Name: Register Number: Class:

For Marker's Use

南僑中學

NAN CHIAU HIGH SCHOOL
PRELIMINARY EXAMINATION TWO 2017
SECONDARY FOUR EXPRESS

PHYSICS **5059/01**

Paper 1 Multiple Choice **15 September 2017**
Friday

1 hour

Candidates answer on the OTAS.

INSTRUCTIONS TO CANDIDATES

Write your name, class and register number in the spaces provided at the top of this page.

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 OTAS.

Each correct answer will score one mark.

The total marks for this paper is 40.
g = 10 N/kg on earth

1. Which of the following pairs of physical quantities have the same unit?

A weight and mass

B force and acceleration due to gravity

C moment and torque

D terminal velocity and acceleration

2. Fig. 2.1 shows part of the vernier scale on a pair of vernier calipers when no object was placed between the jaws. Fig.2.2 shows the same vernier calipers when the diameter of a rod was measured.

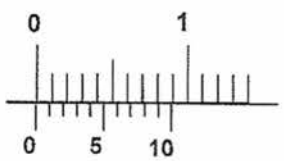


Fig. 2.1

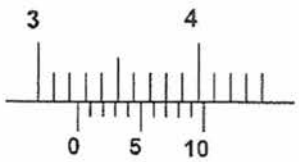


Fig. 2.2

Which is the correct reading of the diameter of the rod?

A 3.35 cm

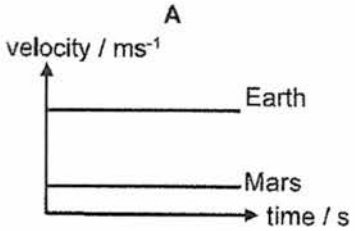
B 3.27 cm

C 3.28 cm

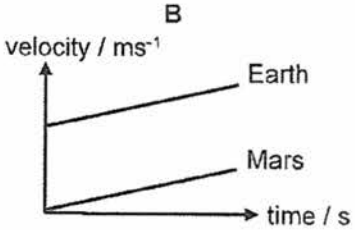
D 3.29 cm

3. When a stone is dropped on Earth, it accelerates constantly at about 10 m/s^2. When the same stone drops on Mars, it accelerates constantly at about 2.0 m/s^2. Which graph best describes the rock motion?

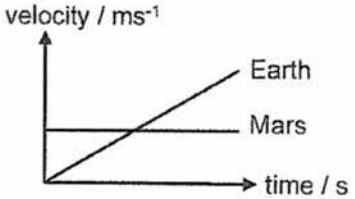
A



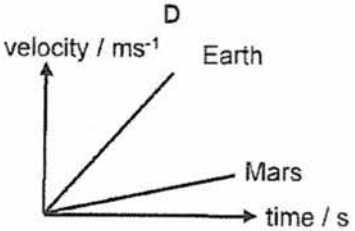
B



C



D



4. A car of mass 700 kg is capable of exerting a maximum engine force of 5000 N. When travelling along a typical road, it has a maximum acceleration of 5.0 m/s^2. What is the total resistive force acting on the car?

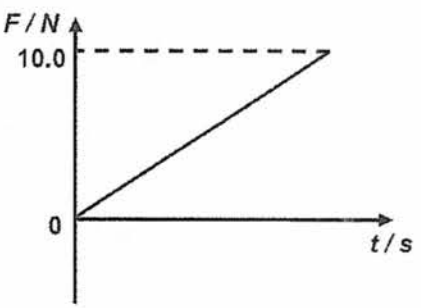
A 36 N

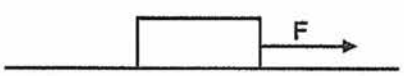
B 1500 N

C 3500 N

D 5000 N

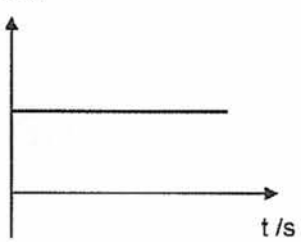
5. The diagram below shows a wooden block initially at rest on a smooth horizontal surface. A pulling force F acting on the wooden block varies as shown in the graph.



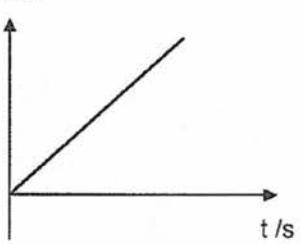


Which graph best describes the motion of the wooden block?

