ZHONGHUA SECONDARY SCHOOL
Preliminary Examination 2017

CANDIDATE NAME		( )
CLASS		

PHYSICS **5059/01**

Paper 1 Multiple Choice **19 September, 2017**

Secondary 4 Express **1 hr**

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Vetted by: **Mr Tan Jun Hong**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and class on the OTAS 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 OTAS Answer Sheet.

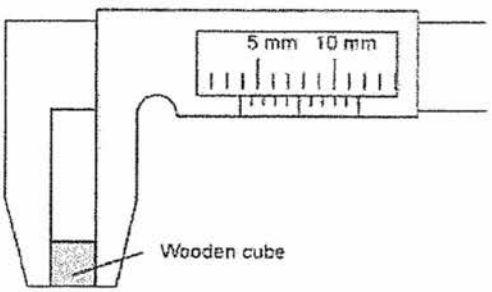
Read the instructions on the Answer Sheet very carefully.

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.

Where necessary, take acceleration due to gravity, g = 10 m/s^2

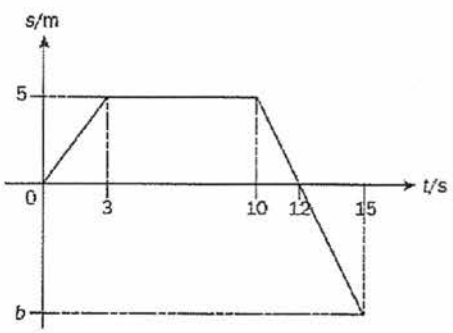
1 The diagram shows a metal cube being measured by a Vernier caliper.



What is the length of the cube?

A 1.5 mm B 3.8 mm C 4.4 mm D 34.8 mm

2 The figure below shows the displacement-time graph of an object.



What is the velocity of the object at 11 s and the value of b?

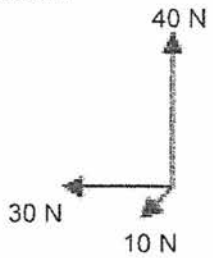
	velocity/m/s	*b*/m
A	-2.5	-5.0
B	-5.0	-5.0
C	-2.5	-7.5
D	-5.0	-7.5

3 A cyclist is travelling at 10 m/s along a level road. The cyclist applies the brakes and comes to rest in a time of 5.0 s. The combined mass of the cycle and cyclist is 80 kg.

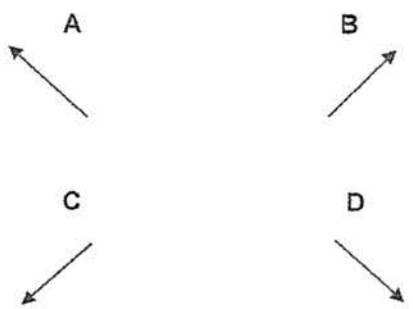
What is the braking force applied at the brakes?

A 80 N B 160 N C 1600 N D 4000 N

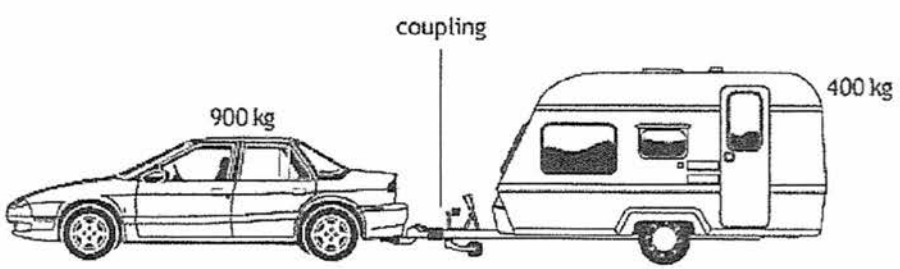
4 The figure shows three force vectors.



Which of the force vectors would be most likely to represent the resultant force?



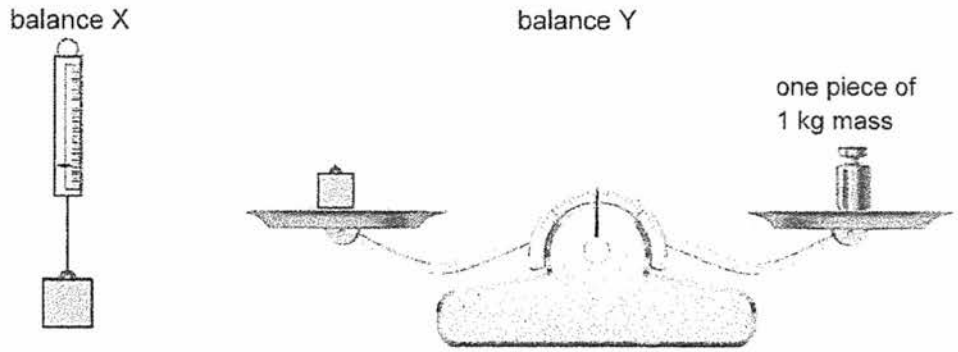
5 A car of mass 900 kg pulls a caravan of mass 400 kg along a straight, horizontal road with an acceleration of 2·0 m/s^2.



Assuming that the frictional forces on the caravan are negligible, the tension in the coupling between the car and the caravan is

A 400 N B 500 N C 800 N D 1800 N

6 Two balances X and Y are used on the Moon to measure the weight and the mass of two different loads as shown in the diagrams below. Balance X reads 60 N and balance Y needs one piece of 1 kg mass to balance the load.

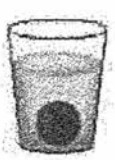


If these measurements were to be repeated on Earth, where the gravitational field strength is 6 times more than that on the Moon, what will be the correct readings?

	reading on balance X / N	number of 1 kg mass to balance the load in balance **Y**
A	60	one
B	60	six
C	360	one
D	360	six

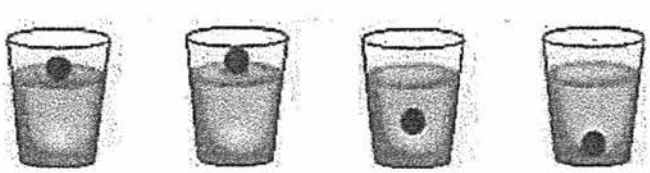
7 Hye Kyo and Joong Ki were attending a Physics lesson. They were given two balls made of the same material as shown below.

Hye Kyo puts the larger ball in a beaker of water and watches it sink as shown.

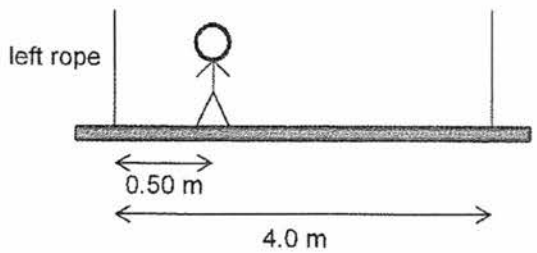


Joong Ki removes the larger ball and places the smaller ball in the same glass of water. Which diagram shows the correct position of the smaller ball?

A **B** **C** **D**



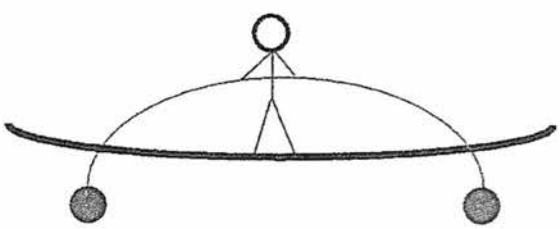
8 A cleaner cleans the windows of a building by standing on a uniform platform. The platform is supported by two ropes as shown in the diagram below. The ropes are of equal distance from each ends of the platform. The cleaner who has a weight of 800 N, is 0.50 m from the left rope.



What is the tension in the left rope? Assume that the platform has negligible mass.

A 100 N B 700 N C 914 N D 6400 N

9 An amateur tightrope walker balances himself by holding a hold pole. Heavy spheres are attached to the ends of the pole.



Which statement explains why the man is able to balance himself on the rope?

The overall centre of gravity of the man and his balancing pole is directly

A below the pivot and therefore the weight will provide a restoring moment.

B on the pivot and therefore the weight will provide a restoring moment.

C above the pivot and therefore the weight will provide a restoring moment.

D above the pivot and therefore the line of action of force will provide a restoring moment.

10 Water flows at a rate of $6{\cdot}25 \times 10^8$ kg per minute over a waterfall. The height of the waterfall is 10.8 m.

The total power delivered by the water in falling through the 10.8 m is

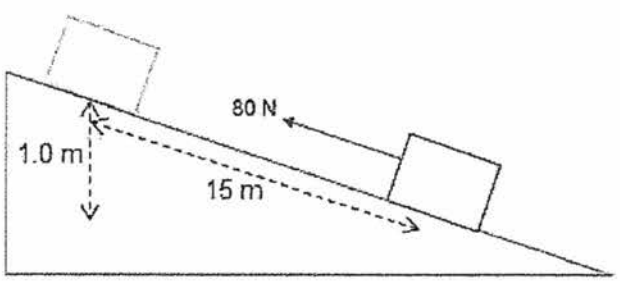
A $1{\cdot}13 \times 10^9$ W.

