BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020

4E5N

CANDIDATE NAME

CLASS | REGISTER NUMBER

SCIENCE (PHYSICS, CHEMISTRY)

5076/02

Paper 2 Physics

28 Aug 2020

1 h 15 min

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or do not use appropriate units.

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

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

At the end of the examination, fasten all your 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

Setter: Mr Adrian Lim

This document consists of **17** printed pages including the cover page

Section A: (45 marks)

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

1 Two forces of magnitude 10.0 N and 14.0 N act on an object, **P** as shown in Fig 1.1.

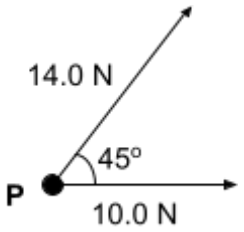


Fig 1.1

Using a suitable scale, draw a scale diagram to determine the magnitude and direction of the resultant force on **P**.

scale: 1 cm represents …… N **[1]**

resultant force = …… N **[2]**

direction = …… **[1]**

2 Fig. 2.1 below shows an electric scooter used by Danial to travel from home to school. He accelerates uniformly from rest to 2.5 m/s in 3.0 s. He continues at this speed for 9.0 s on a straight horizontal path before decelerating uniformly in 5.0 s

Fig. 2.1

(a) On Fig. 2.2, complete the graph to display the variation of speed of the electric scooter with time. **[2]**

sp

Fig. 2.2

(b) Calculate the average speed of the electric scooter for the journey.

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

(c) Calculate the deceleration of the scooter during the last 5.0 s.

[2]

deceleration = ... m/s^2

3 Fig. 3.1 shows a parachutist falling from the aircraft.

Fig. 3.1

He is accelerating towards the Earth.

(a) State his initial acceleration as he steps out of the aircraft

acceleration = ... m/s^2 **[1]**

(b) After he opened his parachute, the forces acting on him are represented in a simplified diagram shown in Fig. 3.2.

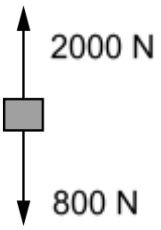


Fig. 3.2

(i) Determine the resultant force acting on him.

resultant force = ... N **[1]**

(ii) Hence, calculate his deceleration. The parachutist has a mass of 80 kg.

deceleration = ... m/s^2 **[2]**

4 Fig. 4.1 below shows a hydraulic system that consists of two pistons and a flexible pipe. The cross-sectional area of the smaller piston is 500 cm^2 and cross-sectional area of the larger piston is 1440 cm^2.

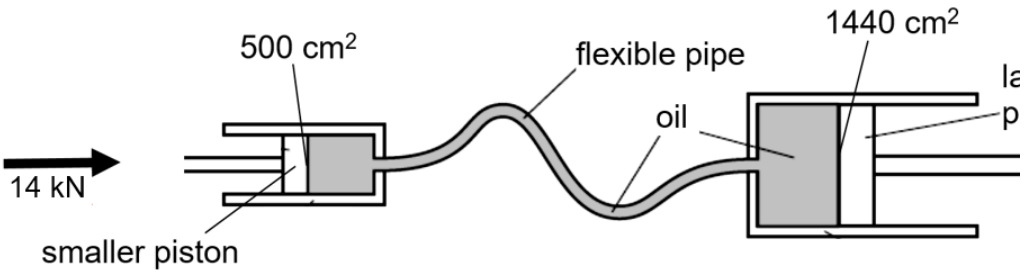


Fig. 4.1

A force of 14 kN is exerted by the smaller piston on the oil.

(a) Calculate the pressure on the oil exerted by the small piston.

[2]

pressure = ... N/cm^2

(b) The pressure on the oil by the smaller piston is the same as the pressure of the oil on the larger piston.

Through the calculation of the forces, show that the force on the larger piston is greater than the force by the smaller piston.

[2]

5 Fig. 5.1 shows a gymnast on a trampoline. At position **A** in Fig. 5.1a, the gymnast starts to rise. She passes through **B** in Fig. 5.1b and reaches her maximum height at **C**.

