

# SEMINAR AND

# PHYSICS



# WORKSHOP

# 2012

## [PERFECT SCORE PHYSICS MALACCA 2012]

*THIS MODULE IS CONSISTING OF 20 QUESTIONS BASED ON ITEM CRITERIA OF UNDERSTANDING, APPLICATION, PROBLEM SOLVING AND DECISION MAKING QUESTIONS.*

*STUDENTS IN RESPECTIVE GROUP WILL CHOOSE A QUESTION AS A SUBJECT OF GROUP DISCUSSION FOR 15 MINUTES. CHOOSE A LEADER TO PRESENT THE ANSWER.*

*STUDENT IS REMINDED TO CHECK THE ANSWER WITH THE FACILITATORS BEFORE THE PRESENTATION SESSION.*



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### Question 1

A thermometer is placed in a beaker filled with water and heated until the water is boiling. Explain in terms of thermal equilibrium, how a thermometer which is placed into the boiling water reads at the temperature of  $100^{\circ}\text{C}$ . [ 4 m]

1<sup>st</sup>: The thermometer is put in the water.

2<sup>nd</sup>: Heat is transferred from water to the thermometer.

3<sup>rd</sup>: until thermal equilibrium is reached.

4<sup>th</sup> : the final temperature of the thermometer and the water.

### Question 2

Diagram 2 shows the pattern of sea waves when approaching the beach.



Diagram 2

Explain in terms of the wave phenomena, why the water waves follow the shape of the beach as it approaches the shore.

[ 4 m]

The water waves travels from deep to shallow region.

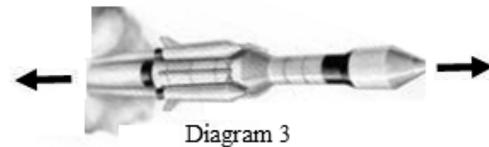
The speed / wavelength of water waves decrease.

The waves refracted towards normal line.

The wave front which perpendicular to the direction of propagation of waves resulting the wave front following the shape of the beach

### Question 3

Diagram 3 shows a space craft of 800 kg of mass. The rocket motor fires for 4 second,s and increases its velocity from 25 m/s to 30 m/s. Calculate the force exerted by the motor?.



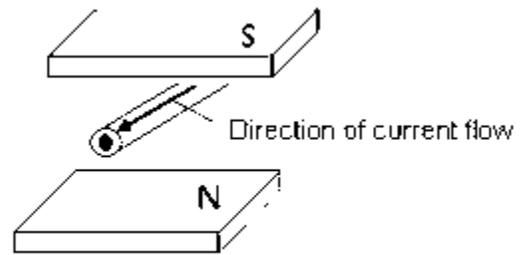
$$800 (30 - 25)/4 = 1\,000 \text{ N}$$

$$F = ma =$$

### Question 4

A current carrying conductor is placed in a magnetic field . This will caused the conductor will move. What causes the conductor to move? Explain your answer

1. Magnetic field produced by the current in



the coil

2. interact with the magnetic field of the permanent magnet

3. producing the catapult field

4. produces resultant force

### Question 5

Diagram 5 shows Ali standing at the side of a pond. Ali can see the image of the fish and the image of the dragon-fly in the water as shown by the ray diagram.

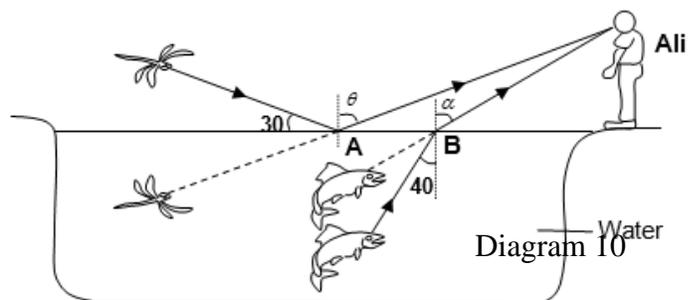


Diagram 5

Calculate the angle  $\theta$  and  $\alpha$  .[ Refractive index of water is 1.33 ]

[4

marks]

$$\theta = 60^\circ$$

$$n = 1.33 = \sin \alpha / \sin 40^\circ$$

### Question 6

Diagram 6 shows the burning candle placed between a pair of parallel metal plates.

