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YUYING SECONDARY SCHOOL
PRELIMINARY EXAMINATION
 Secondary 4 Exp/ 5 N(A)/ 4 N(A) 'O'

NAME

CLASS

REG. NO

SCIENCE (PHYSICS)**5076, 5077/01**

Paper 1 Multiple Choice

30 August 2022

30 mins

Setter: Mr Jameson Kang

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

There are **twenty** questions in this section. 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.

Read the instructions on the Answer Sheet very carefully.

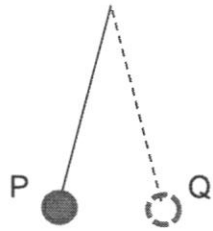
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
 Any rough working should be done in this booklet.
 The use of an approved calculator is expected, where appropriate.

For Examiner's Use	
Total	20

The document consists of **10** printed pages, including the cover page.

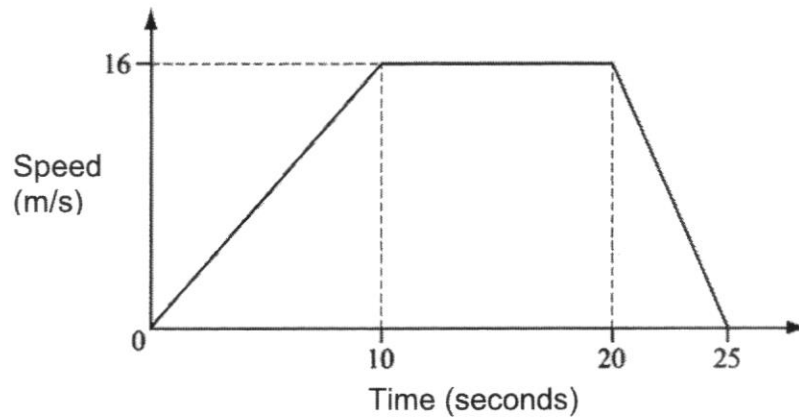
2

1. The time taken for a pendulum to swing from P to Q is shown in the stopwatch.



What is the period of the pendulum?

- A 5.07 s
 - B 10.14 s
 - C 5 min 07 s
 - D 10 min 14 s
2. A speed-time graph of an object moving in a straight line is shown below.



What is the average speed of the object over 25 seconds?

- A 11.2 m/s
- B 13.5 m/s
- C 16.0 m/s
- D 22.4 m/s

3. A 4 kg object is moving with constant speed along a flat ground when the applied force is 6 N.

Which of the following describes its motion correctly when the applied force increased to 10 N?

- A The object continues to move with the same constant speed.
- B The object moves with a higher constant speed.
- C The object moves with a constant acceleration of 1 m/s^2 .
- D The object moves with a constant acceleration of 2.5 m/s^2 .

4. The diagram shows a single brick and a pile of 2 bricks. All the bricks are identical.



Compared to the single brick, the pile of bricks has

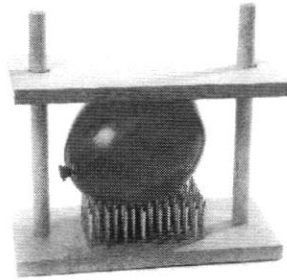
- A the same density but two times the mass and volume.
 - B the same volume but two times the mass and density.
 - C the same mass but two times the volume and density.
 - D two times the mass, volume and density.
5. A tumbler toy is one that can be toppled over and then straighten up by itself.



What are the key design features for such a toy?

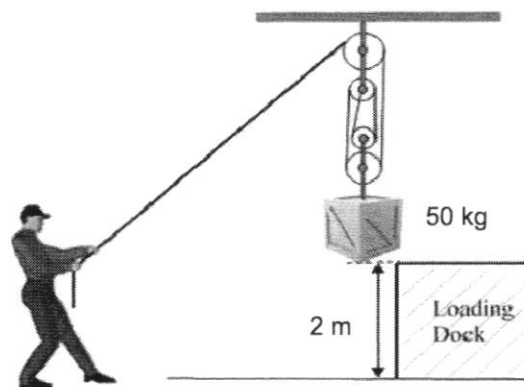
- A heavy top to produce a low centre of gravity
- B heavy bottom to produce a low centre of gravity
- C light bottom to produce a high centre of gravity
- D light top to produce a high centre of gravity

6. A balloon can be burst easily by a single nail but it does not burst when pressed against a bed of nails.



Which of the following best explains why?

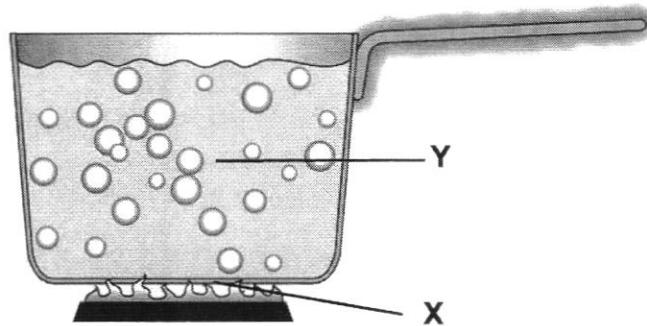
- A The pressure is spread over a larger contact area which reduces the applied force.
 - B The pressure is spread over a smaller contact area which increases the applied force.
 - C The applied force is spread over a smaller contact area which increases the pressure.
 - D The applied force is spread over a larger contact area which reduces the pressure.
7. A worker raises a 50 kg load up by 2 m above ground in 5 seconds. The gravitational field strength, g is 10 N/kg.



What is the useful power during the lifting operation?

- A 20 W
- B 50 W
- C 200 W
- D 500 W

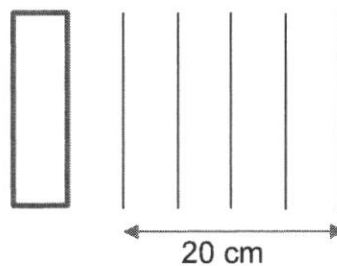
8. A solid is heated.
Which statement about the molecules in the solid is **not** correct?
- A They gain energy.
 - B They expand.
 - C They vibrate faster.
 - D They occupy more space.
9. A pot is used to boil water as shown in the diagram.