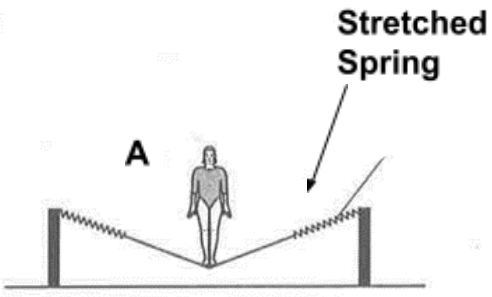


Fig. 5.1a

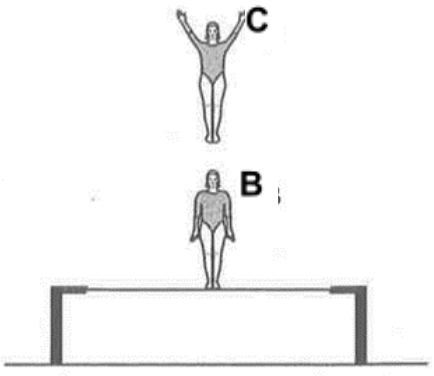


Fig. 5.1b

(a) State the form of energy stored in the stretched springs shown in Fig. 5.1a.

..... **[1]**

(b) When the gymnast is at **B**, her kinetic energy is 1900 J, its maximum value. The mass of the gymnast is 45 kg.

(i) Calculate the speed of the gymnast at **B**.

[2]

speed = ……..…… m/s

(ii) Ignoring the effects of any friction and assuming the gravitational acceleration is 10 m/s^2, calculate the maximum height that the gymnast can rise up to from **B** to **C**.

height = ……..…… m **[2]**

6 Fig. 6.1 shows how a baby's milk bottle can be heated using a bottle warmer. The bottle warmer has foam-filled walls and a shiny outer casing. Heat is provided by a 200 W heating element. The heating element raises the temperature of the liquid in the warmer to 40 ^{0}C.

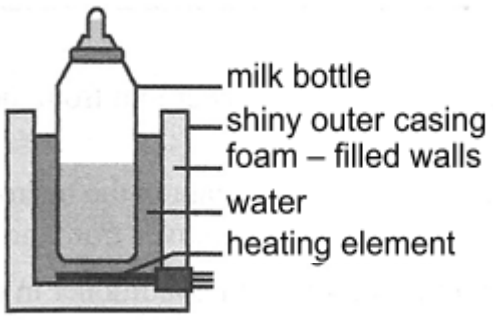


Fig. 6.1

(a) Describe and explain how the foam-filled walls and shiny outer casing reduce heat loss from the bottle warmer to the surroundings.

(i) Foam-filled wall:

……..……..……..

……..……..……..……..……..……

……..……..……..……..……..…… **[2]**

(ii) Shiny outer casing:

……

……

…… **[2]**

(b) When the top part of the bottle is removed, it is noticed that some of the milk evaporates.

Describe and explain, using ideas about molecules, what happens during evaporation and what effect does it have on the temperature of the remaining liquid.

……

……

……

…… **[2]**

7 **(a)** An object is placed 8 cm in front of a thin converging lens, as shown in Fig. 7.1.