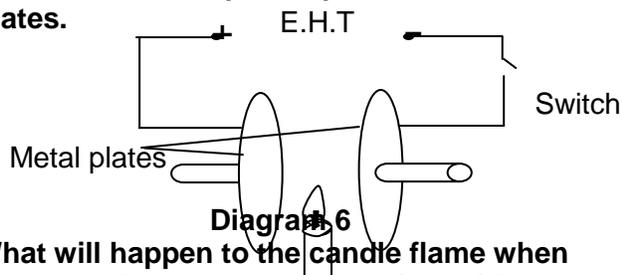


Diagram 6

What will happen to the candle flame when the extra high voltage supply (E.H.T) is switch on?

Explain your answers.

1. The lighted candle / the heat from the candle causes the air molecules to be ionized.
2. The positive charges would be attracted to the negative plate and/or the negative charges would be attracted to the positive plate
3. The flame of the candle would be dispersed (flattened) into two parts // suitable diagram
4. Positive charges are heavier than negative charges
5. More of the flame is attracted to the negative plate //diagram

### Question 7

Diagram 7 shows a candle is placed in front of a plane mirror. A virtual image is formed in the mirror.

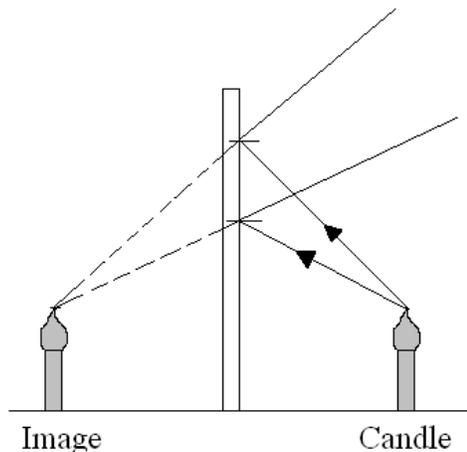


Diagram 7

(a).What is the meaning of virtual image?

**Image that cannot be seen on the screen.**

[1

mark]

(b) In Diagram 7 complete the path of rays to show the formation of image in the plane mirror. [2

marks]

(c) State two other characteristics of the image formed in the plane mirror.

**Upright and same size**

[2 marks]

(d) Based on Diagram 7, calculate the distance between the candle and the image form when the candle is moved to a distance of 2.0 m away from the plane mirror.

$$2 + 2 = 4 \text{ m}$$

[1 mark]

### Question 8

(e) Diagram 8 shows the plane mirrors are used in a construction of a periscope.

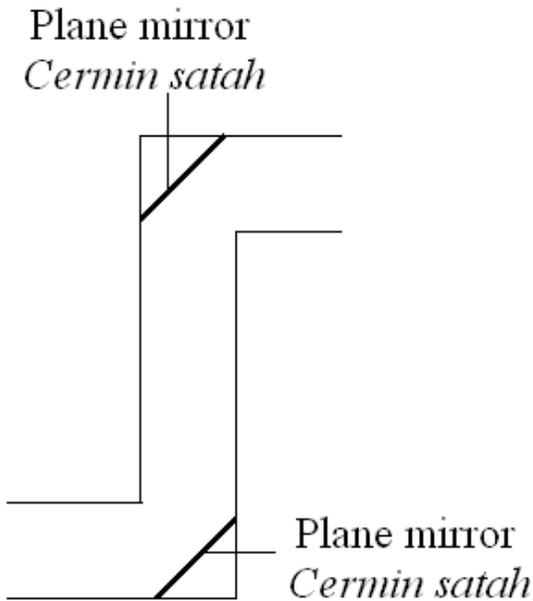


Diagram 8

The image produced by the periscope is not sharp. Suggest a modification that can be made to produce a sharper image through these aspects:

- (i) The apparatus used to replaced the plane mirror  
**Prism**

Reason

**Avoid multiple image // not affected by weather // less likely to be damaged // are the light are totally reflected**

[2 marks]

- (ii) The arrangement of the apparatus used in 8 (e) (i)

**One prism is on the top and other one is at the bottom // diagram**

Reason

**Produce total internal reflection**

[2 mark]

**Question 9**

Diagram 9 shows a fishing boat using a sonar system to detect a shoal of fish.

