# ORCHID PARK SECONDARY SCHOOL
## End-of-Year Examination 2022

CANDIDATE NAME

CLASS | INDEX NUMBER

**SCIENCE (PHYSICS)** **5076 /01**

Paper 1 **13 October 2022**

Secondary 3 Express **1 hour**

Setter: Ms Isa Tan **40 Marks**

Additional Materials: Multiple Choice Answer Sheet

**READ THESE INSTRUCTIONS FIRST**

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

There are forty 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 Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this question paper.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **9** printed pages.

1 Which of the following consists of only vector quantities?

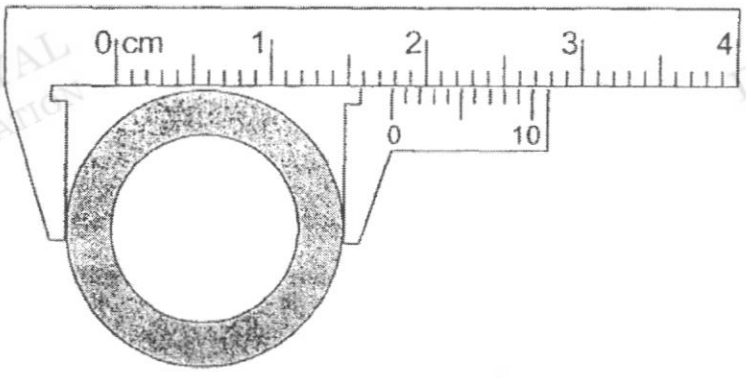
A friction, velocity, electromotive force

B mass, distance, time

C tension, speed, energy

D weight, displacement, electrostatic force

2 The diagram shows a pair of vernier calipers set to measure the external diameter of a metal pipe.




Given that the pipe has an internal diameter of 1.02 cm, what is the thickness of the wall of the metal pipe?

A 0.28 cm

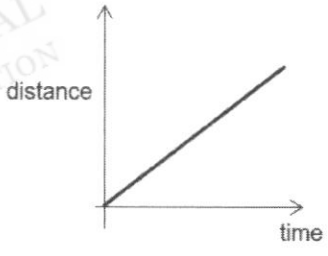
B 0.38 cm

C 0.56 cm

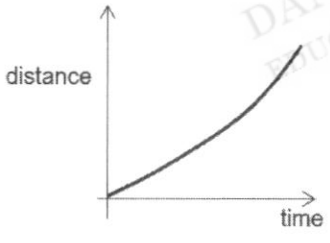
D 0.76 cm

3 Which of the following distance-time graph best represents that of a rock, which is dropped from a tall building? Assume that air resistance is negligible.

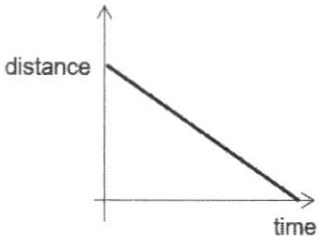
A



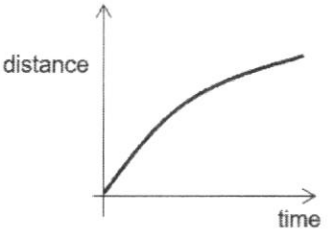

B



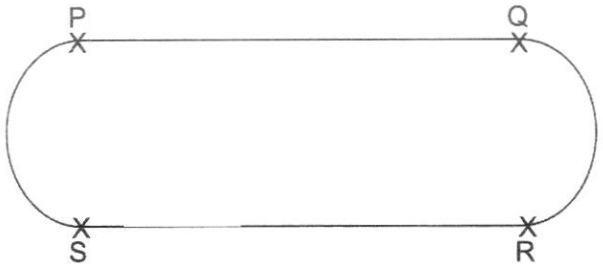

C




D



4 A cyclist cycles at constant speed around the track PQRS.




Where does the cyclist experience acceleration?

**A** all around the track

**B** at no point on the track

**C** along the straight tracks PQ and RS

**D** along the curved tracks PS and QR

5 The resultant force on a body is zero.

Which statement must be true?

**A** The body is slowing down to a stop.

**B** The body moves at constant speed.

**C** The kinetic energy of the body is constant.

**D** There is no force acting on the body.

6 When a book of mass 2 kg was pushed along the horizontal surface of the table with a constant force of 9 N, it experienced a frictional force of 5 N.

Which of the following describes the motion of the book?

**A** The book moves with a speed of 2.0 m/s.

**B** The book moves with a speed of 2.5 m/s.

**C** The book moves with an acceleration of 2.0 $m/s^2$.

**D** The book moves with an acceleration of 25.0 $m/s^2$.

7 The following table shows the result of an experiment in which a sample of solid material is placed in four different liquids.

| liquid | density of liquid (kg / $m^3$) | observation |
|---|---|---|
| water | 1 000 | floats |
| oil | 800 | floats |
| organic compound | 600 | sinks |

What is the density of the sample?

