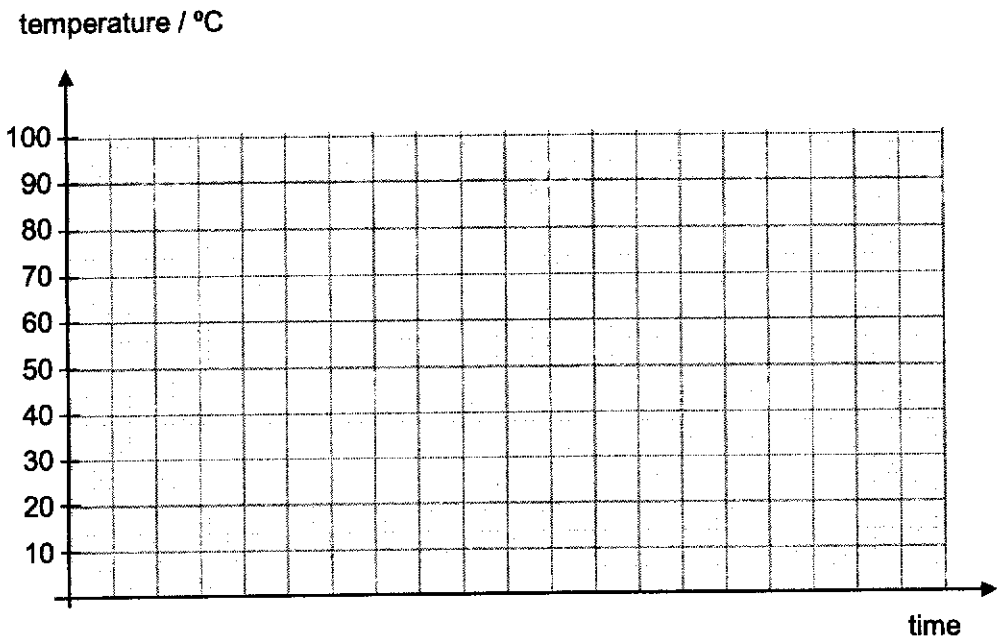
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**Section B [20 marks]**

Answer any **two** questions in the spaces provided.

9 A pure substance with melting point of 65 °C is heated in a water bath. It is left to cool from 90 °C to room temperature of 30 °C.

**(a)** On Fig. 9.1, sketch a graph to show how the temperature of the substance changes with time as it cools from 90 °C to 30 °C.




[2]

**Fig. 9.1**

**(b)** Describe the changes, if any, to the arrangement and to the motion of the molecules of the substance

**(i)** as it cools from 75 °C to 66 °C, and

arrangement of molecules

.....

.....

.....

motion of molecules

.....

.....

..... [2]



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(ii) as it freezes at 65 °C.

arrangement of molecules

.....

.....

.....

motion of molecules

.....

..... [2]

(c) The same experiment is carried out by student B under a different condition. The pure substance is poured into a shiny metal container and temperature is taken using a data logger.

(i) State how the variation of temperature with time collected by student B differs from the first experiment.

..... [1]

(ii) Explain the difference.

.....

..... [1]

(iii) Describe how thermal energy is transferred from the substance to the surrounding.

.....

.....

..... [2]

[ Total : 10 ]

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**10** Fig. 10.1 shows the velocity-time graphs of a ball when it falls towards the ground on Earth and on the Moon.

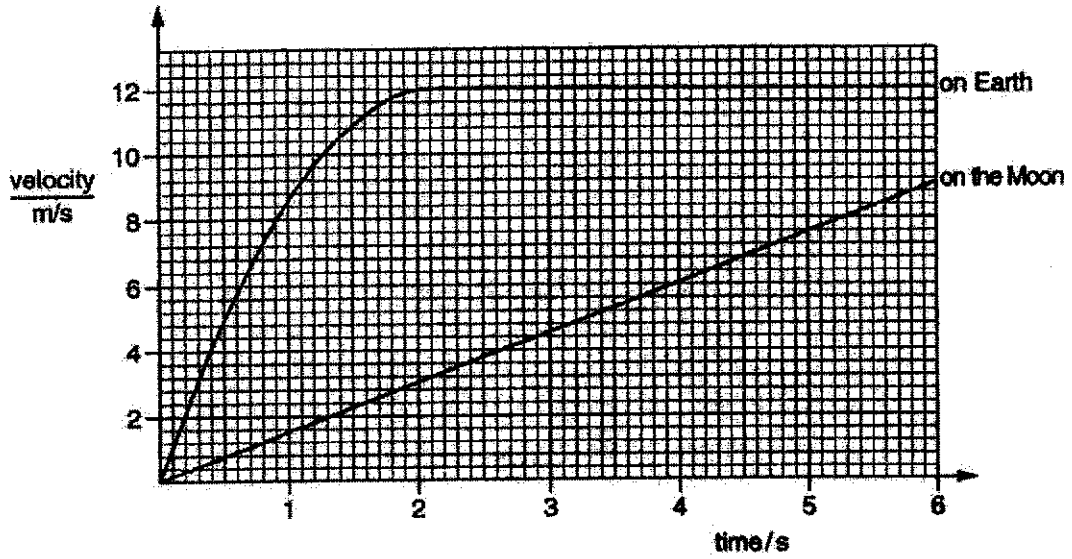



**Fig. 10.1**

**(a)** **(i)** Explain why the acceleration of the ball decreases when it is on Earth from t = 0.0 s to t = 2.0 s while its acceleration on the Moon remains constant throughout.

on Earth

.....