B $1{\cdot}10 \times 10^{10}$ W.

C 6.62×10^{11} W.

D 4.05×10^{12} W.

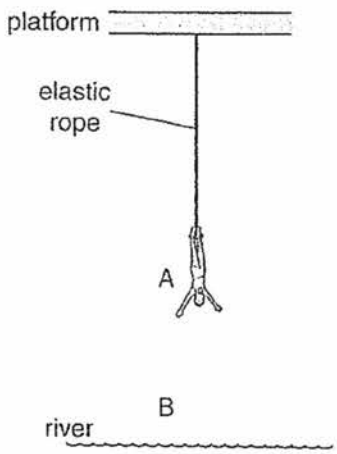
11 A wooden block of mass 10 kg is pulled up a rough inclined plane at a uniform speed by a force of 80 N parallel to the plane. When the distance moved along the plane is 15 m, the increase in height is 1.0 m.



What is the frictional force of the inclined plane?

A 73 N B 80 N C 87 N D 1200 N

12 The diagram shows a man making a bungee jump. He starts from a platform above a river. The elastic rope tied to his feet becomes tight when the man reaches point A. The lowest point he reaches is B.



Which statement best describes the conversion of energy of the man when he travels from A to B?

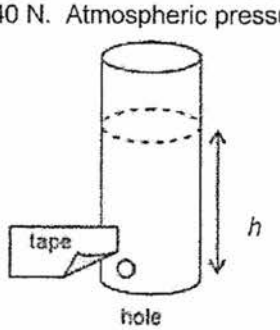
A Decrease in kinetic energy of the man is converted to elastic potential energy of the rope.

B Decrease in elastic potential energy of rope and gravitational potential energy of man is converted to kinetic energy of the man.

C Decrease in gravitational potential energy of man is converted to elastic potential energy of rope and kinetic energy of man.

D Decrease in gravitational potential energy and kinetic energy of man is converted to elastic potential energy of rope.

13 Water of density 1000 kg/m^3 fills up to height h in a container. There is a hole at the base of the container and water starts to flow out from the hole of area 2.0 mm^2. The minimum force that the tape must withstand is 0.0040 N. Atmospheric pressure is 10^5 Pa.



What is height h?

A 10 cm B 20 cm C 100 cm D 200 cm

14 The volume of a gas is halved at constant temperature.
Which of the following changes is/are correct?

1 The frequency of collision increases.

2 The kinetic energy of the gas molecules increases.

3 The force of each collision increases.

A 1 only

B 2 only

C 1 and 3

D 2 and 3

15 Using the kinetic model of matter, which of the following best describes water at 0 °C that is freezing to ice?

	intermolecular bonds	average motion of water molecules
A	forming	slowing down
B	being overcomed	slowing down
C	forming	no change
D	being overcomed	no change

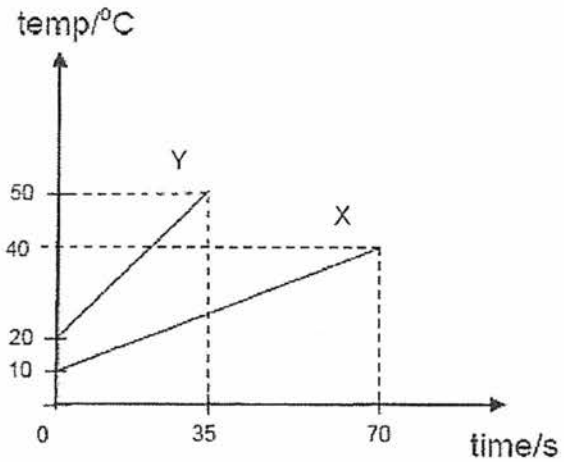
16 A jet of steam at 100 °C is directed for a short time on a large block of ice at 0 °C. Some of the steam condenses to form 0.40 kg of water at 100 °C.

What is the heat given out by the steam that changed to water at 100 °C?

specific latent heat of vaporization of water = 2200 kJ/kg;
specific heat capacity of water = 4.2 kJ/kg K

A 440 kJ B 880 kJ C 1680 kJ D 88000 kJ

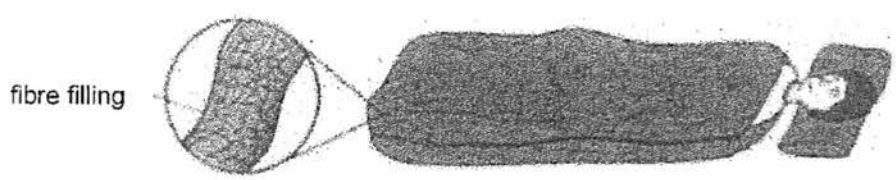
17 An electric heater is used to heat up two blocks, X and Y. Their temperature – time graphs are plotted as shown below.



What is the ratio of heat capacities of X to Y?

A 0.50 B 0.80 C 1.0 D 2.0

18 Sleeping bags are designed to keep the user warm when the surrounding temperature decreases. The bags have a fibre filling.



What mode of heat transfer to the surroundings is reduced with the use of the fibre filling and what should be the colour inside the bag?

	mode of heat transfer	colour inside bag
A	conduction	black
B	conduction	white
C	convection	black
D	convection	white

19 A cup of water, a metal spoon and a piece of cork are placed in the fridge and are in thermal equilibrium. Which of the following objects has the final lowest temperature?

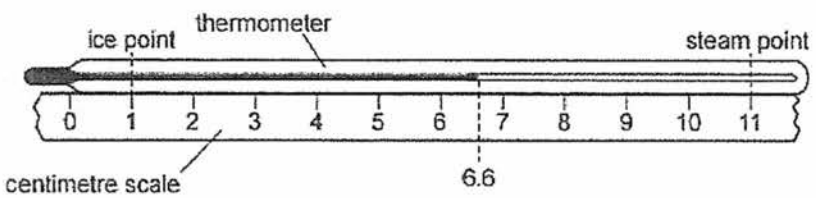
A cup of water

B metal spoon

C piece of cork

D all three items have the same temperature

20 A centimetre scale is fixed next to an unmarked mercury-in-glass thermometer. The ice point and the steam point are marked.



What is the temperature shown on the thermometer?

A 44 °C B 56 °C C 60 °C D 66 °C

21 A man moves towards a plane mirror with a constant velocity of 20 cm/s. The distance between the man and his image in the mirror

A decreases at 20 cm/s

B decreases at 40 cm/s

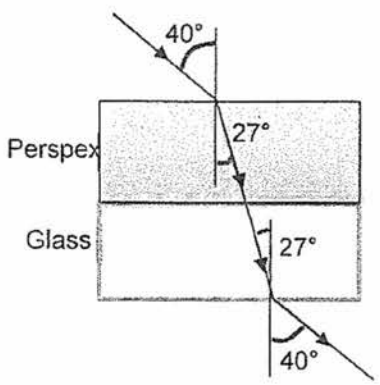
C increases at 20 cm/s

D increases at 40 cm/s

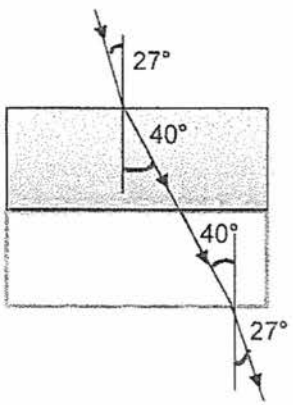
22 Two blocks of glass and perspex are known to have the same refractive index. The speed of light in glass is 2/3 the speed of light in a vacuum.

Which of the following shows the correct path of light through the two blocks?