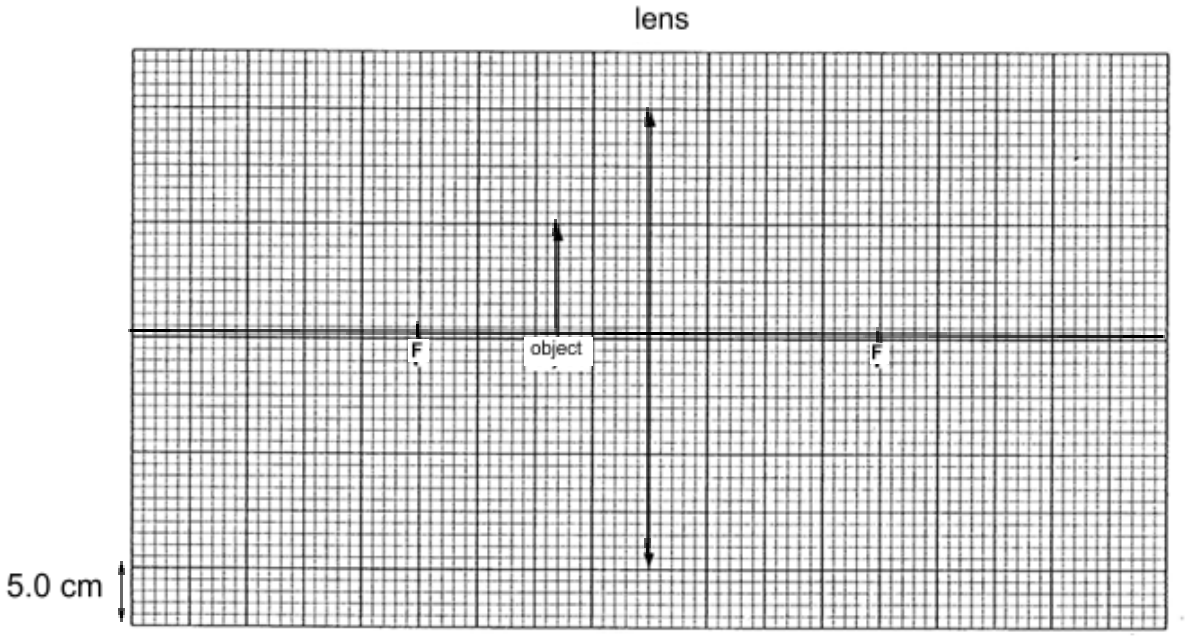


Fig. 7.1.

F is the principal focus of the lens.

(a) On Fig. 7.1, draw rays from the top of the object to determine the position of the image. Mark the position of the image with the letter **I**. **[2]**

(b) The object is now moved so that it is now 40 cm from the lens.

State three characteristics of the new image formed.

.....

..... **[2]**

8 In Fig. 8.1, short metal threads are attached to a metal ball. The metal ball and threads contain negative charges that are free to move throughout the metal and positive charges that are not free to move. The metal rod and thread has no overall charge.

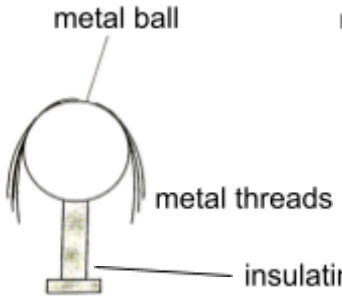


Fig. 8.1

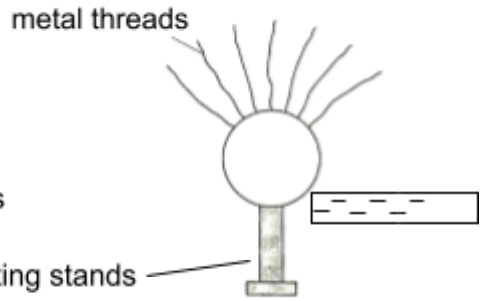


Fig. 8.2

In Fig. 8.2, a negatively charged rod is placed under the metal ball and the metal threads move away from the metal ball as shown.

(a) Explain why the metal threads move away from the metal ball in Fig. 8.2

.....

.....

……

…… **[2]**

(b) An earth connection is connected to the metal ball in Fig. 8.2 and this causes an average of 0.30 mA of current to flow to earth in 50 μs.

(i) Calculate the amount of charge that flow to earth.

charge = …… C **[2]**

(ii) The average potential difference between the metal ball and earth is 120 000 V.
Calculate the electrical energy that is produced by the current.

energy = …… J **[2]**

9 Fig. 9.1 shows two lamps and a 4.0 Ω resistor connected in a circuit with a 6 V cell. The lamps have a resistance of 2.0 Ω each.