Which of the following is the main method of heat transfer in the region marked by X and Y?

	X	Y
A	conduction	convection
B	conduction	radiation
C	radiation	convection
D	convection	conduction

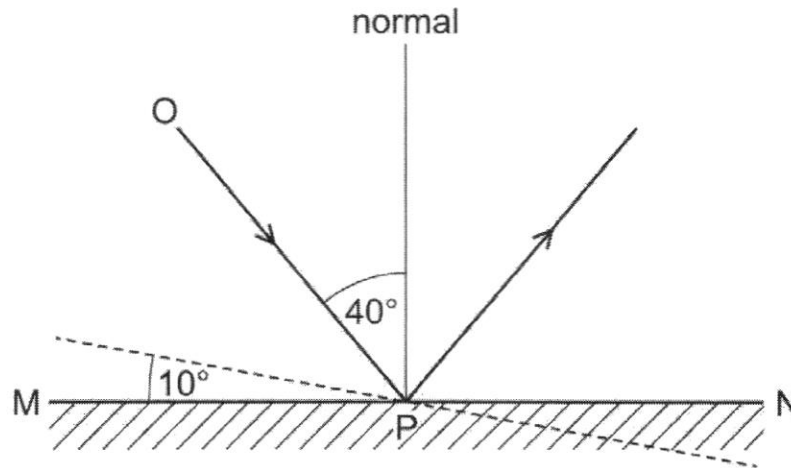
10. Which of the following comparison between boiling and evaporation is **not** correct?
- A Boiling occurs throughout the entire liquid but evaporation only occurs at the surface.
 - B Boiling is a quick process but evaporation is a slow process.
 - C Boiling absorbs heat from surrounding but evaporation requires a constant heating source
 - D Bubbles are seen during boiling but not during evaporation.
11. A wave generator produces 10 oscillations in one second to form the following wave pattern. The distance between two crests shown is 20 cm.



What is the speed of the wave?

- A 0.2 m/s
 - B 0.5 m/s
 - C 1.0 m/s
 - D 2.0 m/s
12. Medium X has a refractive index of 1.25. What is the speed of light in medium X?
- A 3.75×10^8 m/s
 - B 3.00×10^8 m/s
 - C 2.40×10^8 m/s
 - D 0.75×10^8 m/s

13. The angle of incidence of ray OP on the plane mirror MN is 40° .



The mirror is rotated through 10° , as shown by the dashed line. The direction of the incident ray OP does not change.

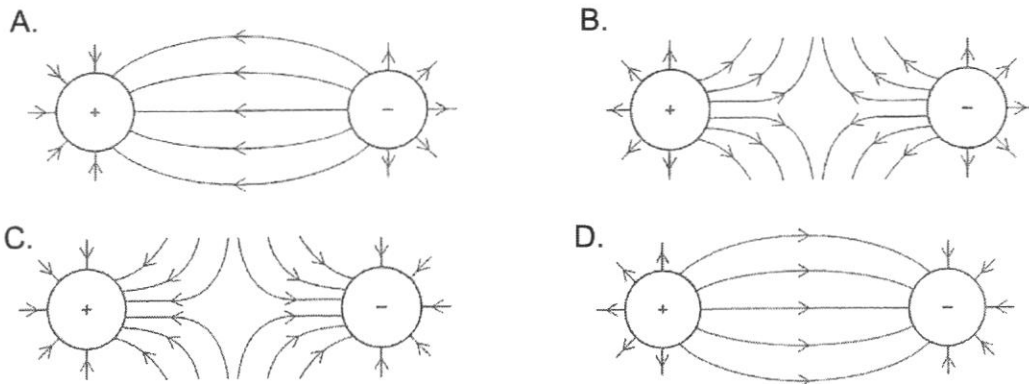
What is the new angle of incidence?

- A 30°
 - B 40°
 - C 50°
 - D 60°
14. Which of the following shows part of the electromagnetic spectrum, arranged in the order of decreasing frequency?
- A ultraviolet rays, gamma rays, X-ray
 - B gamma rays, microwave, infra-red radiation
 - C radio wave, ultraviolet rays, microwave
 - D X-ray, microwave, radio wave

15. A sound was produced by a flute. Another louder sound of a lower pitch was produced by a tuba. Which of the following is correct when we compare the sound from the flute to the sound from the tuba?

	amplitude of sound from flute	frequency of sound from flute
A	higher	higher
B	lower	higher
C	higher	lower
D	lower	lower

16. Which of the following diagrams show the electric field pattern between two charged spheres?

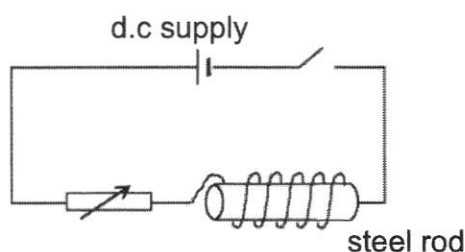


17. A wire of length 1.0 m and a cross-sectional area of $0.5 \times 10^{-6} \text{ m}^2$ has a resistance of $2.0 \, \Omega$. Another wire of the same material has a length of 3.0 m and a cross-sectional area of $1.5 \times 10^{-6} \text{ m}^2$.

What is the resistance of the longer wire?

- A $2.0 \, \Omega$
- B $3.0 \, \Omega$
- C $6.0 \, \Omega$
- D $9.0 \, \Omega$

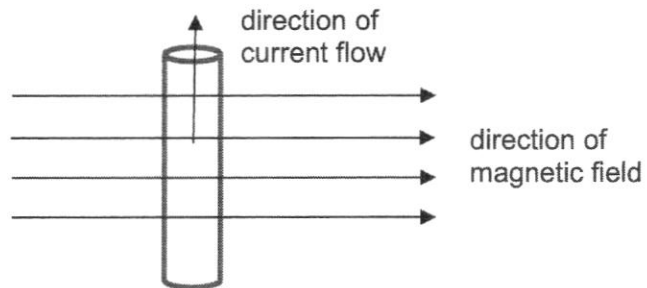
18. An electric heater takes a current of 5 A from a 240 V supply when operating normally. How long would it take for the heater to convert 4.8 MJ of electrical energy?
- A 400 s
B 1000 s
C 4000 s
D 100,000 s
19. The diagram shows a circuit used to magnetise a steel rod.