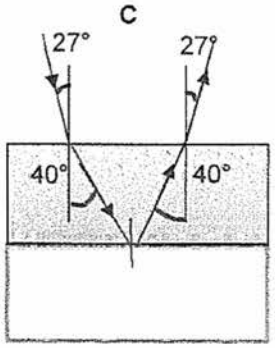
A



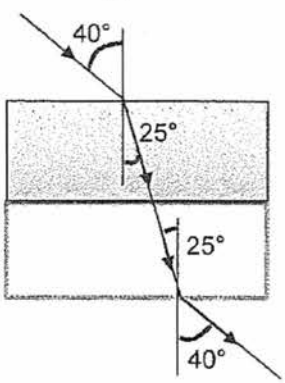
B



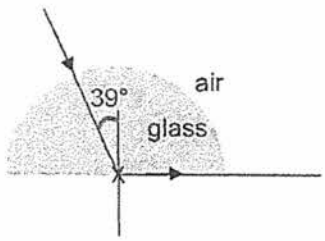
C



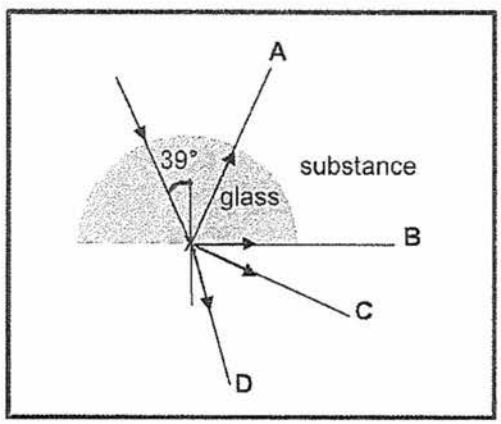
D



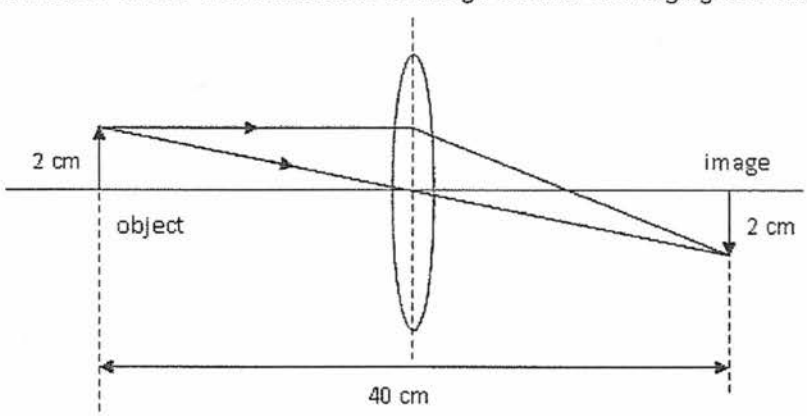
23 A ray of light is incident on a crown glass hemisphere as shown. X is the centre of the hemisphere.



Which of the following shows how the ray of light will travel when the glass is enclosed in a substance of refractive index 1.7?



24 The ray diagram below shows the formation of an image when a converging lens was used.

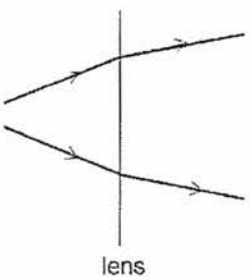


Which of the following object distance will result in a magnified and virtual image?

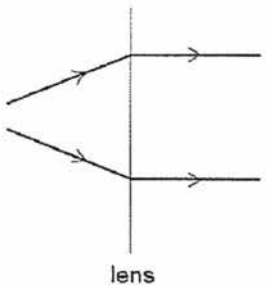
A 8.0 cm **B** 11 cm **C** 19 cm **D** 21 cm

25 Which diagram shows ray of light passing through a diverging lens?

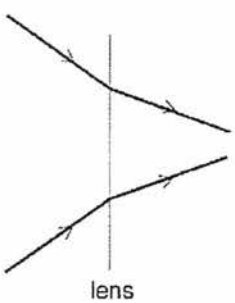
A



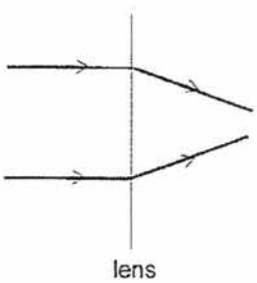
B



C



D



26 Which of the following statement about waves is true?

A They transfer energy with the transfer of particles of matter.

B The frequency of the waves always increases as its wavelength decreases.

C The period of a wave is the time taken for the particles to travel from the maximum positive displacement to the maximum negative displacement.

D None of the above.

27 Fig 27.1 shows a transverse water wave that travels a distance 12 m from X to Y in 1.5 s. A particle O is on the wavefront A.

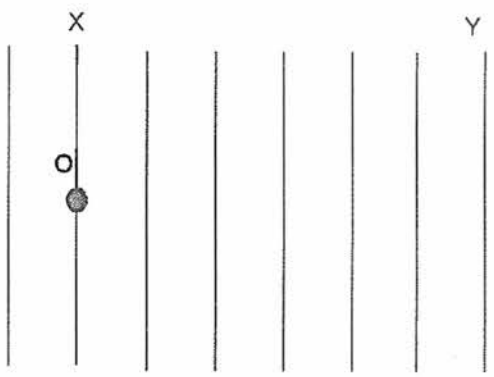


Fig 27.1

Fig 27.2 shows the displacement-distance graph of the same wave, where distance is measured from point X.

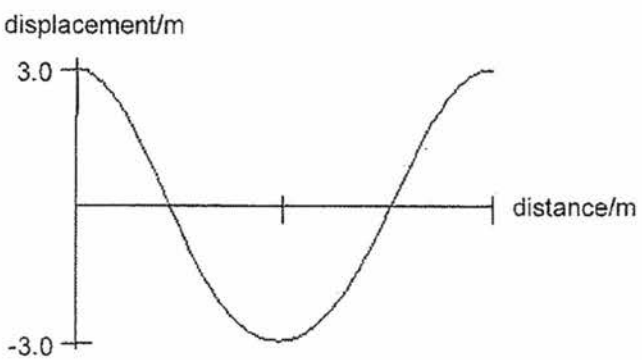
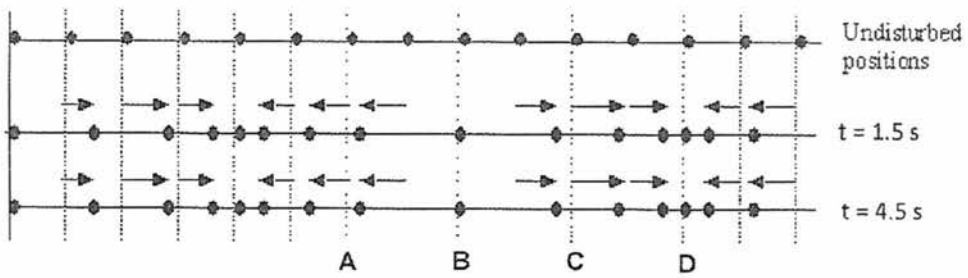


Fig 27.2

What is the displacement of O 0.50 s later from the instant shown in Fig 27.1?

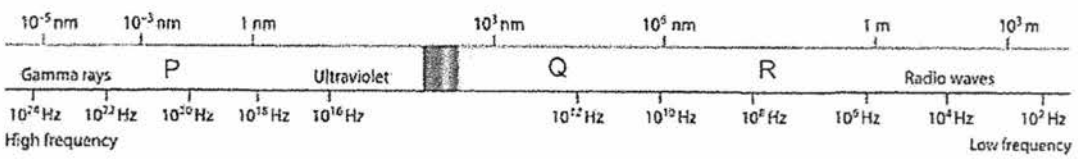
A -3.0 m **B** 0 m **C** 1.5 m **D** 3.0 m

28 The following diagram shows the air molecules in a sound wave with their undisturbed positions at t = 0 s and when the particles are displaced t = 1.5 s and t = 4.5 s later.



Which of the points above will be the location of a centre of compression at t = 15 s?

29 The following EM spectrum shows waves and their various frequencies.



Which of the following shows the EM waves at the correct position of the spectrum?

	P	Q	R
A	infra-red	X-ray	microwave
B	X-ray	infra-red	microwave
C	microwave	X-ray	infra-red
D	microwave	infra-red	X-ray

30 A neutral conducting rod touches a rubber balloon that has been positively charged by friction. Which one of the following shows their final charge?

	rod	balloon
A	neutral	positive
B	neutral	neutral
C	positive	positive
D	negative	positive

31 The following diagram shows a storm cloud. The cloud has lost electrons through friction as it moves. The X charges on the clouds has induced charges Y and Z on the ground.

Y

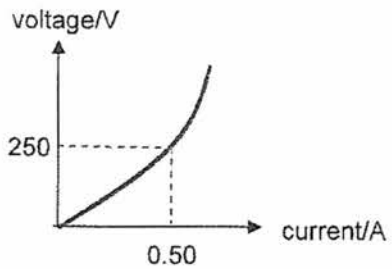
Z

Which of the following shows the charges, X, Y and Z and the direction of a resulting lightning strike?

	X	Y	Z	direction
A	negative	positive	negative	downwards
B	positive	negative	positive	upwards
C	positive	negative	negative	upwards
D	positive	positive	negative	upwards

32 A hand phone battery requires 900 C of charge before it is 100% charged.

The following digram shows the characteristic voltage-current graph of the charging circuit. It initially displays ohmic behaviour at low voltages but its gradient increases as the circuit heats up.



The phone is plugged into a 255 V supply. Which of the following shows the time required to charge the phone to 100%?

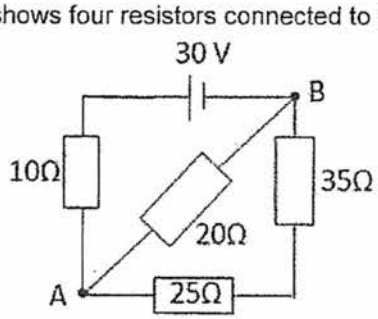
A 1800 s

B 1.8 hours

C slightly more than 1800 s

D slightly less than 1800 s

33 The following diagram shows four resistors connected to a 30 V DC supply.



What is the effective resistance of the circuit?