**A** exactly 600 kg / $m^3$

**B** exactly 800 kg / $m^3$

**C** between 600 kg / $m^3$ and 800 kg / $m^3$

**D** between 800 kg / $m^3$ and 1000 kg / $m^3$

8 Which of the following objects has the greatest inertia?

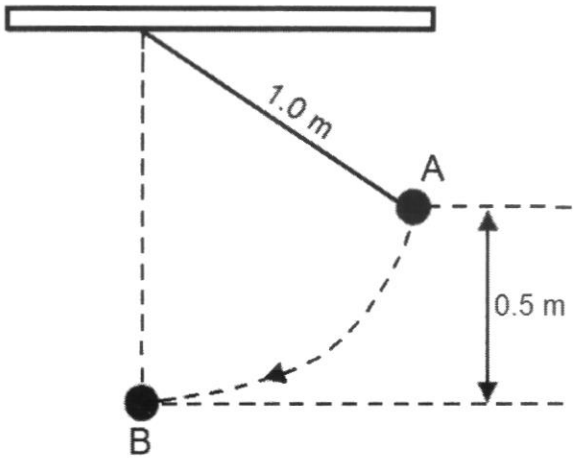
**A** a stationary car of mass 800 kg

**B** a 2.0 kg trolley traveling at 0.50 m/s

**C** a ball of mass 200 g traveling at 4.0 m/s

**D** a 50 kg athlete running the 100 m race in 10 s

9 A pendulum with length of 1.0 m is displaced to position A and released as shown. The gravitational field strength is 10 N/kg.

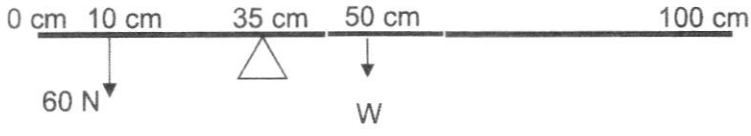



Ignoring air resistance, what is the speed of the pendulum bob as it passes its lowest point B?

**A** 1.5 m/s **B** 2.3 m/s

**C** 3.2 m/s **D** 4.5 m/s

**10** A uniform metre rule is being pivoted at the 35 cm mark. A 60 N weight is loaded at the 10 cm mark to keep the rule balanced.

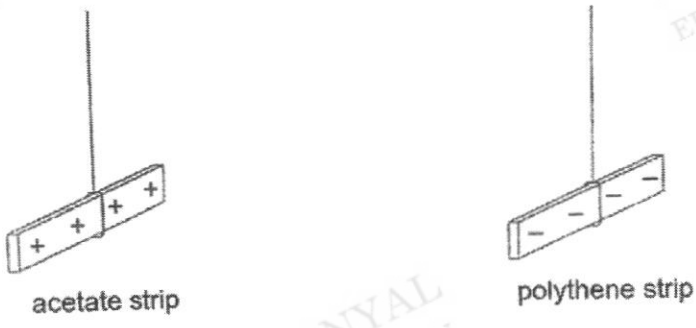



What is the weight of the rule, W?

**A** 15 N **B** 25 N

**C** 50 N **D** 100 N

**11** The diagram shows a positively-charged acetate strip and a negatively-charged polythene strip which are freely suspended.

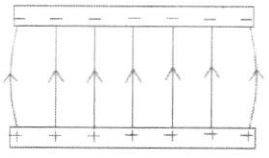


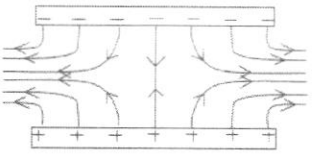

Two rods **X** and **Y** are brought near these two strips. Rod **X** attracts the acetate strip, but repels the polythene strip. Rod **Y** attracts both the acetate strip and the polythene strip.

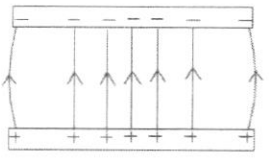
Which of the following correctly shows the charges on each rod?

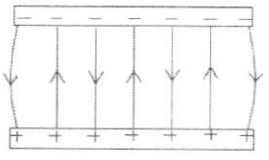
| | rod **X** | rod **Y** |
|---|---|---|
| **A** | negative | uncharged |
| **B** | uncharged | positive |
| **C** | positive | uncharged |
| **D** | uncharged | negative |

12 Which of the diagrams correctly shows the uniform electric field between two charged parallel metal plates?

A 

B 

C 

D 

13 What is the unit of the electromotive force (e.m.f.) of a battery?

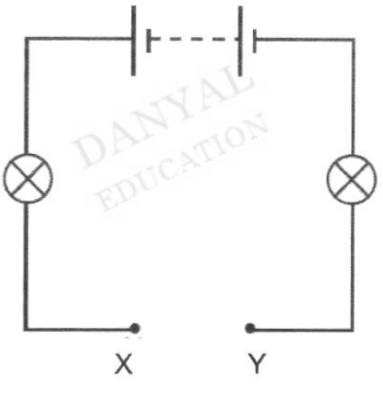
A coulomb

B joule

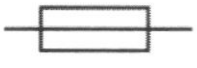
C newton

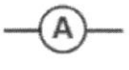
D volt

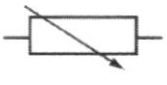
14 The diagram shows part of a circuit.

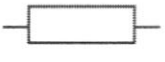



Which component can be connected between X and Y so that the brightness of the lamps may be varied?