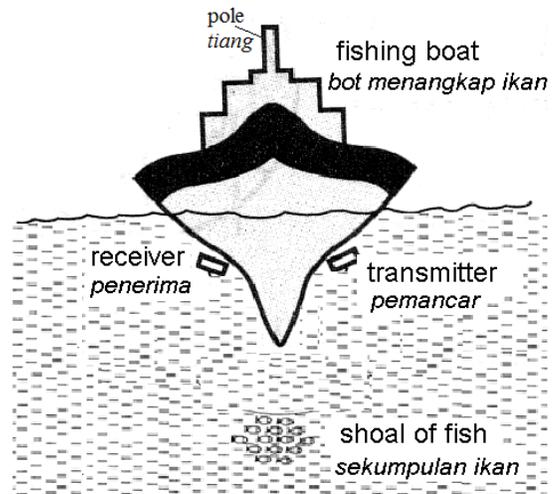


Diagram 9

- (a) (i) Name the wave phenomenon used to detect the fish.

**Reflection**

[1 mark]

- (ii) Compare the time taken for sending detective wave to the fish and the time taken for the receiver to receive the signal.

**Equal**

[1 mark]

- (b) Why did sonar system is used as a device to detect the fish?

**It has high frequency / high energy**

[1 mark]

- (c) The time to detect the shoal of fish is 0.05 seconds, the speed of the sound waves in water is  $1500 \text{ ms}^{-1}$ . Calculate the distance of the shoal of fish from the fishing boat

$$1^{\text{st}} : s = \frac{vt}{2} = \frac{(1500)(0.05)}{2}$$

$$2^{\text{nd}} : s = 37.5 \text{ m}$$

[2 marks]

**Question 10**

(d) The fishing boat is to be upgraded with a better communication system such as a transmitter and a receiver and a radar system hence able to detect any air flight. Suggest a modification that can be made to produce an efficient radar system through these aspects:

- (i) the best location of the new detection device to work efficiently.  
**At a higher place**

Reason:

**Easier to receive the signal**

[2 marks]

(ii) The communication device to increase the effectiveness of the communication system

**increase the diameter of the device**

Reason:

**receive more signals**

[2 marks]

(iii) State the type of wave produce by the new detection device.

**microwaves**

[1 mark]

**Question 11**

Diagram 11 shows an archer aiming an arrow to a target board.

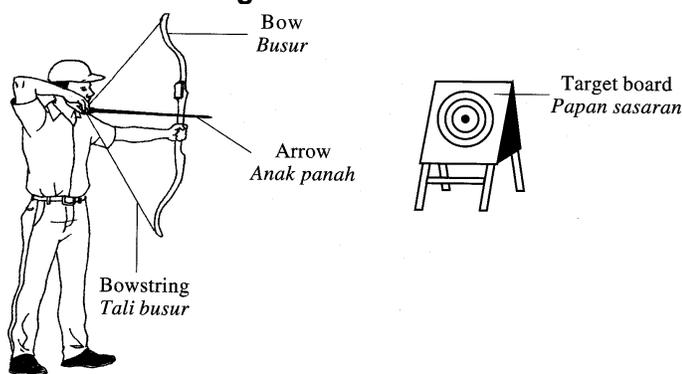


Diagram 11

Using appropriate physics concept, explain the use of suitable equipments and techniques to improve his performance. Your answer should include the following aspects:

- (i) mass of the arrow
- (ii) shape of the arrow

- (iii) elasticity of the bowstring
- (iv) strength of the bow
- (v) position of the aiming arrow compared to the centre of the target board.

[ 10 marks]

M1 – small mass	M2 –lighter / accelerate / high velocity
M3 – sharp / aerodynamics / bullet / torpedo / streamline /	M3 – reduce air resistance
M5 – high elasticity	M6 – high velocity /energy /move faster / move further / easy to bend
M7 – strong	M8 - Not break easily /
M9 – above / higher / upper / parabolic	M10 – gravitational force

**Question 12**

Diagram 10 shows a cross section of a moving coil microphone. A microphone converts one form of energy into another.