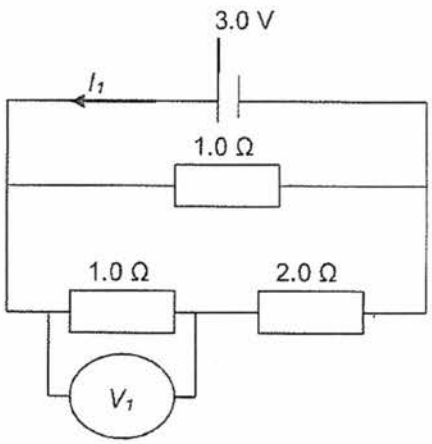
A $\left(\frac{1}{10}+\frac{1}{20}+\frac{1}{60}\right)$

B $\left(\frac{1}{10}+\frac{1}{20}+\frac{1}{60}\right)^{-1}$

C $10+\left(\frac{1}{20}+\frac{1}{60}\right)^{-1}$

D $25+\left(\frac{1}{10}+\frac{1}{20}+\frac{1}{35}\right)^{-1}$

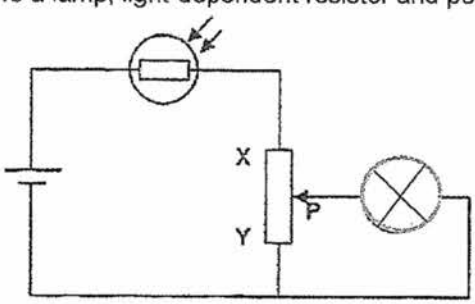
34 Three resistors are connected to a 3.0 V DC supply.



Which of the following shows the value of I_1 and V_1?

	I_1/A	V_1/V
A	1.5	3.0
B	6.0	3.0
C	4.0	3.0
D	4.0	1.0

35 The circuit diagram shows a lamp, light-dependent resistor and potential divider.



Which of the following adjustments will cause the lamp to be the brightest?

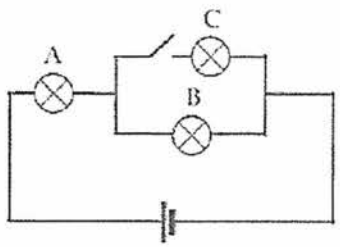
A Light is incident on the LDR and P is moved to X.

B Light is incident on the LDR and P is moved to Y.

C The LDR is covered and P is moved to X.

D The LDR is covered and P is moved to Y.

36 The following diagram shows three identical lamps, A, B and C. What happens to the brightness of lamps A and B when the switch is closed?



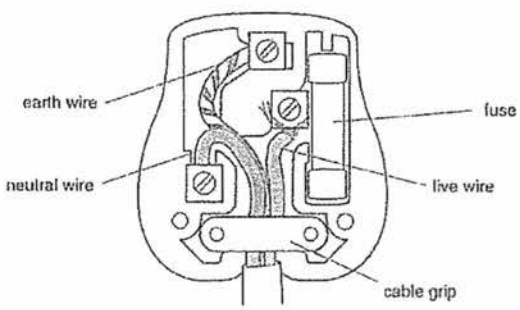
A Brightness of A and B remain the same.

B Brightness of A and B decrease.

C A becomes brighter and B becomes dimmer.

D Brightness of A stays the same, B becomes dimmer.

37 The following shows a three pin plug of a kettle whose live wire has not been connected properly.



The exposed copper wires of the exposed live wire touch the neutral pin. Which of the following will occur?

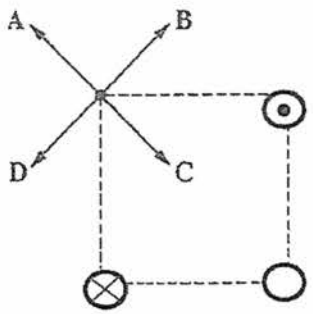
A The metal casing of the kettle will be at high potential and pose an electrocution risk.

B The current increases and the fuse will blow to prevent any electrical fire risk.

C The earth wire will divert the high current to the ground to prevent any electrical risk.

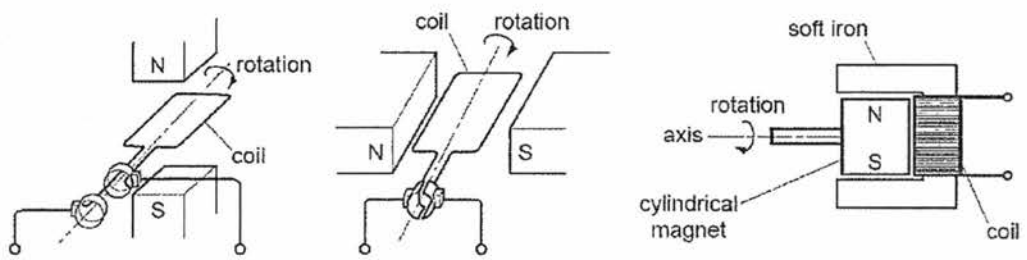
D The neutral wire will divert the high current to the ground to prevent any electrical risk.

38 The following diagram shows the top view of three wires placed at three corners of a square. Two of the wires carry a current while the third does not.



What is the resultant magnetic field at the fourth corner due to the three wires?

39 The following diagram shows three electrical generators.



Which generator(s) provide an alternating voltage?

A X only

B Y only

C X and Y

D X and Z

40 Voltage is stepped up for power transmission so that

A power loss in transmission cables is minimised.

B resistance of transmission wires are reduced.

C current in the transmission wires are increased.

D more power is available to overcome resistance of transmission wires.

-End of Paper-

Scholars & Leaders

ZHONGHUA SECONDARY SCHOOL
Preliminary Examination 2017

CANDIDATE NAME		( )
CLASS		

PHYSICS **5059/2**

Paper 2 Theory **14 September, 2017**

Secondary 4 Express **1 hr 45 minutes**

Set by: **Mr Lawrence Tang and Mrs Ngiam-Fok Kar Yin**

Vetted by: **Mr Tan Jun Hong**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page and on all separate answer paper used.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs 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 all **three** questions, the last question is in the form either/or.

You are advised to spend no longer than one hour on **Section A** and no longer than 45 minutes on **Section B**.

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.

All essential working must be shown clearly.

Where necessary, take acceleration due to gravity, g = 10 m/s^2.

For Examiner's Use	
Section A	
B 12	
B 13	
B 14	
Total	

This document consists of **23** printed pages, including this cover page.

[Turn over

Section A

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

1 Fig. 1.1 shows a man pulling a truck of logs along a level path from P to Q against a resistive (frictional) force.

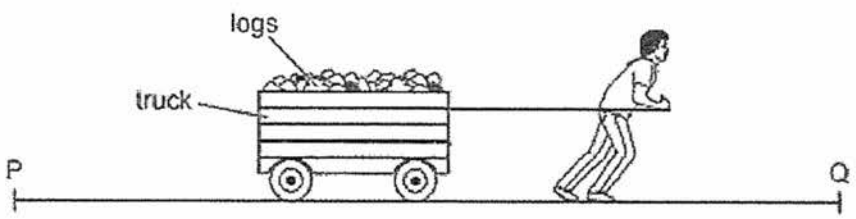


Fig. 1.1

(a) In Fig. 1.1, draw all the forces acting on the truck. Label all the forces clearly. [2]

(b) When the truck is just leaving its initial rest position, state if the pulling force exerted by the man is the same or larger than the resistive force. Explain your answer.

_____

_____ [1]

(c) An accurate value for the force applied by the man is obtained. Describe what measurement is taken and how it is used to determine the average force.

_____

_____ [1]

(d) The man calculates his power when he moves from P to Q.

(i) Apart from the measurement in **(c)** and the distance moved by the truck from P to Q, state the additional quantity that is needed.

_____

_____ [1]

Total marks:	

(ii) State, in words, the equations needed to calculate the man's power.

_____

_____

_____

_____ [2]

2 Fig. 2.1 shows a man travelling on snow using a rocket pack.

Fig. 2.1

Initially, he is at rest and accelerates at a decreasing rate for 10 s. For the next 5.0 s, he travels at a uniform velocity of 8.0 m/s. His rocket pack malfunctions and he decelerates at a decreasing rate for the last 10 s till he comes to a rest.

(a) In the space below, sketch the velocity-time graph of the man.

[2]

(b) Calculate the distance travelled by the man when his velocity is uniform.

distance = _____ [1]

Total marks:	

(c) Explain, in terms of the forces acting, why the acceleration changes for the entire 25 s of his motion.

[3]

(d) The man bends down while he is in motion as shown in Fig. 2.1. He wants to reduce air resistance so he can have a greater acceleration. Explain another possible reason for doing so.