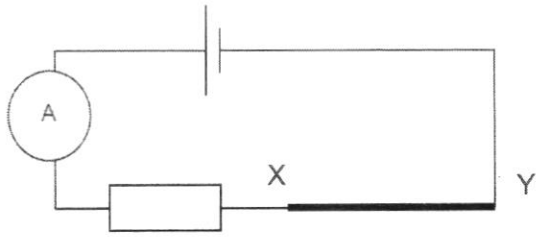
A 

B 


C 

D 

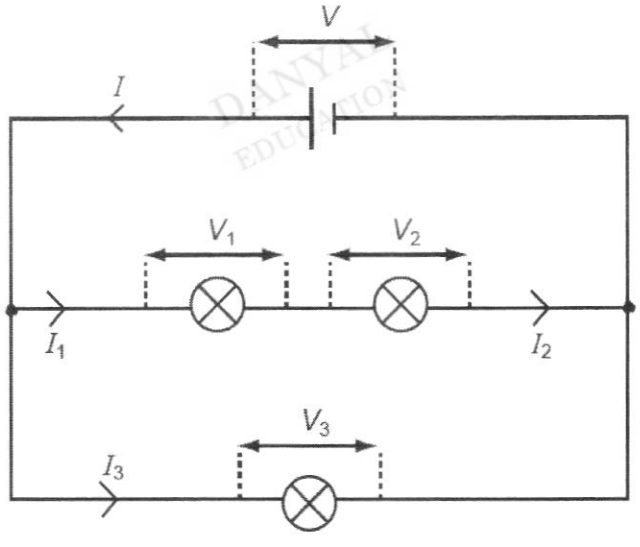
**15** The diagram shows a series circuit where the current is measured using an ammeter. Four wires of the same material are connected across XY one at a time and the current is recorded for each wire.




Which wire will result in the highest ammeter reading?

| | diameter | length |
|---|---|---|
| **A** | 0.1 cm | 2.0 cm |
| **B** | 0.1 cm | 10.0 cm |
| **C** | 1.0 cm | 2.0 cm |
| **D** | 1.0 cm | 10.0 cm |

**16** The circuit shows identical lamps connected to a cell.




Which pair of equations is correct for this circuit?

| | potential difference | current |
|---|---|---|
| **A** | $V = V_1 + V_2 + V_3$ | $I = I_1 + I_2 + I_3$ |
| **B** | $V = V_1 + V_2$ | $I = I_1 + I_2$ |
| **C** | $V = V_1 + V_2$ | $I = I_1 + I_3$ |
| **D** | $V = V_3$ | $I = I_3$ |

**[Turn over**

17 Diagram 1 shows a resistor connected to a battery, an ammeter and a voltmeter.

The ammeter reading is 0.5 A and the voltmeter reading is 3.0 V

A second identical resistor is now connected in parallel with the first resistor, as shown in diagram 2.

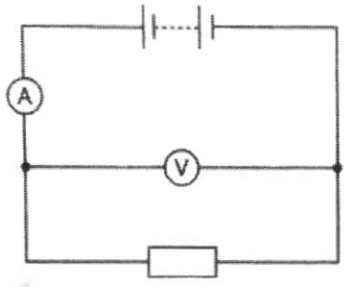



diagram 1

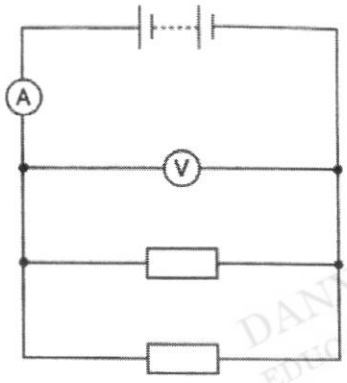



diagram 2

What are the ammeter and voltmeter readings in the circuit shown in diagram 2?

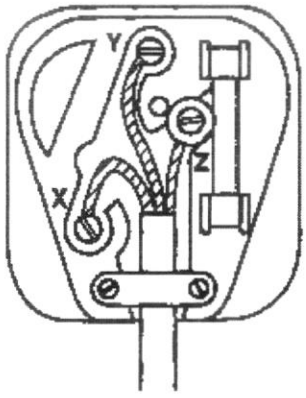
| | ammeter reading / A | voltmeter reading / V |
|---|---|---|
| **A** | 0.5 | 3.0 |
| **B** | 0.5 | 6.0 |
| **C** | 1.0 | 1.5 |
| **D** | 1.0 | 3.0 |

18 An electrical appliance is rated at 240 V, 1.38 kW.

What is the current that flows through the live, neutral and earth wires during normal operation?

| | live | neutral | earth |
|---|---|---|---|
| **A** | 5.75 A | 0 A | 0 A |
| **B** | 5.75 A | 0 A | 5.75 A |
| **C** | 5.75 A | 5.75 A | 0 A |
| **D** | 5.75 A | 5.75 A | 5.75 A |

**19** The diagram shows an electrical plug with the cover removed.




What is the correct colour for each wire?

| | X | Y | Z |
|---|---|---|---|
| **A** | blue | green and yellow | brown |
| **B** | green and yellow | blue | brown |
| **C** | brown | green and yellow | blue |
| **D** | brown | blue | green and yellow |

**20** An electrical cable contains three wires: live, neutral and earth. The cable is correctly wired to a plug which contains a 3 A fuse. The insulation becomes damaged and bare wires show.