Which statement describes how the steel rod can be **demagnetised**?

- A Reverse the d.c supply and gradually increase the current in the circuit.
B Reverse the d.c supply and gradually decrease the current in the circuit.
C Use an a.c supply and gradually increase the current in the circuit.
D Use an a.c supply and gradually decrease the current in the circuit.

20. A current-carrying conductor is in a magnetic field. The directions of current flow and magnetic field are shown.



What is the direction of the force on the wire?

- A out of the paper
- B into the paper
- C to the right of the paper
- D to the left of the paper

END OF PAPER



YUYING SECONDARY SCHOOL
PRELIMINARY EXAMINATION
 Secondary 4 Exp/ 5 N(A)/ 4 N(A) 'O'

NAME

CLASS

REG. NO

SCIENCE (PHYSICS)**5076, 5077/02****29 August 2022**

1 hour 15 mins

Setter: Mr Jameson Kang

Candidates answer on the Question Paper.
 Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on this question booklet and the separate Answer Sheet.
 Write in dark blue or black pen on both sides of the paper.
 You may use a 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 in the spaces provided.

Section B

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

The number of marks is given in brackets [] at the end of each question or part question.
 The use of an approved calculator is expected, where appropriate.

For Examiner's Use	
Total	65

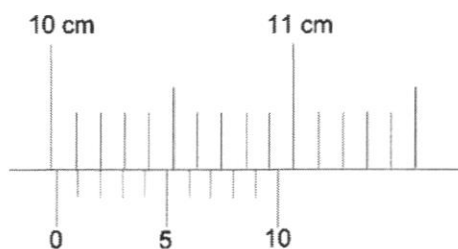
The document consists of **19** printed pages, including the cover page.

Section A

Answer **all** questions in this section.
The total mark for this section is 45.

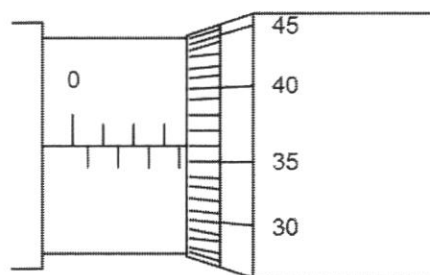
1. The following diagrams show the scales of some measuring instrument. Write down the readings for each instrument.

- a) Vernier Caliper



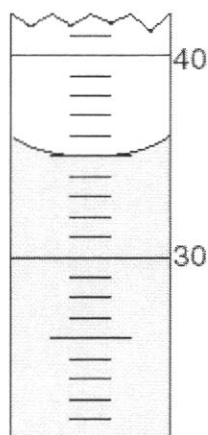
reading: cm [1]

- b) Micrometer Screw Gauge



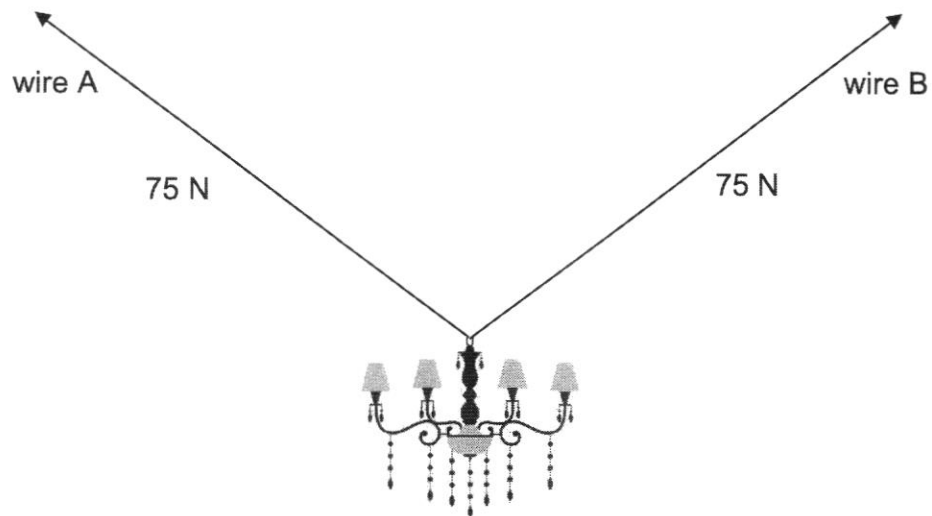
reading: mm [1]

- c) Measuring cylinder



reading: cm³ [1]

2. A chandelier is supported by two wires A and B as shown in the following diagram.



The tension in each wire is 75 N.

The above diagram is drawn to scale.

Complete the above diagram to determine the weight of the chandelier.
State the scale of the diagram.

scale = [1]