[1]

3 An experiment is conducted to determine the specific latent heat of fusion of ice. Fig. 3.1 shows the set-up. The immersion heater set 1 is connected to a 12 V power supply and the current is 10.0 A. The heater in set 2 is not connected to any power supply.

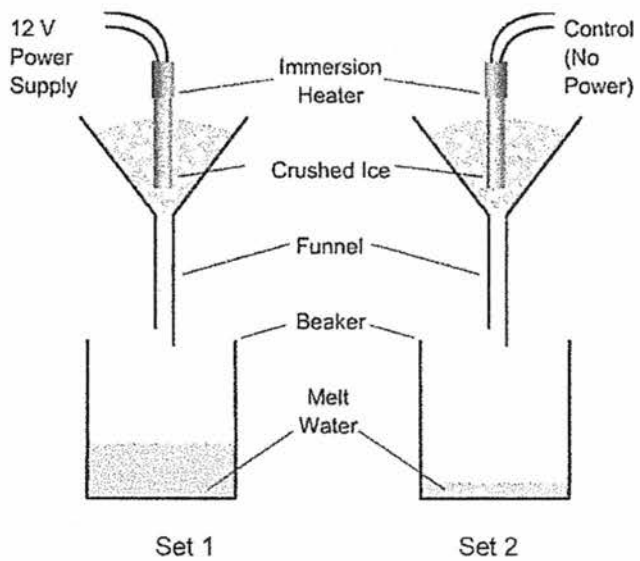


Fig. 3.1

The immersion heater in set 1 is only switched on until water flows at a steady rate from the funnel, for a duration of 5.0 minutes.

Table 3.1 shows the data collected from the experiment after 5.0 minutes.

Total marks:	

Table 3.1

	set 1	set 2
mass of beaker/g	60	60
mass of beaker with water/g	192	85
mass of melted ice/g		

(a) Define *specific latent heat of fusion.*

_____

_____ [1]

(b) Fill in the blanks for Table 3.1. [1]

(c) Set 2 is known as a control set. Explain the purpose of having a control set in the experiment.

_____

_____ [1]

(d) Calculate the heat energy provided by the immersion heater for 5.0 min.

heat energy = _____ [1]

(e) Hence, calculate the ideal value of the specific latent heat of fusion of ice.

specific latent heat of fusion of ice = _____ [2]

Total marks:	

4 Fig. 4.1 shows a container in which coffee is served at an airport kiosk.

Fig. 4.1

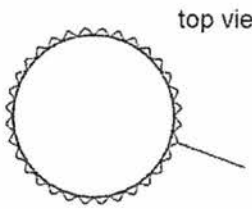


Fig. 4.2

The container itself is made of two layers of cardboard, as shown in Fig. 4.2. It has a thin plastic lid.

(a) State one reason why the layer of corrugated cardboard stops the fingers of the person holding the container from becoming uncomfortably hot.

_____

_____ [1]

(b) Another airport kiosk serves coffee in pottery mugs. The mugs all have the same internal dimensions but some have a high heat capacity and some have a low heat capacity.

When hot drinks are poured into the mugs, the temperature of the drink always drops because of the thermal energy absorbed by the mug.

State which mug, high heat capacity or low heat capacity, causes the least fall in temperature of the hot drink, and explain why.

_____

_____

_____

_____ [2]

Total marks:	

5 A robotic vacuum cleaner uses ultrasonic waves to detect obstacles and avoid them as it cleans the floor.

Fig 5.1 shows how it sends off a pulse of ultrasound and detects the reflected ultrasound (echo) pulse off the obstacle.

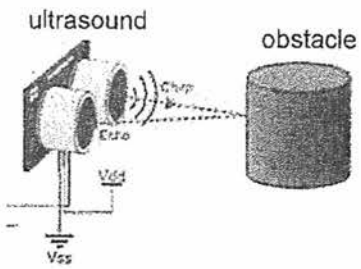


Fig 5.1

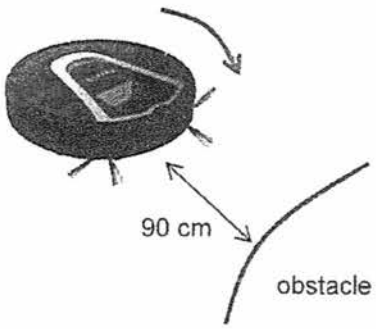


Fig 5.2

Fig 5.2 shows how the robot is programmed to turn right when it detects an obstacle 90 cm away.

(a) Calculate the time interval taken in ms for the robot to detect an object 90 cm away. Assume the speed of ultrasound to be 330 m/s.

time interval = _____ ms [1]

Total marks:	

(b) An engineer uses another ultrasound sensor to check on the actual performance of the robot. The sensor also works by sending a sound wave to the obstacle and recording the time for the reflected pulse to come back. The voltage output of the sensor is connected to an oscilloscope.

In Fig 5.3, pulse A represents the first ultrasound pulse sent out while pulse B represents the echo pulse.

The time-base of the oscilloscope is set at 0.70 ms/cm.

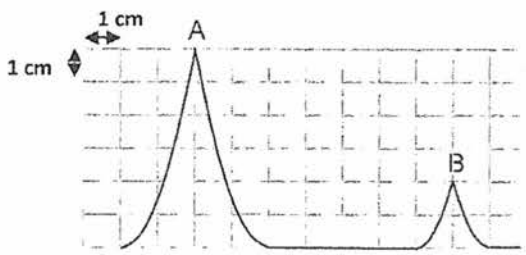


Fig 5.3

Calculate the distance between the robot and the obstacle when it turns if the robot performs based on the oscilloscope results.

distance = _____ [2]

(c) Suggest a possible reason for the difference in the programmed distance of 90 cm and the actual distance in (b). This difference in distance is more evident when the mass of the robot is higher.

_____

_____ [1]

Total marks:	

6 Fig 6.1 shows the experimental setup to obtain the fixed value of a resistor. Fig 6.2 shows how the ammeter reading varies with the voltmeter reading.

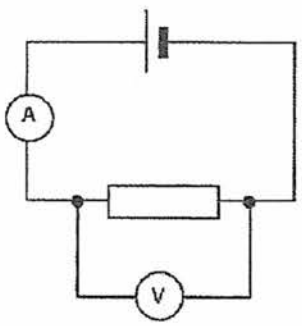


Fig 6.1

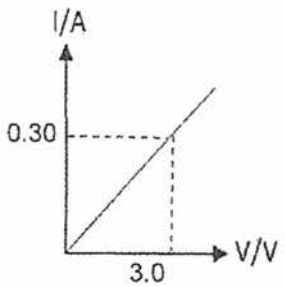


Fig 6.2

(a) Calculate the resistance of the fixed resistor.

resistance = _____ [1]

(b) The resistor is a 2.0 m long constantan wire with a diameter of 0.20 mm. It is replaced with another constantan wire that is 1.0 m long with a diameter of 0.10 mm. The rest of the setup remains unchanged.

Predict the ammeter reading when the voltmeter reading is 3.0 V.

ammeter reading = _____ [2]

Total marks:	

7 Fig 7.1 shows a potential divider circuit with a fixed resistor and a thermistor connected to a 200 V supply. A cooling fan motor is connected across the fixed resistor.

Fig 7.2 shows the resistance behavior of the thermistor as the temperature increases.

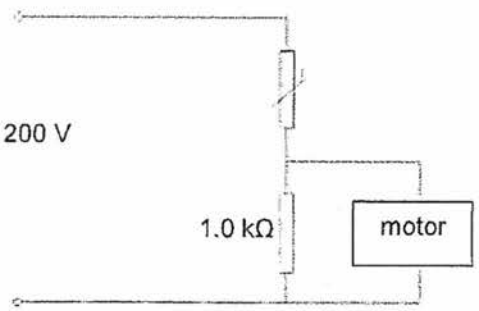


Fig 7.1

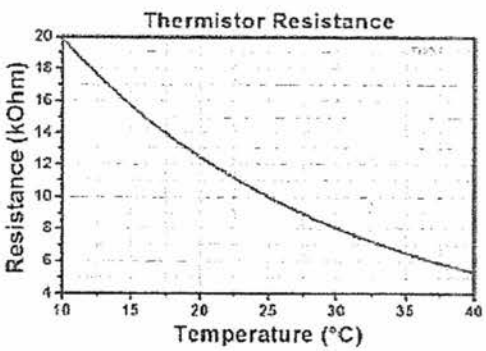


Fig 7.2

(a) Explain how a rise in the ambient temperature will switch on the fan.

_____

_____

_____

_____ [2]

(b) The fan is switched on when the ambient temperature rises to 32.5°C. Calculate the current in the resistors and hence the potential difference of the fan motor when this happens.

current = _____

potential difference = _____ [3]

Total marks:	

8 A kettle rated at 2.0 kW, 240 V is shown in Fig. 8.1. A 1.0 A fuse is used in the kettle.

Fig 8.1 shows how an electrician measures the potential difference across terminals P2 and N1 with a voltmeter. The voltmeter measures a potential difference of 240 V.