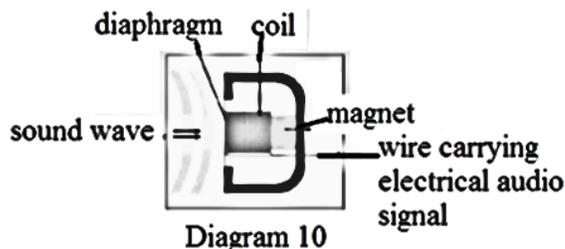


Diagram 10

When the diaphragm moves in response to sound, the attached coil moves in the magnetic field and generates a very small current in the wire of the coil. Using an appropriate concept in physics, suggest and explain suitable modifications or ways to enable the microphone to detect sound effectively and generate bigger current based on the following aspect:

- (i) thickness of diaphragm
- (ii) strength of the material for diaphragm
- (iii) number of turns of coil
- (iv) diameter of the wire of coil
- (v) strength of magnet

[10 marks]

<i>suggestion</i>	<i>reason</i>
use thin diaphragm	Easy to vibrate
Use strong material	Not easy to break
More number of turns of coil	Increase the rate of change of magnetic flux linkage // The magnitude of the induced current or is also increased
Thicker diameter of wire of coil	reduce the resistance of the coil
Using more powerful magnet to increase the strength of the magnetic field	The magnitude of the induced current is also increased

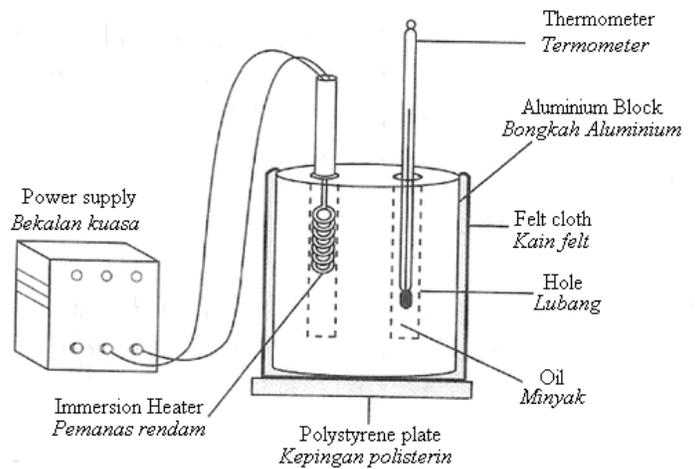


Diagram 13.2

(a) What is the meaning of specific heat capacity?

The quantity of heat required to increase the temperature of 1 kg of substance by 1 °C.

[1 mark]

(b) Based on Diagram 13.1 and Diagram 13.2, state the suitable characteristics of the arrangement of the apparatus to determine the specific heat capacity of aluminium block.

Give reason for the suitability of the characteristics.

(i) The type of plate to be used as the base.

Type of plate : Polystyrene

Reason

Avoid heat loss to surrounding

[2 marks]

(ii) The type of liquid poured in the hole oil

Reason

to produce good thermal contact between Aluminium block and thermometer.

[2 marks]

(iii) Material used to wrap the aluminium block.

felt cloth

Reason : Avoid heat loss to surrounding

[2 marks]

### Question 13

Diagram 13.1 and Diagram 13.2 show two arrangements of the apparatus to determine the specific heat capacity of aluminium block.

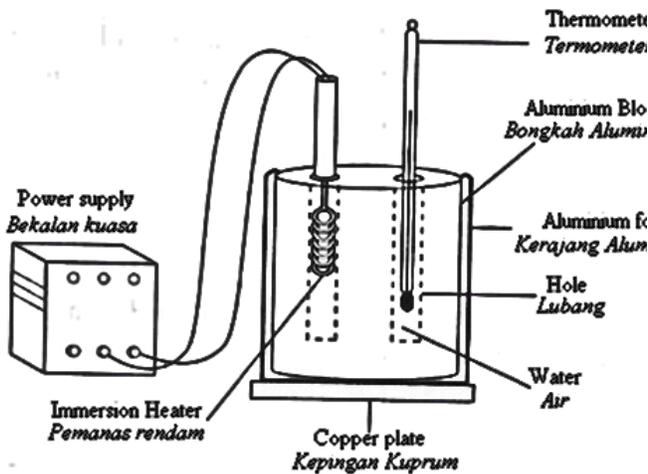


Diagram 13.1

**Question 14**

(c) The aluminium blocks in both diagrams have 1 kg mass and being heated by using the electric heater of power 200 W within 4 minutes. The increasing of temperature in Diagram 13.1 is 30 °C whereas in Diagram 13.2 is 50 °C.