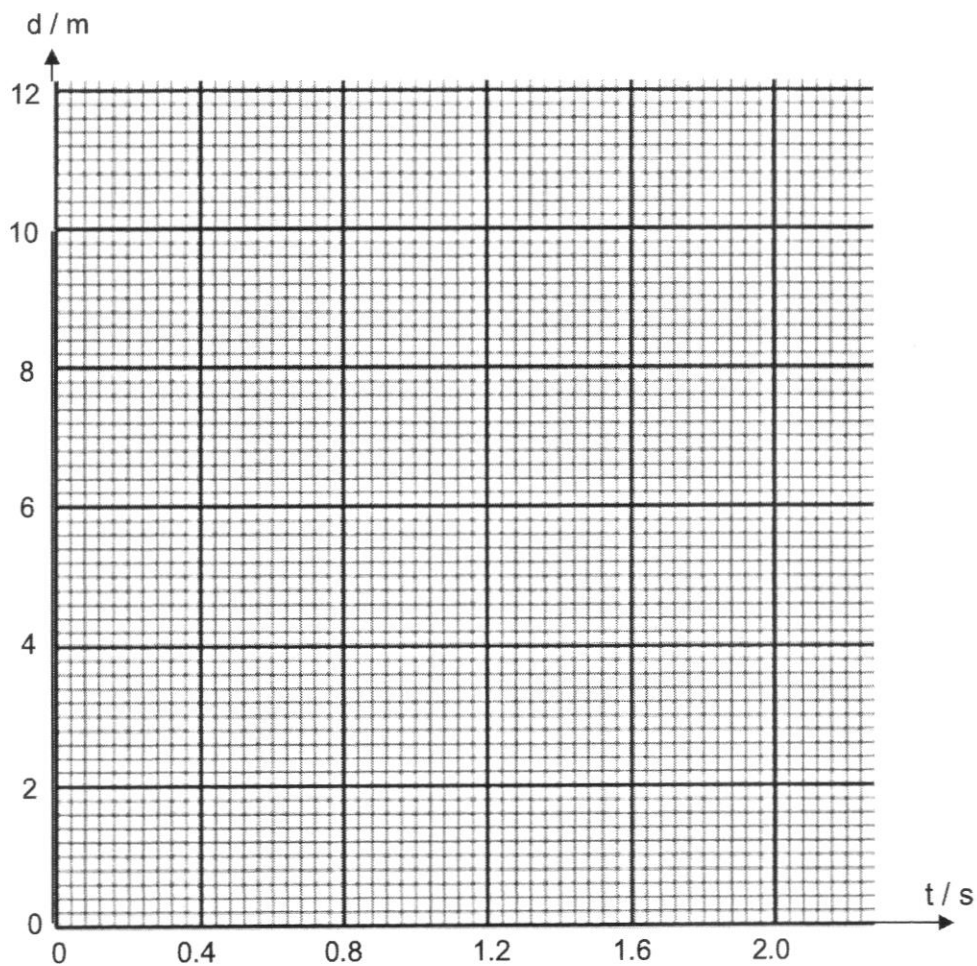
weight of chandelier = N [2]

3. A badminton shuttlecock is a light, cone-shaped object with a large surface area. In an experiment using electronic apparatus, a shuttlecock is released from rest and the distance d fallen is measured at different time t .

The results obtained are shown in the table.

t / s	d / m
0	0
0.40	0.60
0.80	2.20
1.20	4.20
1.60	6.70
2.00	9.20

- a) On the grid provided, plot these results, marking each point with a cross (x). [1]
- b) Draw a curve line of best fit taking into account all the plotted points. [1]



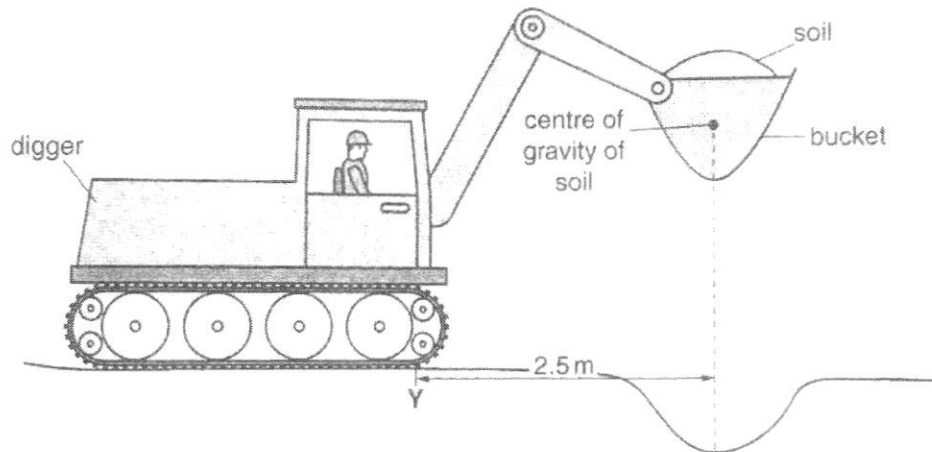
- c) From your graph, determine the uniform speed of the shuttlecock.

uniform speed = m/s [2]

- d) Explain, in terms of forces acting on the shuttlecock, why it reaches a uniform speed.

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

4. The diagram shows a mechanical digger which is used to remove soil from the ground.



The bucket of the digger contains $1.2 \times 10^6 \text{ cm}^3$ of soil.

The density of the soil is 2.5 g/cm^3 .

The gravitational field strength is 10 N/kg .

- a) Calculate the mass of the soil.

mass of soil = kg [2]

- b) The centre of gravity of the soil is a horizontal distance 2.5 m from the front edge Y of the tracks in contact with the ground.
Calculate the moment of the soil about Y.

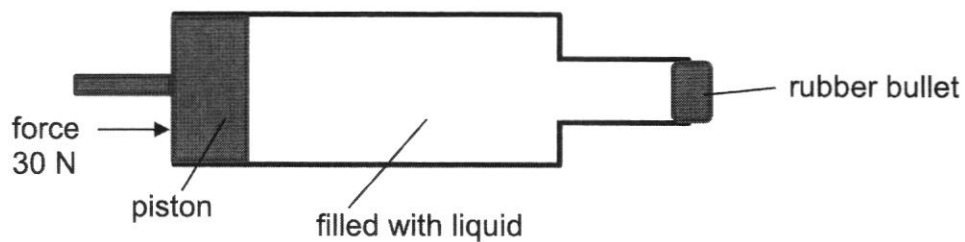
moment about Y = Nm [3]

- c) The centre of gravity of the digger is located at a horizontal distance of 1.5 m away from Y.

Calculate the minimum weight of the digger needed to prevent it from toppling at the current position.

minimum weight of digger = N [2]

5. A toy consists of a piston designed to fire a rubber bullet using liquid pressure.



The cross-sectional area of the piston is 15 cm^2 .

The cross-sectional area of the nozzle with the rubber bullet is 5 cm^2 .