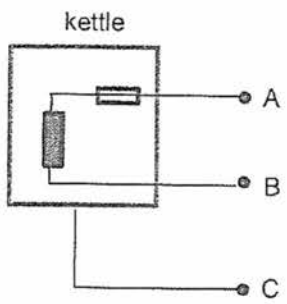


Fig. 8.1

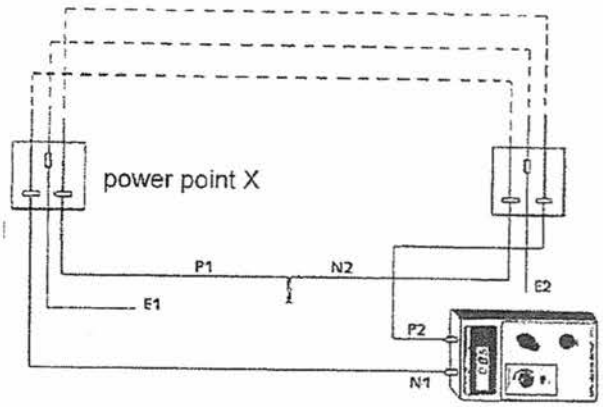


Fig. 8.2

(a) State what is meant by "*the potential difference is 240 V*".

_____

_____ [1]

(b) A kettle in Fig. 8.1 is to be connected to power point X in Fig. 8.2.

(i) Connect points A, B and C to the correct points at power point X in Fig 8.2. Include an open switch in your sketch. [2]

(ii) Describe and explain what would happen to the fuse when the switch is closed.

_____

_____

_____

_____ [2]

Total marks:	

9 Fig 9.1 shows a permanent magnet X hung from a taut string. A permanent magnet Y is placed near it as shown and repels X towards the right.

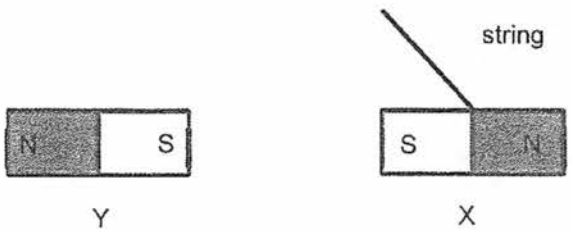


Fig 9.1

(a) Sketch the magnetic lines of force between the two magnets at the instant shown on Fig 9.1. [1]

(b) Explain why magnet X is repelled by Y.

_____

_____ [1]

10 Fig 10.1 shows an electric bell.

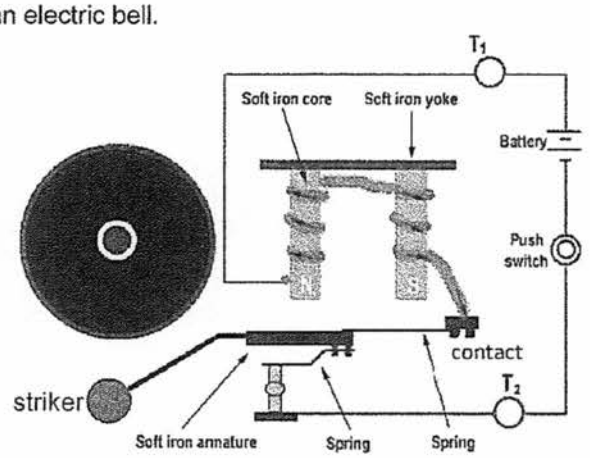


Fig 10.1

(a) Explain how the bell will ring when the push switch is closed.

_____

_____

_____

_____ [2]

Total marks:	

(b) Suggest with a reason what would happen if the armature was made of steel instead of soft iron.

_____

_____ [1]

11 Fig 11.1 shows a torchlight that is lit when its handle is cranked by a hand

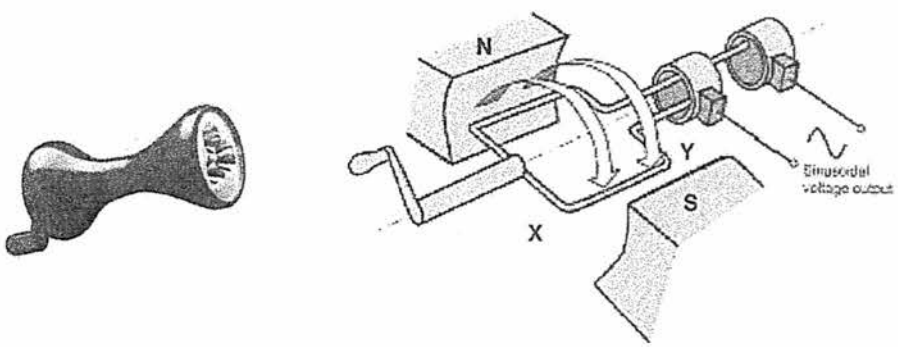


Fig 11.1

(a) State the direction of the current flow in branch XY at the instant shown in Fig 11.1.

_____

_____ [1]

(b) The rotation of the coil when cranked by hand produces a sinusoidal voltage output as shown in Fig 11.2.

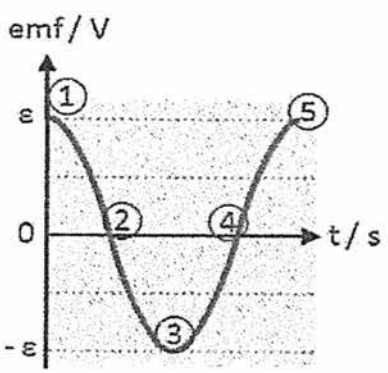


Fig. 11.2

Total marks:	

Explain the change in voltage during each relevant stage (stages 1,2,3,4 and 5) of the coil rotation using Faraday's Law and Lenz's Law.

[3]

(c) Explain using Faraday's Law why the torch shines brighter when the hand cranks the coil at a faster speed.

[1]

Total marks:	

Name: _____ ( )5

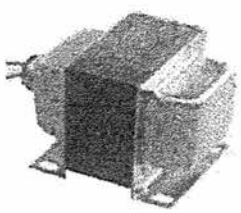
Class: _____

Section B

Answer all **three** questions, the last question is in the form either/or.

Write your answers in the spaces provided on the question paper.

12 Fig 12.1 shows a screenshot of the specifications of a website that sells two models of transformers. Both models have an input power of 20 W (or VA).



MODEL	Pri V	PRI(VAC)	HZ	Sec V	UL MARK	CE MARK	A
2001MWSH	20	240	50/60	24	V	V	1.00"
2011MWSH	20	120	50/60	24	V	V	1.00"

Fig. 12.1

Wei Kang intends to buy a transformer that can be plugged into a typical 240 V three pin power socket. The transformer is meant to be used to power a fish pump that has an input voltage of 24 V.

(a) Explain why a transformer requires an alternating input voltage to work.

_____

_____

_____

_____ [2]

Total marks:	

[Turn over

(b) State the model of transformer Wei Kang should purchase and the normal operating current in the fish pump. Assume the transformer is operating at 100% efficiency.

model = _____ [1]

operating current = _____ [1]

(c) Fig 12.2 shows the representation of one of the transformers.

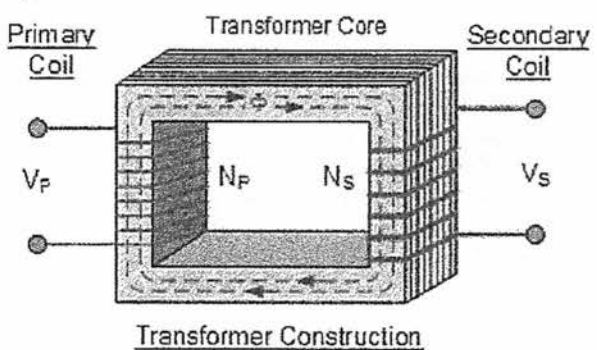


Fig 12.2

(i) Sketch the direction of the current in the primary coil that will produce the magnetic flux shown above. [1]

(ii) Sketch the direction of the current in the secondary coil in the instant shown in Fig 12.2. [1]

(iii) State two ways to increase the secondary voltage.

_____

_____

_____

_____ [2]

Total marks:	

(d) Fig 12.3 shows how the output voltage of a transformer changes over time. The step-down transformer has a turns ratio of 0.10. The input voltage is set at 120 V, 50 Hz.

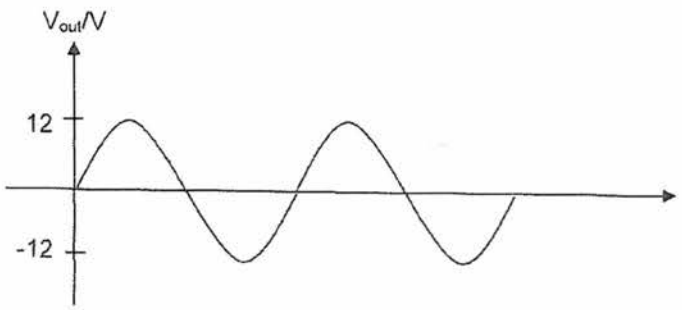


Fig 12.3

An input voltage of 240 V, 100 Hz is now applied across the input terminals of the same transformer. Sketch on Fig 12.3 the new output voltage. [2]

13 Fig 13.1 shows a DC motor that is designed to rotate anti-clockwise. A rheostat is used in the circuit to adjust the motor speed.