.....

.....

..... [2]

on the Moon

.....

..... [1]

**(ii)** Calculate the acceleration of the ball on the Moon.

acceleration = ..... [2]

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10 (b) (i) State the two forces acting on the ball when it is on Earth.

force 1: ..... , force 2: ..... [1]

(ii) Use the graph to describe how the two forces relate to each other from t = 2.0 s to t = 6.0 s.

.....

.....

.....

.....

..... [2]

(c) Calculate the distance travelled when it is on the Moon from t = 0.0 s to t = 6.0 s.

distance = ..... [2]

[ Total : 10 ]

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**11** **(a)** Fig 11.1 shows a water wave passing a floating log of length 6.0 m. The log is stationary.

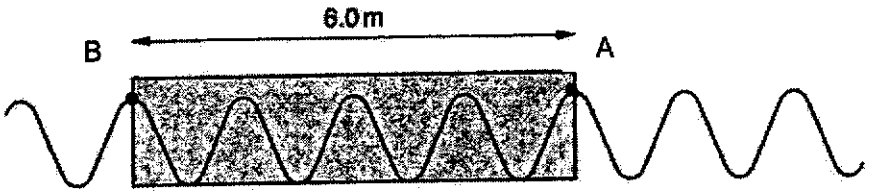



**Fig. 11.1**

The water wave completes 5 oscillations in 12 seconds to pass point A. Determine

**(i)** the wavelength of the water waves,

wavelength = ..... [1]

**(ii)** the time taken for the wave to travel from A to B.

time = ..... [3]

**(b)** Fig. 11.2 shows regions of the electromagnetic spectrum in order of decreasing frequency. Some regions are identified by letters.

high frequency → low frequency

| | | | | | | |
|---|---|---|---|---|---|---|
| P | X-ray | Q | visible light | R | microwave | radio waves |

**Fig. 11.2**

**(i)** State the difference between transverse waves and longitudinal waves.

.....

.....

..... [1]

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(ii) State two common properties of waves in all regions.

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1. .....

.....

2. .....

..... [2]

(iii) State the applications of waves from regions P, Q and R.

P: .....

Q: .....

R: ..... [3]

[ Total : 10 ]

**End - of - Paper 2**

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# FAJAR SECONDARY SCHOOL
# 2019 END OF YEAR EXAMINATIONS
# SECONDARY 3 EXPRESS

CANDIDATE NAME

## Marking Scheme

SUBJECT
SCIENCE (Physics)
**Paper 1**
Setter: Koh K C
Additional Materials: OTAS

Subject Code : 5076 / 01

Date:
Duration: 1 hour

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

**Paper 2**

1 (a) Temperature / K [1]
Time / s [1]

(b) Scalar quantity has **only magnitude** while vector quantity has **magnitude and direction**. [1]

(c) (i) Diameter = length / number of turns [1]
= 5.80 / 30 = 0.193 cm [1]

(ii) Instrument = Vernier calipers/ cm or micrometer screw gauge [1]

2 (a) t=0 s to t=15 s: [1]
the taxi travels at constant speed of 4.0 m/s

t=15 s to t=30 s: [1]
the taxi travels at a decreasing acceleration

t=30 s to t=45 s: [1]
the taxi travels at a constant deceleration

(b) (i) Frictional force = 1500 N [1]
(ii) $a = (V-U)/t = (0 - 8)/15 = -0.533\ m/s^2$
$F = m \times a = 1200 \times 0.533 = 639.6 = 640\ N$

3 (a) (i) G = 11.1 / 3 = 3.7 N/kg [1]
(ii) Density = m/V
= ¾ = 0.75 $kg/m^3$.

(b) Rock Y falls off. [1]
[2]

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Rock Y has a **large mass contributes a higher inertia.** It **continue straight** with the road when the driver is making a turn.