- a) Calculate the pressure exerted by the piston on the liquid when the applied force is 30 N.

pressure =N/cm² [2]

- b) For safety reason, the force pushing out the rubber bullet should be smaller than the applied force.
Explain how this is achieved in the toy.

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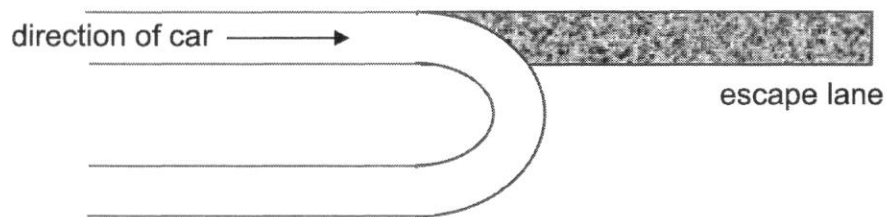
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..... [2]

6. At a sharp corner on a racing circuit there is an escape lane, as shown in the following diagram.



The escape lane is a bed of small stones. A car of mass 700 kg approaches at a speed of 40 m/s. The brake fails and the car stops in the escape lane.

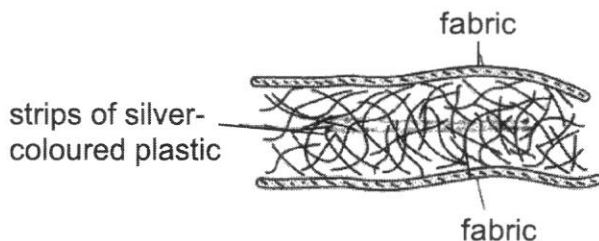
- a) Calculate the kinetic energy of the car as it approaches the corner.

kinetic energy = J [2]

- b) The car comes to rest 80 m along the escape lane.
Calculate the average frictional force on the car in the escape lane.

frictional force = N [2]

7. The following diagram shows the design of a type of insulating material used for making coats in cold countries. It consists of a layer of silver-coloured thin plastic strips inserted between two layers of fabric. The plastic strips trap small pockets of air between them.



Explain why the layer of plastic strips reduces loss of thermal energy by

- a) conduction,

[2]

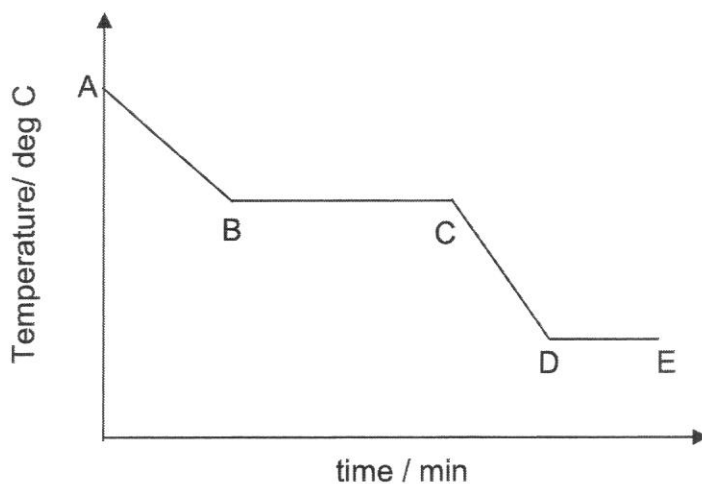
- b) convection,

[1]

- c) radiation,

[1]

8. The graph shows the cooling curve of liquid P.



- a) State the process occurring along BC: [1]
- b) Explain why the temperature remains constant along BC.

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.....

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.....

.....[2]

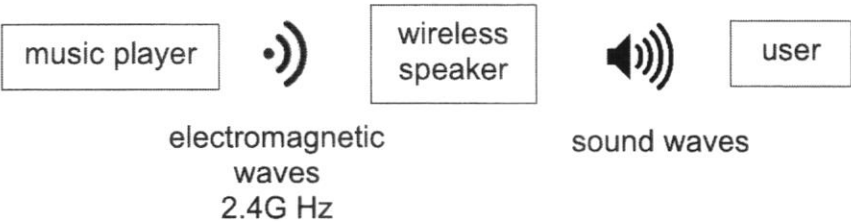
- c) Explain why the temperature remains constant along DE.

.....

.....[1]

9. Electromagnetic waves are used in many applications in our lives.

A wireless speaker receives signals from the music player via electromagnetic waves. It converts the signals into sound and project the music to the users as sound waves.



a) State **two** differences between electromagnetic waves and sound waves.

.....

.....

.....

.....

.....

.....[2]

b) Calculate the wavelength of the electromagnetic waves signal between the music player and the wireless speaker.

wavelength = m [2]

c) State the type of electromagnetic waves for the following applications.

intruder alarm :

satellite communications : [2]

10. A battery has an output potential difference of 6.0 V and is connected to a lamp. The current in the lamp is 2.5 A.

a) Calculate the amount of charge passing through the lamp in 5 minutes.

charge = C [2]