Calculate the specific heat capacity of the aluminium blocks in:

(i) Diagram 13.1.

$$P \times t = m \times c \times \theta$$

$$c = \frac{P \times t}{m \times \theta}$$

$$c = \frac{200 \times 240}{1 \times 30} = 1600 \text{ J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$$

[2 marks]

(ii) Diagram 13.2.

$$P \times t = m \times c \times \theta$$

$$c = \frac{P \times t}{m \times \theta}$$

$$c = \frac{200 \times 240}{1 \times 50} = 960 \text{ J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$$

[2 marks]

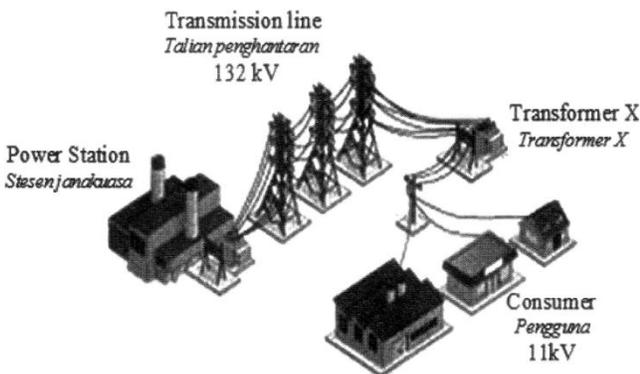
(d) Determine the most suitable apparatus that can give an accurate result to determine the specific heat capacity of the aluminium block.

**Diagram 8.2**

.....  
[1 mark]

**Question 15**

Diagram 15 shows an electricity transmission system from the power station to the consumers.



**Diagram 15**

(a) What is the function of a transformer?  
**To increase and decrease the voltage**  
.....  
[1 mark]

(b) Table 15 shows the characteristics of electricity transmission system models P, Q and R.

Models	P	Q	R
Number of turns of primary coil	100	3600	1200
Number of turns of the secondary coil	1200	1200	100
Type of transformer core	Laminated soft iron	Soft iron	Laminated soft iron
Materials of transmission wire	Constantan	Aluminium	aluminium

Based on Table 15, state the suitable characteristics of a model for the electricity transmission system shown in Diagram 15.

(i) Number of turns of primary and secondary coils for Transformer X

Primary coil: **greater**

Secondary coil: **less**

Reason

**To step down the voltage**

[2 marks]

(ii) Type of core of the transformer.

**Laminated soft iron core**

Reason

**To reduce Eddy current**

[2 marks]

(iii) Material of transmission wire

**Aluminium**

Reason

**Low resistance / less density**

[2 marks]

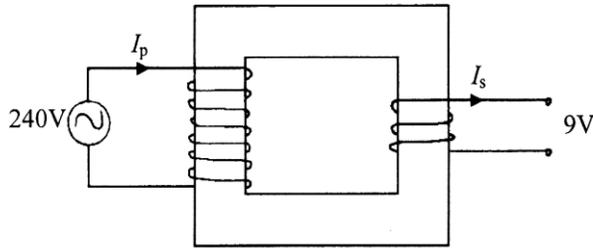
(iv) Based on your answers in (b)(i), (b)(ii) and (b)(iii), determine the most suitable model for the electricity transmission system shown in Diagram 15

R

[1 mark]

**Question 16**

(c) Diagram 16 shows a transformer which changes the mains supply from 240 V to 9 V.



**Diagram 16**

The electric current in the primary coil,  $I_p$  and the secondary coil,  $I_s$ , is 0.1 A and 2.0 A respectively.