**4 (a)** Anti-clockwise moment = clockwise moment
550 X 1.6 + T x 3.0 = 2000 X 0.5 [1]
880 + 3T = 1000 [1]
3T = 120
T = 40 N [1]

**(b)** When the rope is detached from the metal ring, the beam rotates in the anticlockwise direction. [1]
This is because the anti-clockwise moment is larger than clockwise moment. [1]

**6 (a)** Pressure = F / A [1]
= 20 / 0.02 = 1000 Pa [1]

**(b)** $P_Y = PX$
$F_y / A_y = 1000$ [1]
$F_x = 1000 \times 0.75$
$= 750$ N [1]

**(c)** The distance moved by Y and is much smaller than the distance moved by X. [1]
As liquid is incompressible, volume displaced by piston X must be equal to the volume added to piston Y [1]

**7 (a)** GPE = m X g X h [1]
= 0.5 X 10 X 9 = 45 J [1]

**(b)**
GPE at C = m X g X h
= 0.5 X 10 X 6 = 30 J [1]

KE at C = 45 – 30 = 15 J [1]

**(c)** KE = 15 J
$\frac{1}{2} \times m \times V^2 = 15$
$V^2 = 60$ [1]
V = 7.75 m/s [1]

**(d)** Speed at <u>D is slower than B</u>. [1]
Kinetic energy may have converted into heat and sound along the track **due to frictional force.** [1]

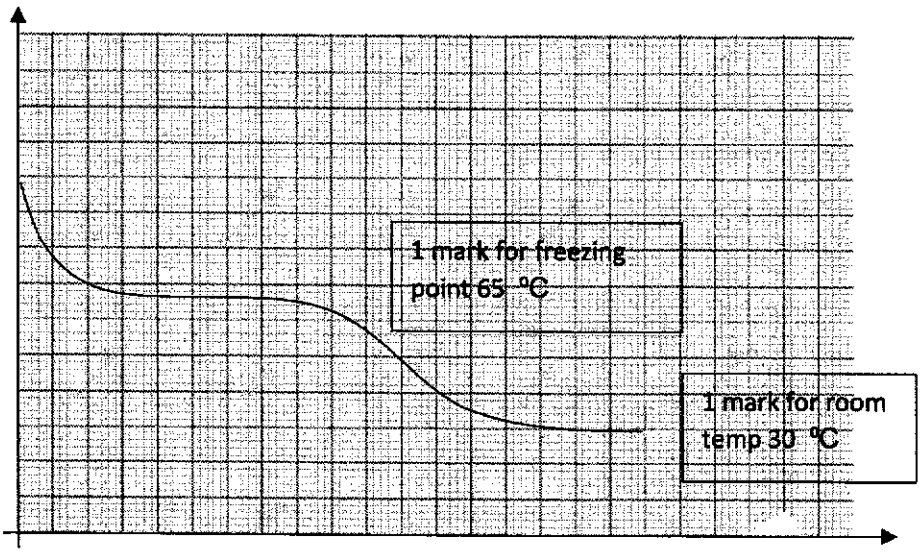
**8 (a) (i)** F = 1/T = 1/ 1.5 = 0.667 hz [1]
[1]

**(ii)** Speed = $\lambda$ / T [1]
= 1.5 / 1.5 = 1.0 m/s [1]

**(iii)** The water takes completes 2/3 or 0.667 wave in 1 second. [1]


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9 (a)




[2]

(b) (i) 75 ° C to 66 °C,
Arrangment :
The molecules are aranged in **irregular pattern** and **closely packed** together. [1]

motion of molecules
**Particles slide pass** each other. [1]

(ii) at 65 °C.
Arrangment :
The molecules are **closely packed and arranged in regular** pattern [1]

motion of molecules [1]
The articles **vibrates about a fixed** position.

(c) (i) The cooling process and freezing process **take longer time** than experiment 1. [1]

(ii) The shiny metal container is a poor emitter of heat. [1]

(iii) Heat from the pure substance is transferred the metal box by conduction and by convection current. [1]
From the metal container, heat is transferred to the surrounding by radiation. [1]

10 (a) (i) On the Earth, the ball experience air resistance when it falls. [1]
**Air resistance increases with speed**. Hence **resultant force decreases**. [1]
Which results in decreasing acceleration.

There is **no air on** the Moon. Hence acceleration is constant. [1]

(ii) A = (V-U) / t = (8.5 – 0 ) / 6 [1]
= 1.41 m/s$^2$. [1]

(b) (i) Force 1: weight [1]
Force 2: air resistance



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(ii) The weight of the ball is equal and opposite to the air resistance when falling. [1]
The resultant force acting on the ball is zero. [1]

(c) Distance = ½ X 6 X 8.5 = 25.5 m [1]
[1]

11 (a) (i) Wave length = 6 / 4 = 1.5 m [1]

(ii) Frequency = 1/T = 5/12 = [1]
Speed of wave = f X λ
= 5/12 X 1.5
= 0.625 m/s [1]

Time = distance / speed = 6 .0 / 0.625 = 9.6 s [1]

(b) (i) Longitudinal waves vibrates parallel to the direction of travel. [1]
Transverse waves vibrates perpendicular to the direction of travel.

(ii) All EM waves are transverse waves. [2]
They travel at $3X10^8$ m/sin vacuum.
They show properties like reflection and refraction.
They obey v = f X λ
**Any two**

(iii) A: to kill cancer cells for cancer treatment. [1]
B: to check for counterfeit bank notes. / Sun bed [1]
C: for remote control / Burglar alarm. [1]

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