Five possible events can occur.

- The live wire touches the neutral wire.
- The live wire touches the earth wire.
- A person touches the earth wire.
- A person touches the neutral wire.
- A person touches the live wire.

How many of these five events cause the fuse in the plug to blow?

**A** 1 **B** 2

**C** 3 **D** 4

**END OF PAPER 1**

# ORCHID PARK SECONDARY SCHOOL
## End-of-Year Examination 2022

CANDIDATE NAME

CLASS | | | | INDEX NUMBER | | |

## SCIENCE (PHYSICS) 5076 /02

Paper 2 — 10 October 2022

Secondary 3 Express — 1 hour 15 minutes

Setter: Ms Isa Tan — 65 Marks

Additional Materials: NIL

**READ THESE INSTRUCTIONS FIRST**

Write your name, register number and class on all the work you hand in. Write in dark blue or black ink on both sides of the paper. You may use an HB pencil for any diagrams, graphs, tables or rough working. Do not use staples, paper clips, 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.

Candidates are reminded that **all** quantitative answers should include appropriate units. The use of an approved scientific calculator is expected, where appropriate. Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

The number of marks is given in brackets [ ] at the end of each question or part question section.

| For Examiner's Use | |
|---|---|
| Section A | |
| Section B | |
| Total | |

This document consists of **16** printed pages.

## Section A (45 marks)

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

1 Complete the following sentences.

**(a)** 5 μm is equal to ..... m.

**(b)** 1 kg is equal to ..... mg. [2]

2 **(a)** Speed is a scalar quantity. Velocity is a vector quantity.

State the difference between a scalar and vector quantity.

.....

..... [1]

**(b)** Fig. 2.1 shows two forces of magnitudes 3 N and 4 N acting on object P. The forces are at right angles to each other. The diagram is not to scale.

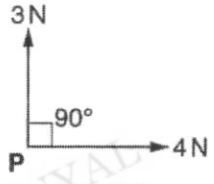
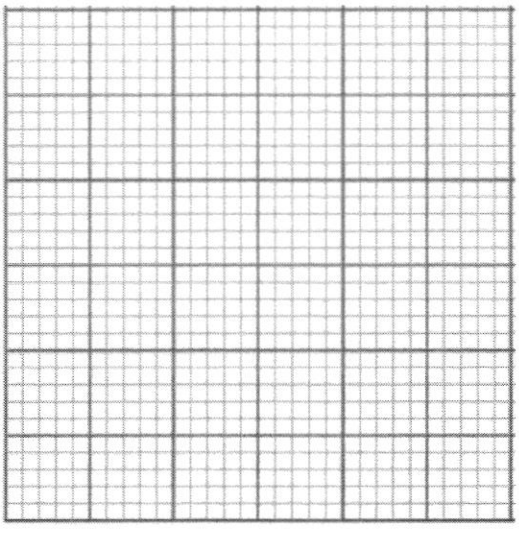



**Fig. 2.1**

On the grid below, draw a vector diagram to determine the resultant force on object P. State the magnitude of the resultant force and show its direction on your vector diagram.



magnitude = ..... N [4]

3 Fig. 3.1 shows two blocks, X and Y, are resting on a table. The dimensions of the blocks are shown. Each block has a mass of 50 g.

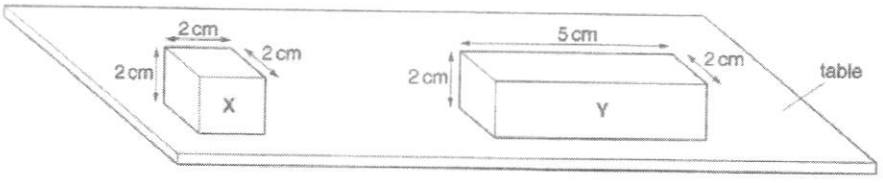



**Fig. 3.1**

**(a)** Name the apparatus used to measure the mass of the block.

..... [1]

**(b)** Explain which block has a larger density.

.....

.....

..... [2]

**(c)** Explain which block exerts a larger pressure on the table.

.....

.....

..... [2]

**(d)** Calculate the pressure that Y exerts on the table.

pressure = ..... N / $cm^2$ [3]

**(e)** State and explain how the values of each of the following quantities would change if block X is brought to the Moon, where the gravitational field strength is reduced.

**(i)** density of block X

.....

..... [1]

**(ii)** pressure that block X exerts on the table

.....

.....

..... [2]

4 Fig. 4.1 shows a force F of 280 N being applied to a box to accelerate it up an inclined plane with rough surface.

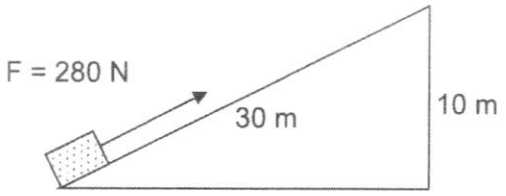



**Fig. 4.1**

**(a)** State and explain the changes in kinetic energy and gravitational potential energy as the box moves up the inclined plane.