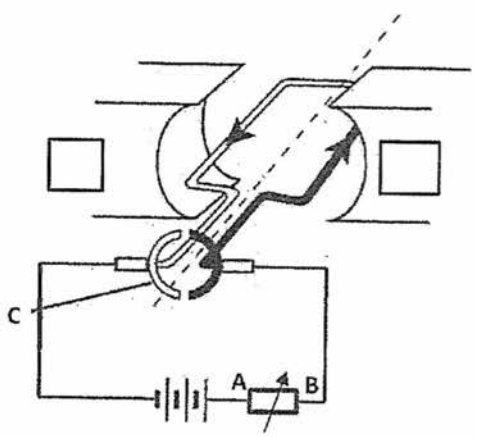


Fig 13.1

(a) Label the two poles of the permanent magnet in Fig 13.1. [1]

(b) Name component C and state its function.

_____

_____

_____

_____ [2]

Total marks:	

(c) Explain how the current causes the coil to rotate.

[3]

(d) Fig 13.2 shows the rheostat that is connected to the DC motor.

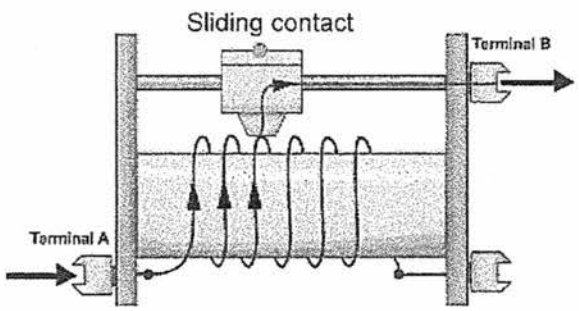


Fig. 13.2

The sliding contact is shifted towards the right.

State and explain the effect of shifting the contact on resistance of the circuit and hence the speed of the DC motor.

[4]

Total marks:	

B14 EITHER

Fig. 14.1 shows a "My Fun Fish Cleaning Tank" that is sold at Toysrus. The product description is as follows, "MY FUN FISH™ —THE AQUARIUM THAT CLEANS ITSELF! Kids and parents alike will love this easy-care, light-up fish tank that works like magic! The secret is gravity clean technology—just pour clean water in; dirty water automatically flushes out from a specially-designed reservoir as fresh water is added. No filters, no cords, and no need to remove fish or decorations from the tank!"

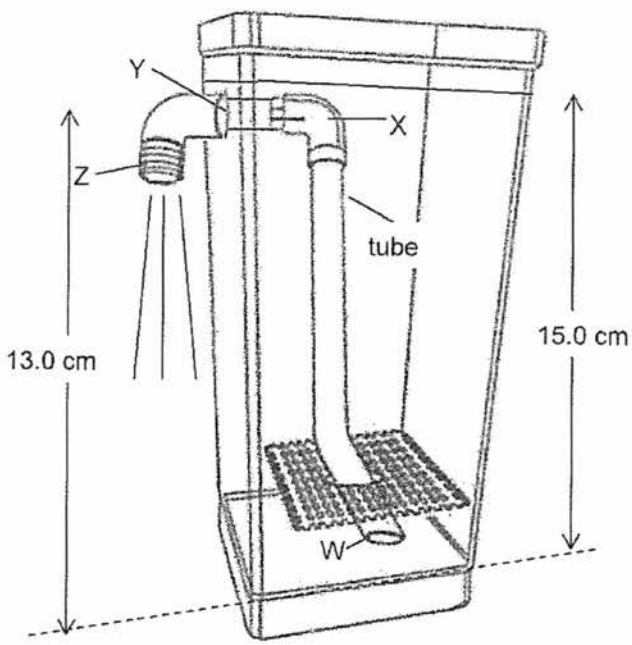


Fig. 14.1

Jessica wants to clean her tank now. She pours in water so that the water level is 15.0 cm from the base of the tank. Dirty water is seen flowing from positions W, X, Y to Z of the tube. Positions X and Y of the tube are at the same vertical height and are 13.0 cm from the base of the tank.

The density of water is 1000 kg/m^3. Atmospheric pressure is 10^5 Pa.

(a) Explain *pressure is 10^5 Pa.*

_____

_____ [1]

Total marks:	

(b) Calculate the pressure at the base of the aquarium when the water level is 15.0 cm from the base of the tank.

pressure = _____ [2]

(c) Explain why water flows out of the tank when the water level is 15.0 cm from the base of the tank. You may use the positions W, X, Y, or Z of the tube to explain your answer.

_____

_____

_____

_____

_____

_____ [3]

(d) State the position of the water level in the tank so that water will just not flow out of the tank.

_____

_____ [1]

Total marks:	

(e) Jessica bought a toy fish that is shown in Fig 14.2. Fig 14.2. is drawn to scale.

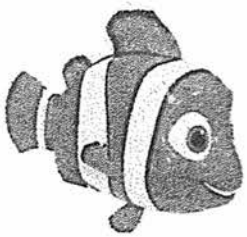


Fig 14.2

Describe an experiment to calculate the density of the toy so that you can determine if the toy will sink or float in the tank when it is filled with water. In your account,

- the apparatus that you are using must be clearly stated,
- state the readings that are taken,
- explain how density in SI units is calculated from the readings.

_____

_____

_____

_____

_____

_____ [3]

Total marks:	

B14 OR

Ailee wanted to lift a uniform slab on a step. She inserted the end of a 2.0 m long non-uniform metal bar under the slab and arranged the system as shown in Fig. 14.3. The weight of the metal bar is 80 N.

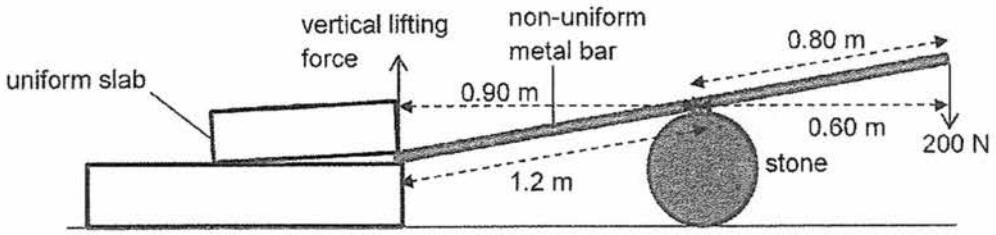


Fig. 14.3

A stone was placed such that the centre of gravity, X of the metal bar was directly above the stone. Ailee just managed to lift the metal bar by exerting a force of 200 N on the end of the bar.

(a) Define *centre of gravity*.

_____

_____ [1]

(b) Describe the other force that is part of the action-reaction pair with the vertical lifting force exerted on the edge of the slab.

_____

_____ [1]

(c) Calculate the vertical lifting force exerted on the edge of the slab.

lifting force = _____ [2]

(d) Calculate the force of the stone on the bar.

force = _____ [1]

Total marks:	

(e) Calculate the weight of the uniform slab.

weight = _____ [1]

(f) Suggest a way for Ailee to lift the stone slab with a force that is less than 200 N. Explain your answer.

_____

_____

_____

_____ [2]

(g) Ailee wanted to verify that the centre of gravity of the metal bar is 0.80 m from the right end of the bar.

Describe an experiment to determine the exact location of the centre of the gravity of the bar. In your account,

- set-up must be drawn and clearly labelled,
- explain how Ailee can conclude that the centre of gravity is indeed 0.80 m from the right end of the bar.