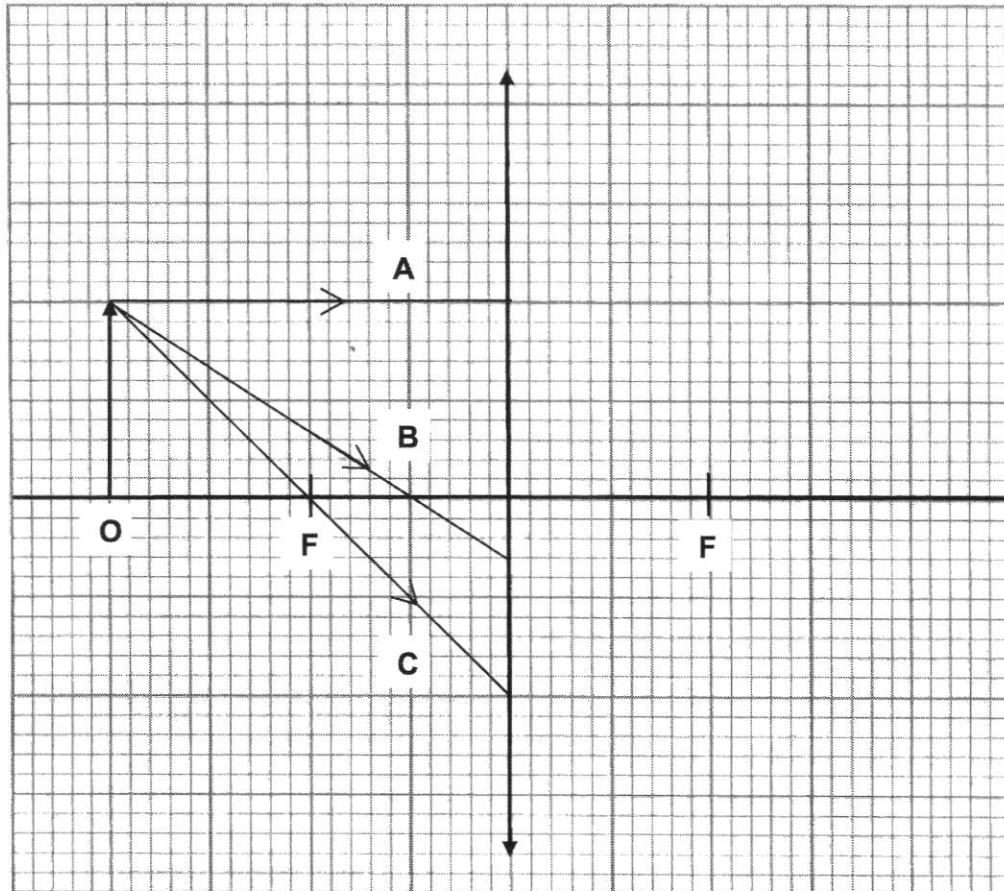
b) Calculate the electrical energy delivered to the lamp in 5 minutes.

energy = J [2]

Section B

Answer any **two** questions from this section in the spaces provided.
The total mark for this section is 20.

11. An object is placed 20 cm away from the thin converging lens, as shown below.



F is the principal focus of the lens.

- Use light ray A and C to locate the position of the image.
Draw an arrow to represent the image. [2]
- Use the image to complete the path of light ray B after passing the lens. [1]
- Describe the **three** characteristics of the image formed. [1]

.....[1]

- d) The phenomenon of light rays changing directions after passing through a medium is known as the refraction of light. Under certain conditions, total internal reflection will occur instead of refraction.

State the two conditions necessary for total internal reflection to occur.

.....

.....

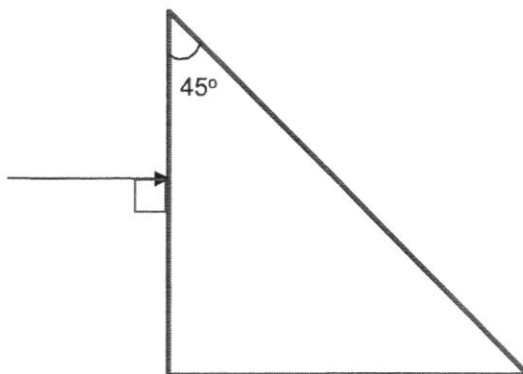
.....

.....

.....[2]

- e) A light ray is incident normally on one face of the glass prism as shown.

The refractive index of the glass prism is 1.50.

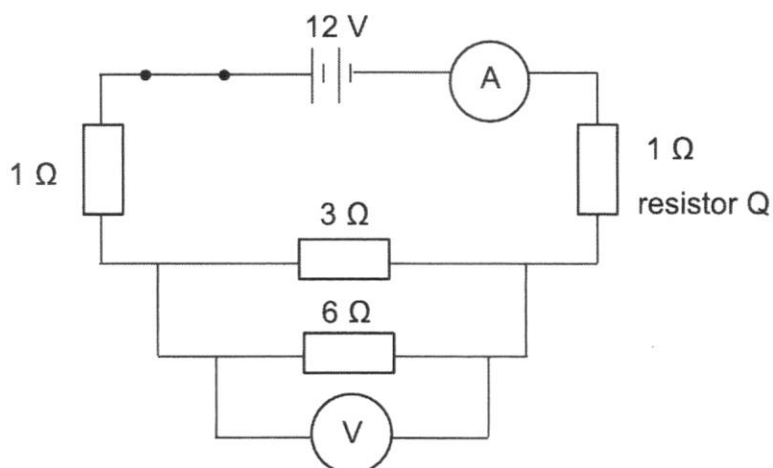


- (i) Calculate the critical angle.

critical angle =° [2]

- (ii) Complete the diagram to show the path of the light ray in the prism and in the air beyond the prism. Label all the relevant angles clearly in the drawing. [2]

12. An electric circuit is set up as shown in the following diagram.



- a) Calculate the total resistance of the circuit.

total resistance = Ω [2]

- b) Determine the reading of the ammeter.

ammeter reading = A [2]

- c) Determine the reading of the voltmeter.

voltmeter reading = V [2]

- d) Calculate the power dissipated in resistor Q.

power = W [2]

- e) The $3\ \Omega$ resistor is subsequently removed from the circuit.
Explain the change in the voltmeter reading across the $6\ \Omega$ resistor.

.....

 [2]

13. An electric grass cutter has a power of 1250 W and it operates with a 240 V mains electric supply.

- a) A fuse is used to protect the grass cutter when a fault develops. Explain why a 3 A fuse would not be suitable to protect the grass cutter.

.....

.....

.....

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.....[2]

- b) In some circuits, a circuit breaker is used to do the same job as a fuse. Fig 13.1 shows a circuit breaker with the contacts closed.