.....

.....

.....

..... [2]

**(b)** On Fig 4.1, draw and label the frictional force and the normal reaction force on the box. [2]

**(c)** It takes 8 s for the box to move up the full length of the inclined plane.

Calculate

**(i)** the work done by force F to move the box up the full length of the inclined plane.

work done = .....J [2]

**(ii)** the power of force F in moving the box.

power = .....W [2]

5 One method of painting a metal panel uses electrostatic charges. A spray paint produces paint droplets, all of which are given a positive charge. The metal panel is given a negative charge, as shown in Fig. 5.1.

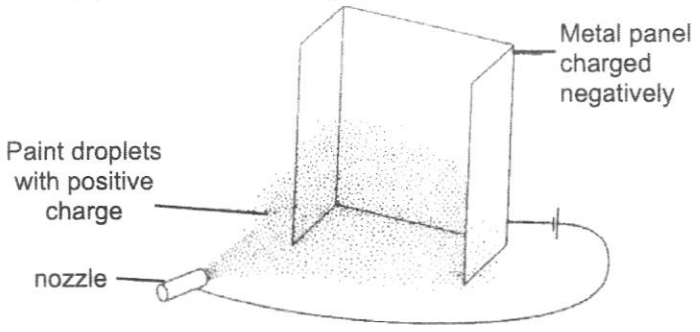



**Fig. 5.1**

**(a)** Explain why the droplets spread out as they leave the nozzle in Fig. 5.1

.....

.....

..... [2]

**(b)** Explain why it is important that the metal panel has a negative charge.

.....

.....

..... [2]

6 An electric fence which is used to keep animals in one part of a field is shown in Fig. 6.1.

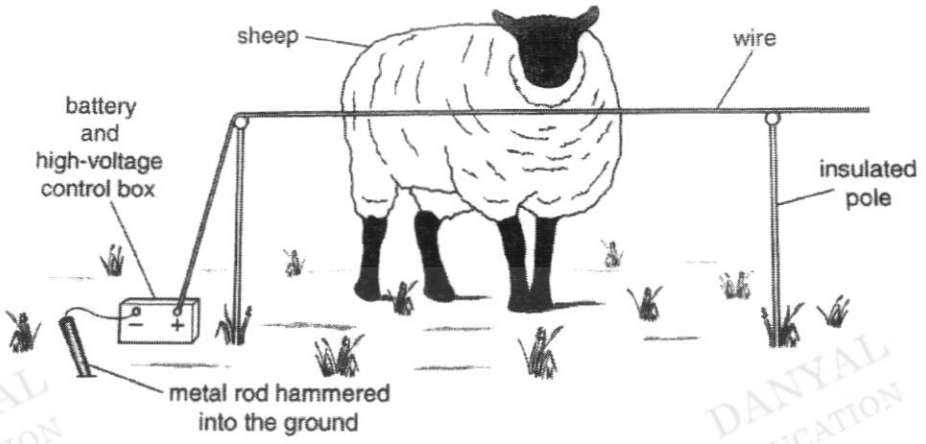



**Fig. 6.1**

One side of the high voltage control box is connected to a wire. The other side of the control box is connected to a metal rod that is hammered into the ground.

The control box gives out short high-voltage pulses that each last for 0.1 s.

When an animal touches the wire, a current of 12 mA passes through its body into the ground. This current is not enough to harm the animal but gives it an electric shock.

**(a)** Calculate the charge that passes through an animal when it receives a current of 12 mA for 0.1 seconds.

charge = .....C [2]

**(b)** The potential difference between the wire and the ground is 5000 V.

Calculate the energy contained in the high voltage pulse.

energy = .....J [2]

7 Fig. 7.1 shows four resistors connected to a battery with an electromotive force of 12 V in a circuit.

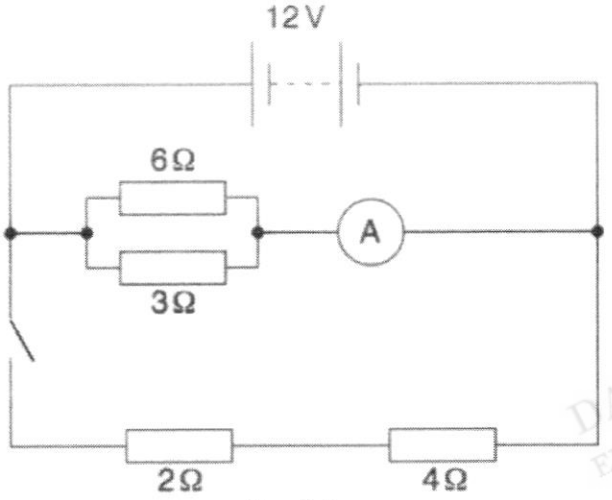



**Fig. 7.1**

**(a)** State what is meant by "*electromotive force of 12 V*".

.....

.....