(i) Calculate the efficiency of the transformer

[2 marks]

$$\text{Efficiency} = \frac{(9 \times 2)}{[240 \times 0.1]} \times 100\% = 75\%$$

(ii) What is the power loss in the transformer?

$$\text{Power loss} = 24 - 18 = 4 \text{ W}$$

[2 marks]

(iii) Give two reason of energy loss in transformer and state methods to overcome the loss of energy in the transformer

[4 marks]

**Question 17**

Diagram 17 shows four methods of towing a cargo ship to a Harbour.

You are required to determine the most suitable methods and the characteristics of the cable rope to tow the ship effectively.

<p><b>Method J</b></p>	
<p><b>Method K</b></p>	
<p><b>Method L</b></p>	
<p><b>Method M</b></p>	

**Diagram 17**

Study the specification of the four arrangement based o the following aspects:

(i) the angle of the two towing boats.

[2 marks]

(ii) the shape of the towing boats

[2 marks]

(iii) type of cable rope used.

[2 marks]

(iv) the elasticity of cable used.

[2 marks]

Explain the suitability of each aspect and then determine the most suitable arrangement.

Give a reason for your choice.

[2 marks]

ASPECT	REASONING
Small angle	Produce bigger resultant force
Streamlined	Reduce resistance
Steel Rod	Strong// able to withstand high tension
Inelastic	Produce uniform force during the towing.
Arrangement K is chosen	Big angle, Streamlined, Steel Rod, Inelastic



Diagram 18

[10 marks]

**Question 18**

Diagram 18 shows four racing motorcycles, P, Q, R and S, with different specifications. You are required to determine the most suitable motorcycle to move fast and safe when racing. Study the specifications of all the four motorcycles from the following aspects: Explain the suitability of the aspects. Justify your choice.

<p>Racing bike A Type of brake : without ABS Mass : 205.0 kg</p>	
<p>Racing bike B Type of brake : without ABS Mass : 220.0 kg</p>	
<p>Racing bike C Type of brake : ABS (Antilock Brake System) Mass : 208.0 kg</p>	

Specification	Explanation
With ABS	To reduce jerking when it is stopped immediately / can be controlled if direction changes/ does not move side ways
Wide tyres	Better support / more stable /safer when turn
Low mass	Lighter, can move faster / low inertia
Low seat height	Lower centre of gravity/ more stable
<b>C</b>	It has ABS, wide tyres, low mass, low seat height.

**Question 19**

(a) Diagram 19 shows heating element in a toaster.

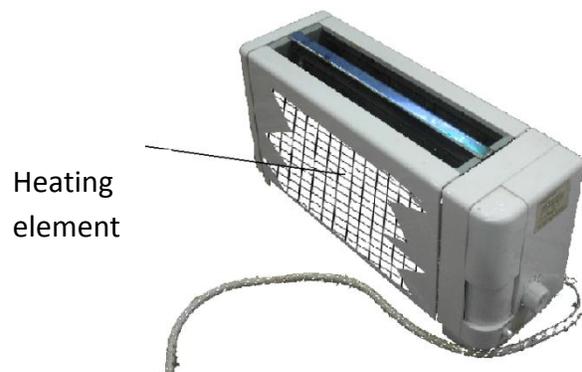


Diagram 19

(b) Table 19 shows 5 heating elements M,N,O,P and Q with characteristics to used as an effective bread toaster heater.

Heating element /	Size of wire / swg	Resistivity / $\Omega\text{m}$	Specific Heat Capacity / $\text{Jkg}^{-1}\text{ }^{\circ}\text{C}^{-1}$	Length / m
M	15	$2.0 \times 10^{-8}$	900	2
N	15	$10.0 \times 10^{-8}$	390	3
O	30	$8.0 \times 10^{-8}$	450	2
P	30	$6.0 \times 10^{-8}$	440	3
Q	15	$7.0 \times 10^{-8}$	390	2

Table 19

(c) You are required to determine the most suitable element heating that can be used to toast bread fast and crispy. Study the specifications of all the five heating element based on the following aspects

- (i) Size of wire [2 marks]
- (ii) Resistance per meter [2 marks]
- (iii) Specific Heat Capacity [2 marks]
- (iv) Length of the heating element [2 marks]

Explain the suitability of each aspect and then determine the most suitable heating element.