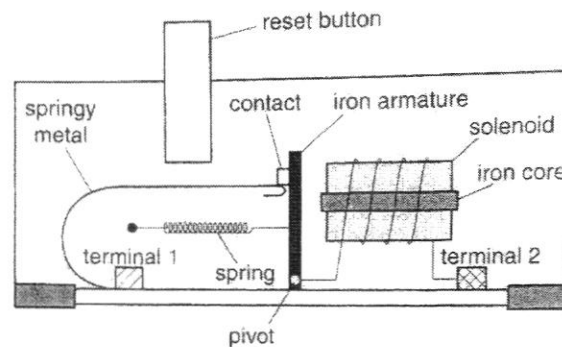


Fig. 13.1

Fig. 13.2 shows the circuit breaker after a large current has passed through the circuit.

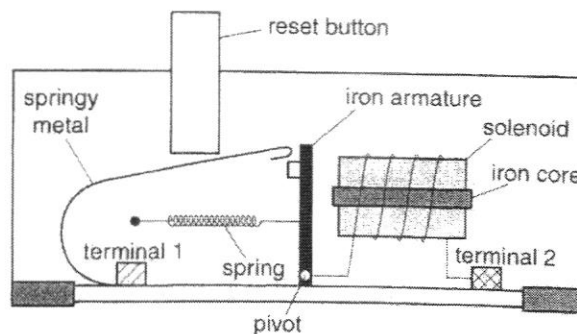


Fig. 13.2

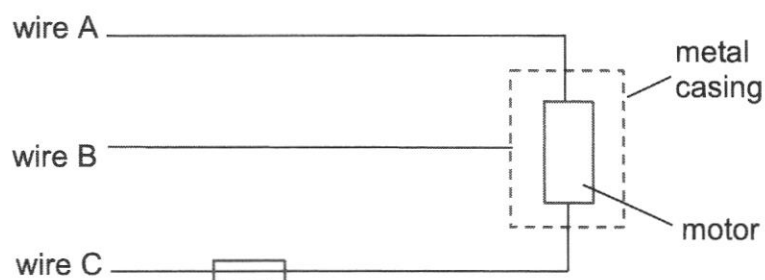
Describe what happens in the circuit breaker when large current above its rating enters the circuit breaker.

[3]

- c) The grass cutter operates an average of 30 hours per month.
The cost of electrical energy is 26 cents per kWh.
Calculate the average cost of using the grass cutter per month.

cost = \$..... [2]

- d) There are 3 wires from the mains connected to the grass cutter.



- i. Identify the wires and their colours by completing the following table.

wire	name of wire
A	
B	
C	

[1]

- ii. Explain why the fuse is connected on wire C?

.....

[1]

- iii. Explain how wire B can protect the user?

.....

[1]

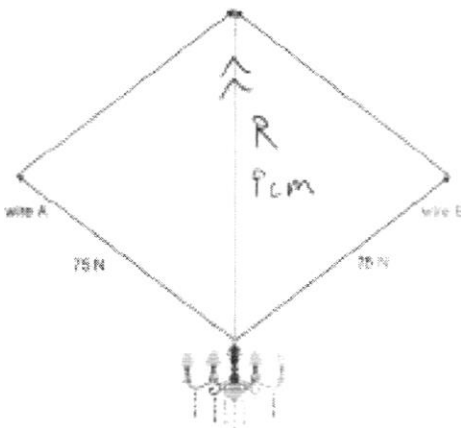
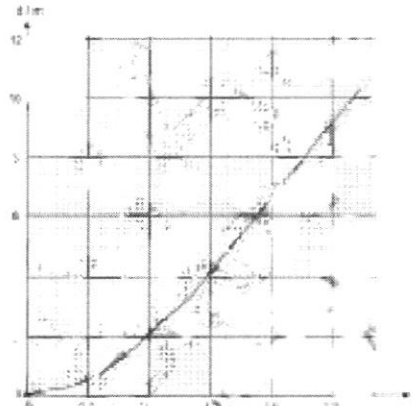
END OF PAPER

Marking Scheme for 4E5N Prelim 2022**Paper 1**

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

Marking Scheme for 4E5N Prelim 2022

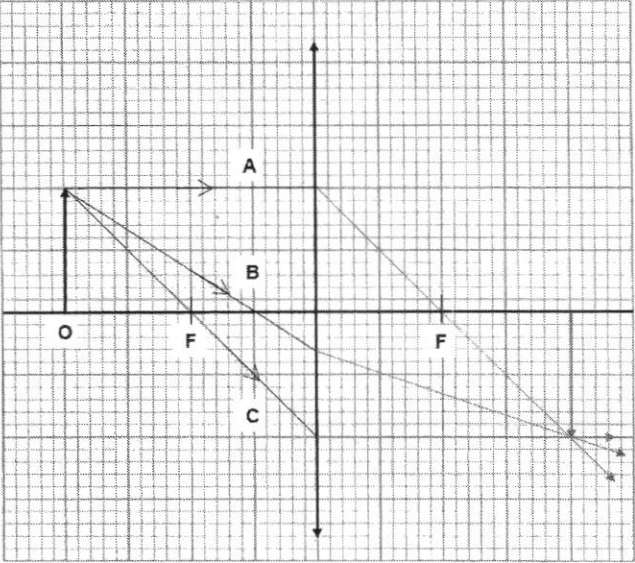
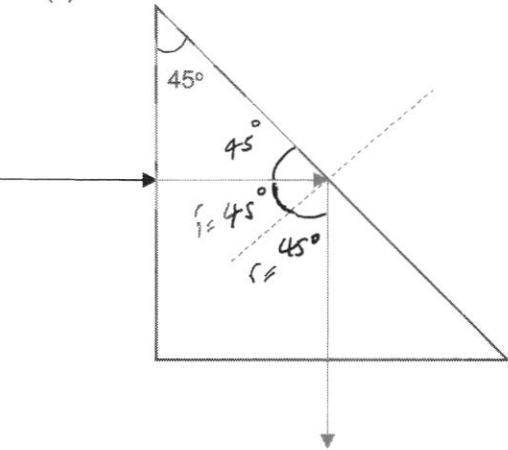
Section A