..... [1]

**(b)** The switch is open.

**(i)** Calculate the effective resistance of the 3 Ω and 6 Ω resistors in parallel.

resistance = ..... Ω [2]

**(ii)** Calculate the reading on the ammeter.

ammeter reading = ..... A [2]

**(c)** The switch is now closed.

**(i)** Calculate the current through the 2 Ω resistor.

current = .....A [2]

**(ii)** Calculate the current through battery.

current = .....A [1]

**(iii)** Calculate potential difference across 4Ω resistor.

potential difference = .....V [1]

**(iv)** When the switch is closed, explain how the ammeter reading will change as compared to the answer in **(b)(ii)**.

.....

.....

..... [2]

## Section B (20 marks)

Answer any **two** questions from this section in the spaces provided.

**8** The graph in Fig. 8.1 shows how the speed of a ball changes as it falls to the Earth and to the Moon respectively. The difference in the shapes of the two graphs is due to air resistance on the Earth.

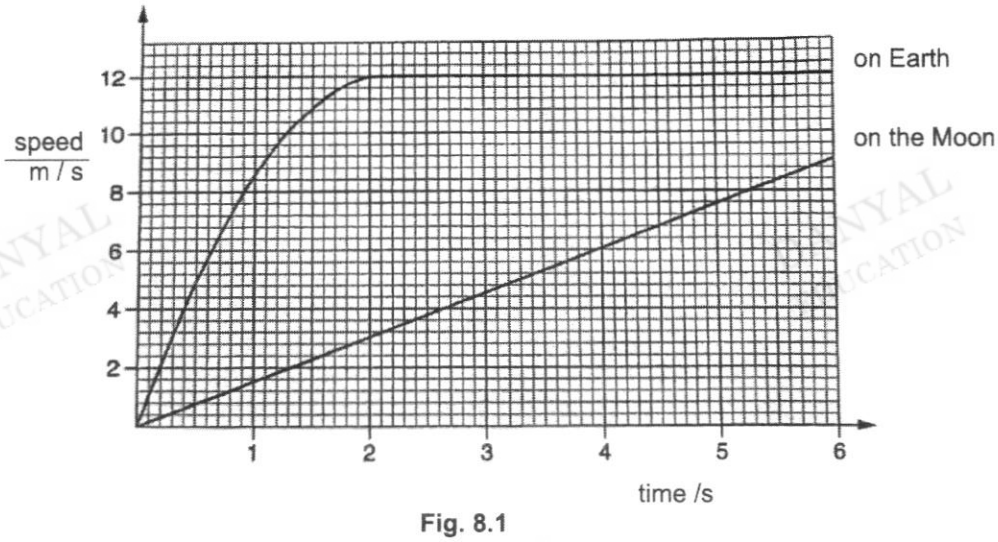



**Fig. 8.1**

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

acceleration = ..... [2]

**(b)** Describe the motion of the ball as it falls to Earth.

.....

.....

..... [2]

**(c)** Calculate the distance travelled by the ball falling to the Moon during the first 4 seconds.

distance = ..... m [2]

**(d)** Compare the size of the weight and air resistance acting on ball falling on Earth

**(i)** from t = 0 s to t = 2 s,

.....

..... [1]

**(ii)** from t = 2 s to t = 6 s.

.....

..... [1]

**(e)** Describe the energy changes of the ball as it is falling to Earth

**(i)** from t = 0 s to t = 2 s,

.....

..... [1]

**(ii)** from t = 2 s to t = 6 s.

.....

..... [1]

9 **(a)** Fig. 9.1 shows a wooden shelf made by securing a uniform wooden plank of weight 50 N and length 80 cm into the wall with the help of a rotatable hinge. A rope of length 1.0 m is used to hold the plank horizontal and prevent it from falling down. The tension T due to the rope is labelled in Fig. 9.1.

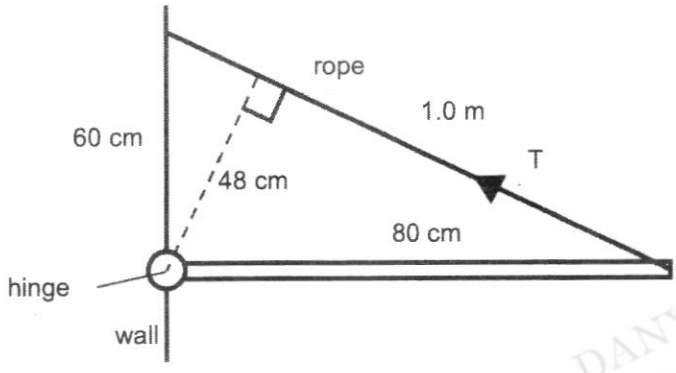



**Fig. 9.1**

**(i)** With the help of arrow, draw and label the weight of the wooden plank in Fig. 9.1. [1]

**(ii)** Calculate the moment about the hinge due to the weight of the wooden plank.

moment = ..... [2]

**(iii)** Hence, calculate the magnitude of tension T.

T = ..... [2]

**(b)** Fig 9.2 shows a uniform block of wood resting on a table. The block is then pushed so that it begins to tilt about the edge at Q.