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-End of Paper-

Scholars & Leaders

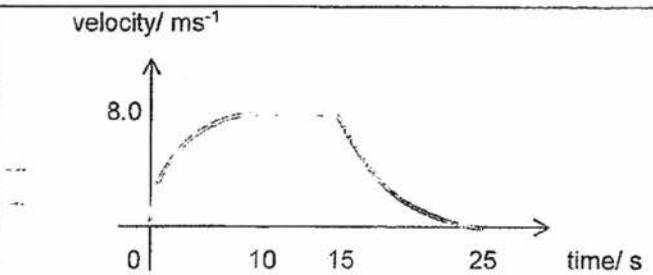
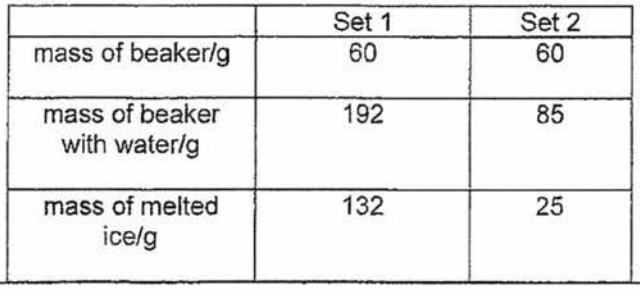
Total marks:	

[Turn over

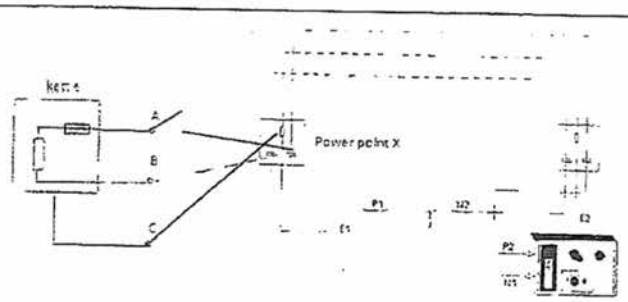
ZHSS 2017 SEC 4E 5059 Preliminary Exams

EOY Paper 1 MCQ Solutions 2017							
1	B	**11**	A	**21**	B	**31**	B
2	C	**12**	D	**22**	D	**32**	D
3	B	**13**	B	**23**	D	**33**	C
4	A	**14**	A	**24**	A	**34**	D
5	C	**15**	C	**25**	C	**35**	A
6	C	**16**	B	**26**	D	**36**	C
7	D	**17**	D	**27**	D	**37**	B
8	B	**18**	B	**28**	B	**38**	C
9	A	**19**	D	**29**	B	**39**	D
10	A	**20**	B	**30**	A	**40**	A

Section A

Qn	Answer	Marks
1a	• Normal reaction force • Weight • Friction • Tension (force of logs on truck)	0.5 M for each ans. Round down
1b	Pulling force is larger than friction so that net force is needed to accelerate load.	1
1c	Attach a newton balance to the rope to measure force.	1
1di	Time taken for the truck to move from P to Q.	1
1dii	• Work done by man = Force applied by man × distance between P and Q • Power = work done by man / time taken for the truck to move from P to Q	1 1
2a		1 m: shape; 1 m: x and y values
2b	distance = 8 × 5 = 40 m	1
2c	• Initial 10 s: F_{net} = uniform forward force – increasing air resistance = ma Therefore net force is decreasing. • Next 5 s: uniform forward force = air resistance. Net force is zero. • Last 10 s: 0 – decreasing air resistance = ma Therefore net force is negative and decreasing	1 1 1
2d	Increase stability due to lower centre of gravity OR To ensure that the force exerted by the rocket pack has a larger horizontal component so that the push force is greater	1
3a	Heat required to melt 1 kg of ice to water at same temperature.	1
3b		1

	Set 1	Set 2
mass of beaker/g	60	60
mass of beaker with water/g	192	85
mass of melted ice/g	132	25

3c	Heat energy supplied by the surroundings to melt the ice can be determined.	1
3d	Heat energy = VIT = 12 × 10 × 5 × 60 = 36 kJ	1
3e	energy = ml_v 36 000 = (132 – 25) × l_v l_v = 336 J/kg = 336000J/kg	1m: diff in mass 1
4a	• Air within the gaps is a poor conductor of heat from the cup to the fingers OR • The cardboard is a poor conductor of heat from the cup to the fingers.	1
4b	• Low heat capacity cup. • Less heat energy is absorbed from the drink to lower the temperature by 1 ^{0}C.	1 1
5a	Time interval = distance/speed = (2 X0.90) / 330 = 5.45 X 10^{-3} = 5.5 ms	1
5b	Distance = speed X time time = ½ (7 X 0.70) ms = 2.45 ms Distance = speed X time = 330 X 2.45 X 10^{-3} = 0.81 m	 1 1
5c	A higher mass leads to a higher inertia. When the robot is programmed to stop (or wheels stop moving), the higher inertia makes the robot harder to stop and it continues to travel, hence distance to obstacle is less (0.81 m instead of ideal 0.90 m)	1
6a	R = V/I = 3.0 /0.30 = 10 Ω	1
6b	New resistance = Old R X ½ X 4 = Old R X 2 = 20 Ω (½ L → ½ R and ½ diameter → ½ A → 4R) Ammeter reading = V/R = 3/ 20 = 0.15 A	1 1
7a	R_{therm} decreases as temperature increases V_{therm} decreases as $V_{therm} = R_{therm}/R_{total}$ X emf $V_{1k\Omega}$ and hence V_{motor} increases as V_{motor} = emf – V_{therm}.	1 1
7b	From graph, at 32.5°C, R_{therm} = 7.0 kΩ (accept up to 7.2 kΩ) I = emf / R_{total} = 200 / 8000 = 0.025 A $V_{motor} = IR_{1k\Omega}$ = (0.025)(1000) = 25 V	1 1 1
8a	The work done needed to bring a unit charge across two points is 240 J	1
8bi		1 m for switch 1 m for connections

8bii	Normal operating current, I = P/V = 2000/240 = 8.3 A 8.3 A is higher than 1 A fuse, fuse will blow.	1 1
9a		1
9b	Forces of repulsion between two S poles are stronger than forces of attraction between S and N poles.	1
10a	Current flow magnetizes two soft iron core The two cores induces opposite poles at the armature and attracts it Causing striker to hit bell (this will break the contact and stop the magnetization of the core and the arm will spring back to close the contact and repeat the cycle)	1 1
10b	Steel is not easily magnetized hence the core may not be magnetized fast enough and arm may have a delay time in striking bell OR Steel is not easly demagnetized and after current is cut off, the striker will remain at bell.	1
11a	Y to X (Use Fleming's Right Hand Rule)	1
11b	emf is maximum at Stages 1, 3 and 5 as coil is horizontal and rate of change of magnetic flux is maximum (Faraday's Law) emf is zero at stages 2 and 4 as coil is vertical and rate of change of magnetic flux is minimum. emf changes direction as each branch is connected to the same slip ring and when each branch changes its direction of motion, the current will also change direction so as to produce an opposing magnetic field. (Lenz's Law)	1 1 1
11c	The magnitude of emf increases as the coil experiences a greater rate of change of magnetic flux whe it rotates faster.	1

SECTION B

Qn	Answer	Marks
12a	A changing magnetic flux produced by an alternating voltage is needed for a transformer to change voltage/ so that an emf can be induced in the secondary coil	1 1
12b	Model 2001 (it uses 240 V) Current I = P/V = 20/24 =0.83 A	1 1
12ci	Current flowing right in primary coil (N pole at top pf primary coil using Right Hand Grip Rule)	1
12cii	Current flowing right (Right hand grip rule, produce A N pole at top to oppose pri coil magnetic field)	1

12ciii	Increase V_p, increase N_S, decrease N_p (any 2)	2
12d	V_p (120 V to 240 V) is doubled, hence V_s is doubled. When frequency is doubled (50 Hz to 100 Hz), Vs is doubled and frequency of Vs is also doubled. Overall, Vs is X 4 (V_{out} = 48 V) and frequency is doubled.	 1 1
13a	S N	1
13b	Split ring commutator – changes direction of current every half a revolution so coil can rotate continuously.	1 1
13c	Current in coil produces a magnetic field This field interacts with the permanent magnetic field to produce a force at each branch These two forces at two branches produces a moment to rotate coil	1 1 1
13d	The slider moves right and <u>increases the R length</u> Since R = ρ L/A, <u>R increases</u> and <u>current deceases</u> the magnetic field due to the current and <u>force decreases</u> hence <u>speed of rotation decreases</u>	1 1 1 1
14a	10^5 N of force is exerted per unit area.	1
14b	$P = h\rho g + 10^5$ $= 0.15 \times 1000 \times 10 + 10^5$ = 102 000 Pa	 1 1
14c	• pressure at X is greater than Y • pressure at Y = P_{atm} • pressure at X = P_{atm} + water pressure due water to 2.0 cm of water	1 1 1
14d	When the water level is the tank is 13.0 cm from the base.	1
14e	• mass is determined by using an electronic balance • volume is measured using displacement can and measuring cylinder • density = mass in kilogram divided by volume in cubic metre	1 1 1
14a	The Center of Mass/Gravity of an object is the point where the whole weight of the object appears to act for <u>any orientation of the object.</u>	1
14b	Force of slab on bar	1
14c	Force × 0.9 = 200 × 0.6 Force = 133 N	1 1
14d	Force = 133 + 80 + 200 = 413 N	1
14e	If the stone slab is 1.0 m wide, Weight × 0.5 = 133 X 1 Weight = 266 N	1

14f	• shift the stone to the left of the bar • the anticlockwise moment provided by the force of slab on bar will decrease. For the clockwise moment to decrease too, the force applied by Ailee will decrease, with a longer perpendicular distance between force and the pivot.	1 1
14g	• using a string, hang the bar at a distance of 0.80 m from the right end of the bar • if the bar is horizontal, the cg is at the pivot. The moments provided by the weight of the bar is zero.	1 1