Qn	Solutions	Remarks
1a	10.02	
1b	3.86	
1c	35	
2	 Scale = 1: 10 [1] Weight = 90 N [1]	Completion of vector diagram [1] Correct scale [1] Correct resultant [1] (allows range 88 – 92 N)
3a/b		Correct data points [1] Draw best fit curve [1]
3c	Gradient = $\frac{(9.2-4.2)}{2.5-1.2} = 6.25 \text{ m/s}$	M1 A1
3d	The weight and the air resistance are equal. The resultant force is zero so acceleration is zero and speed is uniform.	Weight = air resistance [1] (if students stated forces are balanced but did not highlight air resistance and weight, award [A0.5]) Resultant force = 0 N [A0.5] $a = 0 \text{ m/s}^2$ [A0.5]

4a	Mass of soil = density x vol = $2.5 \times 1.2 \times 10^6$ = 3,000,000 g = 3000 kg	M1 A1
4b	Weight = $3000 \times 10 = 30,000$ N Moment = weight x distance = $30,000 \times 2.5$ = 75,000 Nm	A1 M1 A1 Allows for ecf from 4a
4c	Clockwise moment = anticlockwise moment $W \times 1.5 = 75,000$ $W = 50,000$ N	M1 A1 Allows for ecf from 4a,b
5a	Pressure = force ÷ area = $30 \div 15$ = 2 N/cm ²	M1 A1
5b	The pressure is consistent throughout the liquid. (pressure exerted by the liquid on the rubber bullet is equal to the pressure exerted on the liquid by the applied force) With a smaller cross-sectional area at the nozzle, the force pushing the rubber bullet will also be smaller.	A1 A1
6a	KE = $0.5 \times m \times v^2$ = $0.5 (700) (40 \times 40)$ = 560,000 J	M1 A1
6b	Work done = KE $F \times 80 = 560,000$ $F = 7000$ N	M1 A1
7a	Plastic is a poor conductor of heat. The strips created many pockets of air and air is also a poor conductor of heat.	A1 A1
7b	The pockets of air cannot move freely to create a convection current for heat transfer.	A1

7c	Silver is a poor absorber of radiant heat; it does not take the heat away from the body. Or Silver is a poor emitter of radiant heat; it does not release heat to the surrounding quickly.	A1
8a	Solidification / freezing	A1
8b	Energy is released to the surrounding by the particles as they rearrange themselves from liquid into solid state. There is no change in the kinetic energy of the particles hence there is no temperature change.	A1 A1
8c	The substance has reached the room/ambient temperature. Or The substance cannot fall below the room/ambient temperature denoted by DE. Or The substance is at thermal equilibrium with the surrounding.	A1
9a	Electromagnetic waves are transverse waves, but sound wave is longitudinal wave. (EM waves travel in a direction perpendicular to the direction of the particles vibration while sound wave travels in a direction parallel to the direction of particles vibration.) EM waves can travel through vacuum, but sound wave cannot. (Sound requires a medium for transmission but EM waves do not.) EM waves travel at a speed of 3×10^8 m/s in air while sound travels at a speed of 300 m/s in air.	Either two of the logical comparisons – A1 each Alternating ans of the same concept is considered as repeated ans. No mark awarded.
9b	$v = f \lambda$ $3 \times 10^8 = 2.4 \times 10^9 \times \lambda$ $\lambda = 0.125$ m	M1 A1
9c	Infra-red radiation microwave	A1 A1
10a	$Q = It$ $= 2.5 \times (5 \times 60)$ $= 750$ C	M1 A1
10b	$E = VIt$ $= 6 \times 2.5 \times (5 \times 60)$ $= 4500$ J	M1 A1

Section B

Qn	Solutions	Remarks
11ab		Complete ray A and C – A1 each Draw image – A1 Complete ray B – A1
11c	Real, inverted, same size	A1 (no 0.5)
11d	Light must be travelling from an optically denser medium towards an optically less dense medium. The angle of incidence must be greater than the critical angle.	A1 A1
11e	(i) $\sin c = 1/n$ $c = \sin^{-1}(1/1.50)$ $c = 41.8^\circ$ (ii) 	M1 A1 indicate i – A0.5 indicate r – A0.5 horizontal ray within prism – A0.5 vertical ray out of prism – A0.5

12a	Total resistance = $1 + 1 + \left(\frac{1}{6} + \frac{1}{3}\right)^{-1}$ = 4 Ω	M1 A1
12b	$I = \text{emf} \div R$ = $12 \div 4$ = 3 A	M1 A1 Allows ecf for resistance in 12a
12c	pd across parallel resistors = emf – pd of two 1 Ω = $12 - 3(1) - 3(1)$ = 6 V Alt method includes using ohm's law on parallel group resistors ($R = 2 \Omega$, $V = 3 \times 2 = 6 \text{ V}$)	M1 A1 Allows ecf for current in 12b
12d	$P = VI$ = $(3 \times 1) \times 3$ = 9 W	M1 A1 Allows ecf for current in 12b
12e	The total resistance increases. Circuit current decreases. Potential differences across the 1 Ω resistors drops. The potential difference across the 6 Ω resistor will be higher than before so voltmeter reading increases.	A0.5 A0.5 A0.5 A0.5
13a	$I = P \div V$ = $1250 \div 240$ = 5.21 A Operating current is greater than 3 A. The 3 A fuse will always melt and break the circuit so not suitable.	Calculate operating current – A1 Conclude – A1
13b	When large current enters, the iron core will become a stronger magnet. It can pull the iron armature towards the iron core. This will break the contact point with the springy metal. The circuit is opened and current will stop flowing. The iron core demagnetised. The iron armature is pulled back to its upright position by the spring.	A0.5 A0.5 A0.5 A0.5 A0.5
13c	Cost = $(1250 \div 1000) \times (30) \times (\$0.26)$ = \$9.75	M1 A1

13di	Wire	Name of wire		A1 for all correct ans
	A	neutral		
	B	Earth		
	C	Live		
13dii	So that when the fuse breaks the circuit, the appliance will not be connected to the live potential.			A1
13diii	The current will flow to the ground through wire B instead of the user if the metal casing becomes live during an electrical fault.			A1