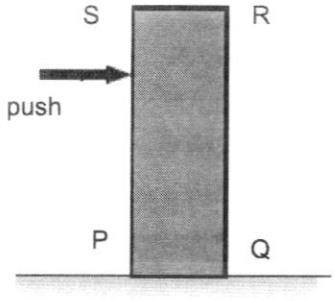
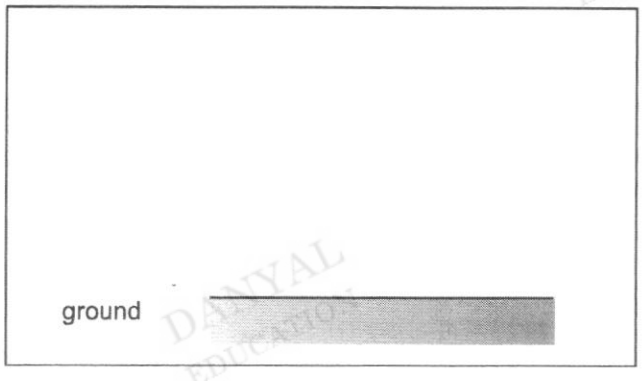



**Fig. 9.2**

Draw a diagram in the box below to show how far the block can be tilted before it topples. Indicate clearly the centre of gravity of the box.




[1]

**(c)** Fig. 9.3 shows two wooden blocks placed on a hinged board with a rough surface.

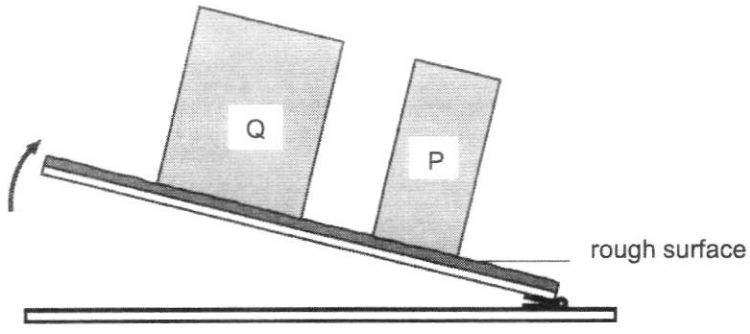



**Fig. 9.3**

**(i)** State and explain which block is more stable.

.....

..... [2]

**(ii)** The board is tilted slowly in the direction shown in Fig. 9.3. Explain why the block in **(c)(i)** eventually topples.

.....

.....

..... [2]

10 **(a)** A main cable has three wires in it: the *live*, the *neutral* and the *earth*.

The cable is to be connected to an electrical heater which is enclosed in a metal case.

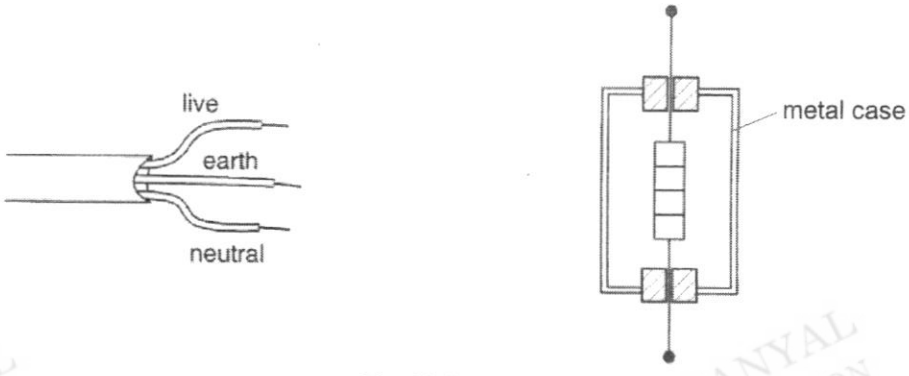



**Fig 10.1**

On Fig. 10.1, complete the circuit diagram to show

**(i)** how the live, earth and neutral wire is connected to the heater; [1]

**(ii)** where the switch and the fuse are found. [2]

**(b)** Fully describe the function of the earth wire.

.....

.....

.....

..... [3]

**(c)** The power rating of the electrical heater is 1000 W, 230 V.

**(i)** Suggest a suitable fuse rating to use for the electrical heater. Support your suggestion with a calculation.

fuse rating = ..... [2]

(i) The electrical heater is switched on for 2 minutes. The cost of 1.0 kWh is 20 cents. Calculate the cost of switching on the electrical heater for 2 minutes.

cost = ..... [2]

**END OF PAPER 2**

Orchid Park Secondary School
**Sec 3E EOY Examination 2022**
**Science (Physics)**
Answer Scheme

Paper 1

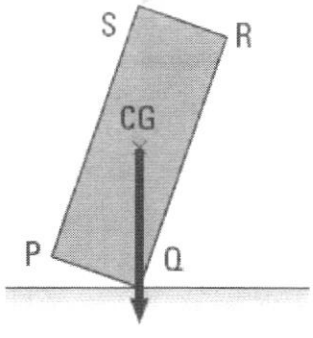
| No | Answer | No | Answer |
|---|---|---|---|
| 1 | D | 11 | A |
| 2 | B | 12 | A |
| 3 | B | 13 | D |
| 4 | C | 14 | C |
| 5 | C | 15 | C |
| 6 | C | 16 | C |
| 7 | C | 17 | D |
| 8 | A | 18 | C |
| 9 | C | 19 | A |
| 10 | D | 20 | B |