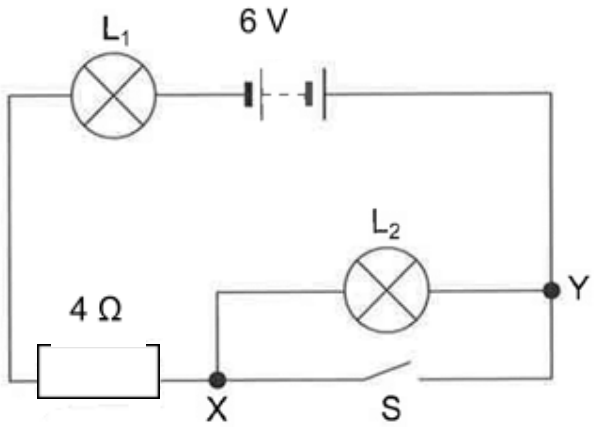


Fig. 9.1

(a) Calculate the current through the resistor in the circuit as shown in Fig. 9.1 when the switch S is open.

[2]

current = ... A

(b) Compare the brightness of L1 and L2 when the switch S is open.
Explain your answer.

.....

.....

..... **[2]**

(c) The switch is closed.
Calculate the new current flowing through the resistor.

current = ... A **[2]**

Section B (20 marks)
Answer any <u>two</u> questions in the spaces provided.

10 A 50 kg woman is doing push-ups and is in the position shown in Fig. 10.1.

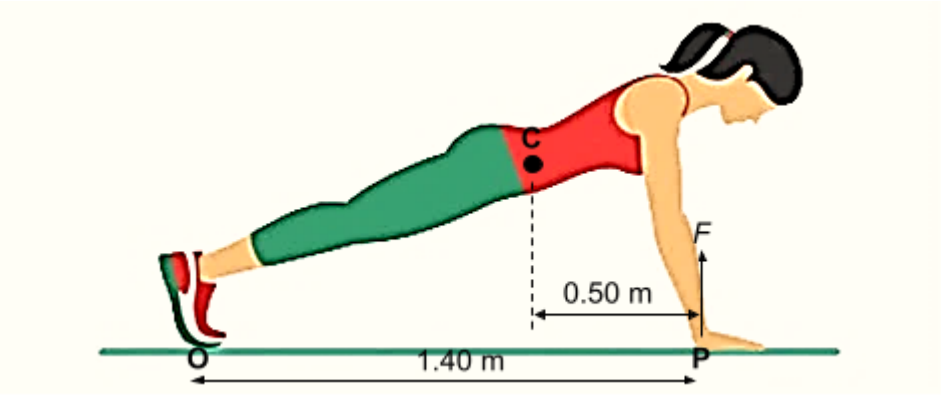


Fig. 10.1

C is the centre of gravity of the woman, **P** is the position of her hands on the ground, and **O** is the position of her feet. A combined vertical force ***F***, acts on her hand by the ground.

Gravitational field strength g = 10 N/kg.

(a) Define centre of gravity.

……

…… **[1]**

(b) Calculate the weight of the woman.

weight = …… **[1]**

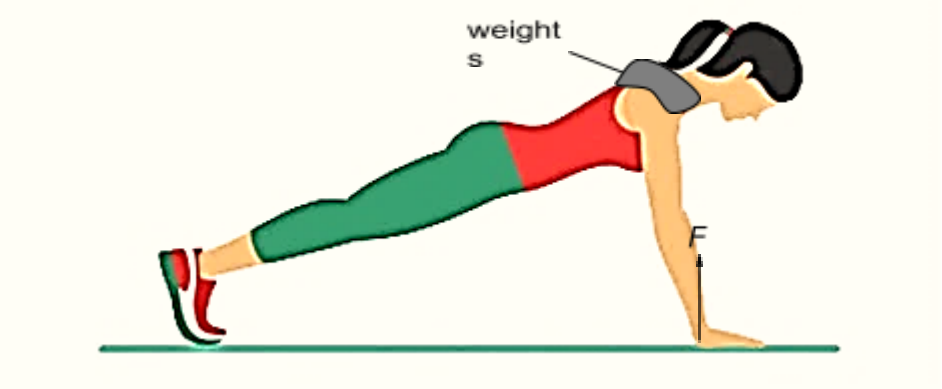
(c) Calculate the clockwise moment about the point **O**.

clockwise moment = …… **[2]**

(d) Calculate the combined vertical force ***F*** exerted on the woman's hands by the ground.

vertical force *F* = …… **[2]**

(e) The woman decides to make the exercise more challenging by strapping weights above her shoulders, as shown in Fig. 10.2.