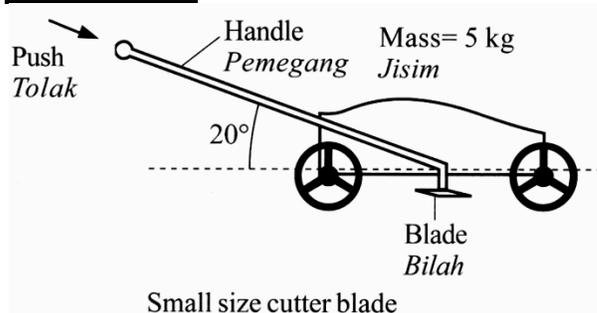
Give a reason for your choice [2 marks]

Characteristics	reason
Size of wire is small	High resistance
Resistivity is high	produce more heat
Low specific heat capacity	Heat up faster
Long wire	High resistance
Choose heating element N	Because the size of wire is small, has high resistivity, has low

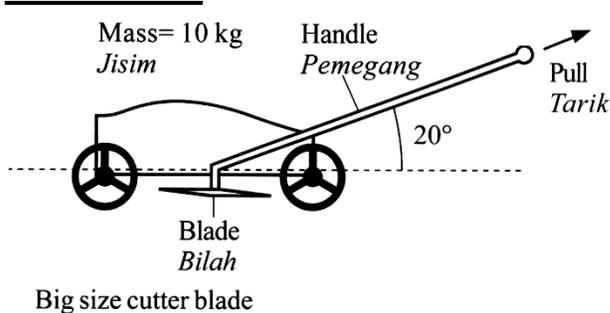
### Question20

Diagram 18 shows four lawnmowers, J, K, L and M with different specifications. You are required to determine the most suitable lawnmower to cut grass effectively.

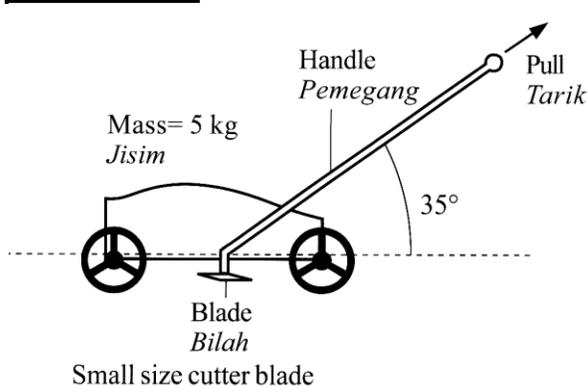
#### Lawnmower J



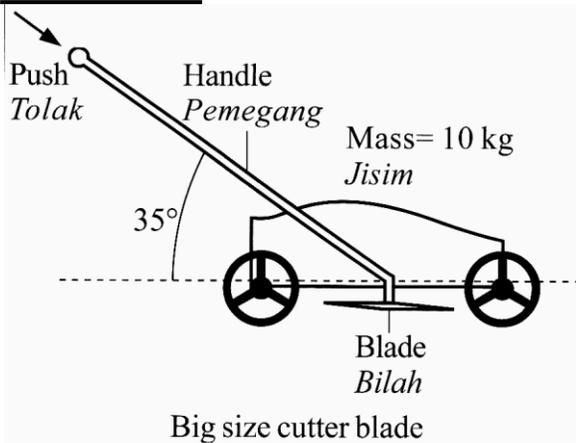
#### Lawnmower K



#### Lawnmower L



**Lawnmower M**



**Diagram 18**

Study the specifications of the four lawnmowers based on the following aspects:

- (i) Method of moving the lawnmower.
- (ii) Mass of the lawnmower
- (iii) Size of the cutter blade.
- (iv) The angle between the handle and the horizontal line.

Explain the suitability of each aspect and then determine the most suitable lawnmower.

[10 marks]

Characteristics	reason
Push	Bigger force
Large mass	Down force bigger/ more stable
Size of cutter is large	Cut more grass / efficient / faster
Angle between handle is large	Force exert to ground bigger
Choose M because pushing, large mass, size of cutter is large and angle between handle is large	

**END OF QUESTION PAPER**