**Paper 2 (Section A)**

| Ques | Answer | Marks |
|---|---|---|
| 1a | 0.000005 m | B1 |
| 1b | 1 000 000 mg | B1 |
| | | |
| 2a | Scalar - magnitude only<br>Vector - magnitude and direction | B1 |
| 2b | parallelogram or tip tail method (diagram)<br>scale<br>magnitude = 5N<br>correct direction for resulta force | M1<br>M1<br>A1<br>A1 |
| | | |
| 3a | Electronic balance/beant balance | B1 |
| 3b | X has a smallervolume Since density = mass / volume.<br>X has the larger density | B1<br>B1 |
| 3c | X has a smallercontact area with ground. Since pressure = force/area.<br>X exerts a larger pressure on the ground. | B1<br>B1 |
| 3d | W= mg<br>= 0.050 x 10<br>= 0.50 N<br><br>P= F/A<br>= 0.50/ (2x5)<br>= 0.050 N / $cm^2$ | C1<br><br><br><br><br>C1<br>A1 |
| 3ei | Density does not change.<br>both the mass and volume of the liquid does not change. | B1 |

| | | |
|---|---|---|
| **3eii** | Pressure will be reduced.<br>According to P = F/A, weight W (= F) of the liquid is smaller on Moon with base area remains constant. | B1<br>B1 |
| | | |
| **4a** | Speed/ velocity of block is increasing, thus kinetic energy is increasing.<br><br>Height of block is increasing, thus gravitational potential energy is increasing. | B1<br><br>B1 |
| **4b** | Normal reaction force<br>Friction | B1<br>B1 |
| **4ci** | W = F x d<br>=280 N x 30 m<br>= 8400 J | C1<br><br>A1 |
| **4cii** | P = W / t<br>P = 8400 J / 8 s<br>= 1050 W | C1<br><br>A1 |
| | | |
| **5a** | The positively charged paint droplets repel from each other as like charges repel | B1<br>B1 |
| **5b** | To attract the positively charged paint droplets as unlike charges attract | B1<br>B1 |
| | | |
| **6a** | Q = I x t<br>=0.012 A x 0.1<br>= 0.0012 C | C1<br><br>A1 |
| **6b** | E = V x Q<br>= 5000 x 0.0012<br>= 6J | C1<br><br>A1 |
| | | |
| **7a** | Work done to drive a coulomb charge around a complete circuit is 12 J. | B1 |
| **7b** | R = ( 3 x 6) / (3+6)<br>= 2 Ω | C1<br>A1 |
| **7bii** | I = V / R<br>= 12 / 2<br>= 6 A | C1<br>A1 |
| **7ci** | I = V/R<br>= 12 / 6<br>= 2 A | C1<br>A1 |
| **7cii** | I = 6+2 = 8A | A1 |
| **7ciii** | V= IR = 2x4= 8V | A1 |
| **7civ** | Current is the same<br>because the potential difference and resistance across the parallel branch remains the same . | B1<br>B1 |
| | | |

**Paper 2 (Section B)**

| | | |
|---|---|---|
| **8a** | acceleration<br>$= \frac{v-u}{t}$<br>$= \frac{6-0}{4}$<br>$=1.5\ m/s^2$ | C1<br><br><br><br>A1 |
| **8b** | For the first 2s, ball undergoes decreasing acceleration<br>From t= 2s to 6s, ball moves at constant speed. | B1<br>B1 |
| **8c** | Distance<br>= area under graph<br>= ½ x 6 x 4<br>= 12 m | <br>B1<br><br>A1 |
| **8di** | Weight is greater than the air resistance | B1 |
| | Weight is equal in size to the air reistance | B1 |
| **8ei** | Gravitational potential energy converts to kinetic and thermal energy. | B1 |
| **8eii** | Gravitational potential energy converts to thermal energy. | B1 |
| | | |
| **9ai** | Centre of wooden plank | B1 |
| **9aii** | Moments = F x d<br>= 50 x 0.40<br>=20 Nm | B1<br><br><br>A1 |
| **9aiii** | Anticlockwise moments = clockwise moments<br>Tx 0.48 = 20<br>T=41.7N | C1<br><br>A1 |
| **9b** |  <br>Cg is directly above Q. [B1] | B1 |
| **9ci** | Block Q<br>Q has a larger base | B1<br>B1 |
| **9cii** | The line of action of the weight lies outside the base area, resulting in a clockwise moment about the right edge. causing the block to topple. | B1<br>B1 |
| | | |
| **10ai** | Live + Neutral connected to heater<br>Earth connected to metal case | B1 |
| **10aii** | Fuse and switch connected to live wire | B2 |

| | | |
|---|---|---|
| **10b** | in the event of a fault where the live wire touches the metal casing,<br>The earth wire provides a low resistance path to the earth<br>The high current through the fuse causes it to blow.<br>This cuts off the electrical supply to the appliance. | B1<br><br>B1<br>B1 |
| **10ci** | I = P/V<br>=1000 ÷ 230<br>= 4.35 A<br>A suitable fuse rating will be 5 A. | <br><br>M1<br>A1 |
| **10cii** | cost = 1 kW x (2 ÷ 60) h x 20 cents<br>= 0.67 cents | C1<br>A1 |