O P

Fig. 10.2

(i) State how the clockwise moments about point **O** change, when the weights are strapped above the woman's shoulders. Explain your answer.

……

……

……

…… **[2]**

(ii) State how the combined vertical force ***F*** changes, when the weights are strapped above the woman's shoulders. Explain your answer.

……

……

……

…… **[2]**

11 **(a)** Fig. 11.1 shows a pressure-time graph of a sound wave.

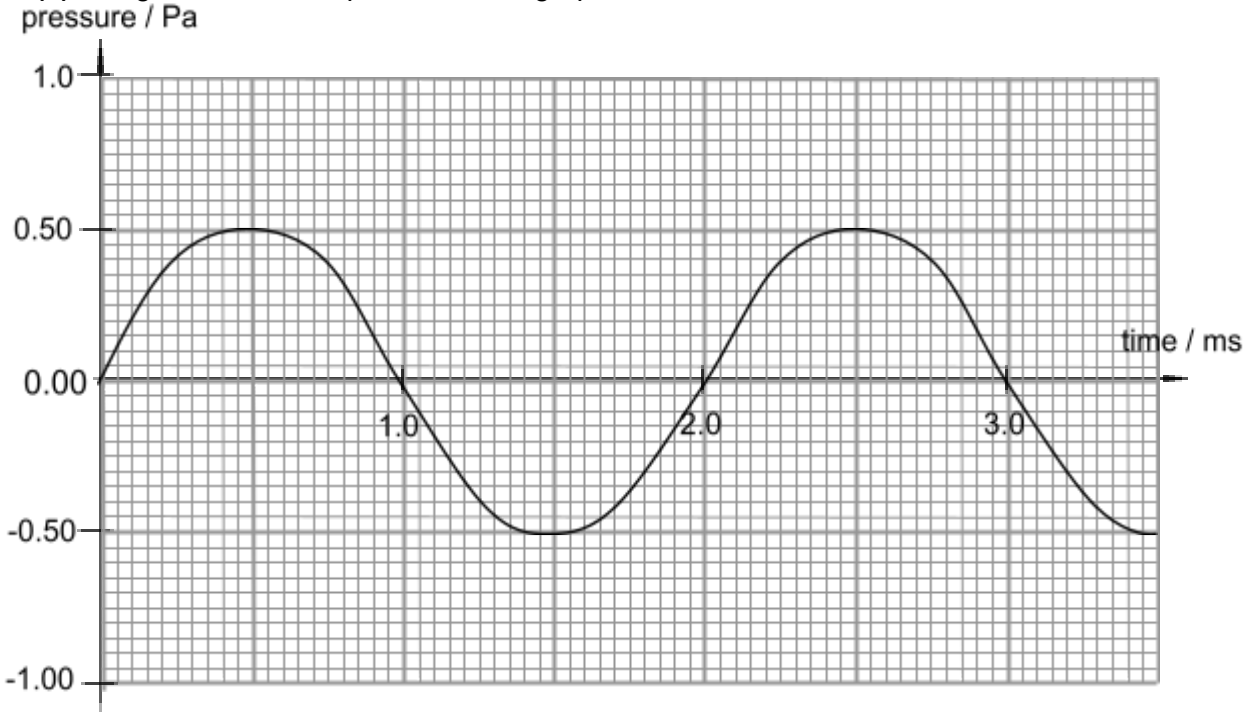


Fig. 11.1

(i) From the graph, state the period of the sound wave. Hence determine the frequency of the wave.

period of wave = …… **[1]**

frequency of wave = …… **[1]**

(ii) Draw on Fig.11.1 another wave that has the same frequency but twice as loud. **[2]**

(iii) Describe the air pressure at the region of compression and rarefaction of the sound wave.

……

……

…… **[1]**

(b) Fig. 11.2 shows a portable counterfeit currency detecting device

Fig. 11.2

(i) State the electromagnetic wave used by the device to detect counterfeit currency.

…… **[1]**

(ii) The electromagnetic wave given out by the device has a wavelength of 2.0×10^{-7} m and frequency of 1.48×10^{15} Hz.
Calculate the speed of the wave.

[2]

speed of wave = ……..……

(iii) State two property differences between the electromagnetic wave and sound wave

Difference 1:

……..……..……..……

……..……..……..……

……..……..……..……

……..……..……..……

Difference 2:

……..……..……..……

……..……..……..……

……..……..……..……

……..……..……..…… **[2]**

12 **(a)** Fig 12.1a shows an electric kettle with a rating of 240 V, 2000 W connected by a flexible cable to the three-pin plug. Fig 12.1b shows the maximum current which can flow safely through the wire of different diameters.

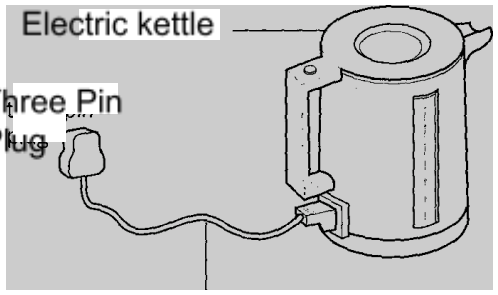


Fig. 12.1a

diameter of wire / mm	maximum safe current / A
0.50	3.0
0.75	6.0
1.00	10.0
1.25	13.0
1.50	15.0

Fig. 12.1b

(i) Explain what is meant by “a rating of 240 V, 2000 W.”

……..……..……..……

……..…….. **[1]**

(ii) Calculate the current flowing through the heating element under normal operating conditions.

current = **……** **[1]**

(iii) Hence, based on the information given in the Fig 12.1b, state the smallest diameter of wire that can be used safely as the flexible cable of the electric kettle. Explain your answer.

……

……

……

…… **[2]**

(iv) Based on Fig 12.1b, explain how over heating can be prevented by using a wire of a bigger diameter.

……

……

……

…… **[2]**

(b) Fig 12.2 shows the connection in the three-pin plug that is connected to the electric kettle from **(a)**. A fuse and a switch is connected to wire P.

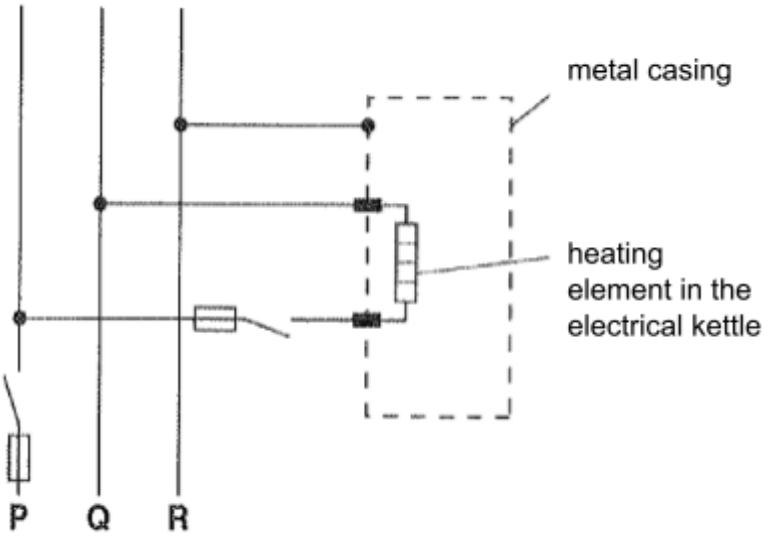


Fig 12.2

(i) Identify the wires P, Q and R

P: **……** wire

Q: **……** wire

R: **……** wire **[2]**

(ii) State the purpose of a fuse.

……

…… [1]

(iii) The electric kettle requires a three-pin plug connected to the mains supply, while some electrical appliances require only a two-pin plug.

State why this is possible.

……

…… [1]

End of Paper