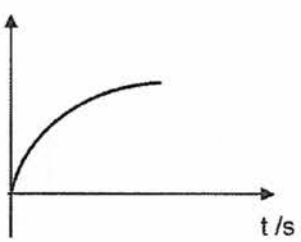
A



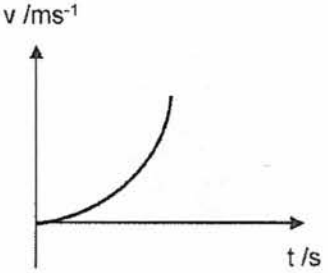
B



C

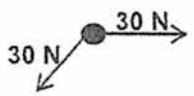


D

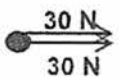


6. Two forces of 30 N act simultaneously on a body. Which of the following would produce the smallest resultant force?

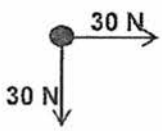
A



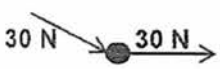
B



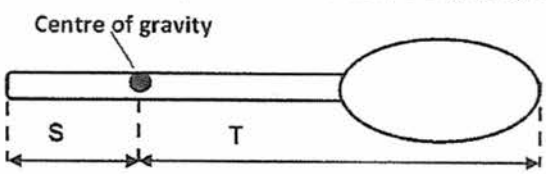
C



D



7. The diagram below shows the position of the centre of gravity of an object made of different material.



Which of the following statements about the object is ***not*** **correct**?

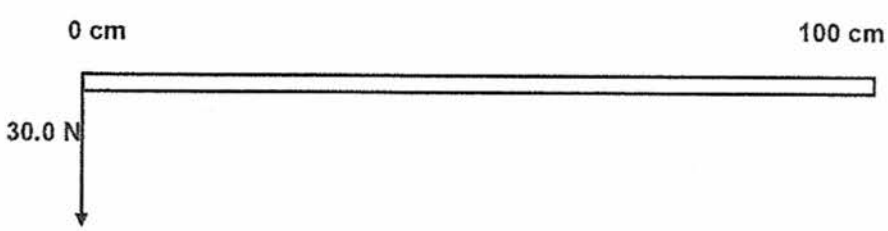
A The weight of the object acts through the centre of gravity.

B The spoon can be balanced by placing a knife edge at the centre of gravity.

C The mass of part **S** of the spoon is more than that of part **T**.

D The mass part **S** of the spoon is equal to that of part **T**.

8. The diagram below shows a uniform metre ruler with a weight of 10 N, under the action of a vertical force of 30.0 N.



At what mark must a fulcrum be placed to hold the ruler in equilibrium?

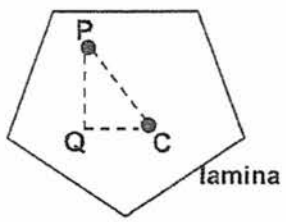
A 12.5 cm

B 16.7 cm

C 25.0 cm

D 37.5 cm

9. A flat lamina is freely suspended from point **P**.
The weight of the lamina is 4.0 N and the centre of mass is at **Q**.

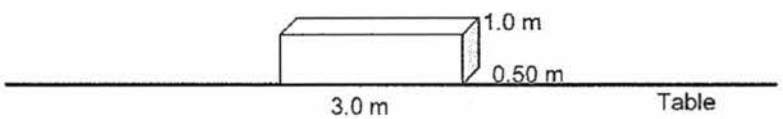


PC = 0.50 m
PQ = 0.40 m
QC = 0.30 m

What is the moment due to the weight of lamina that will cause the lamina to swing?

A 0 N m
B 1.2 N m
C 1.6 N m
D 2.0 N m

10. An object of mass 4.0 kg with a length of 3.0 m, width of 0.50 m and height of 1.0 m is placed on a table as shown in the diagram below.



What is the pressure exerted by this object on the table?

A 0.33 Pa
B 2.7 Pa
C 1.3 Pa
D 27 Pa

11. Which of the following **incorrectly** shows the thermometric property of the thermometer?

	Thermometer	Thermometric property
A	Mercury-in-glass thermometer	Volume of a fixed mass of liquid varies with temperature.
B	Thermocouple	Electromotive force between two junctions at different temperature varies with the temperature difference across the junctions.
C	Constant-volume gas thermometer	Volume of a fixed mass of gas varies with temperature.
D	Resistance thermometer	Resistance of a piece of conducting wire varies with temperature.

12. Illuminated smoke particles, suspended in air, are viewed under a microscope. They are seen to move randomly. Which of the following best describes the movement of the smoke particles?

A The smoke particles are moving due to the energy gained from the illuminated light.

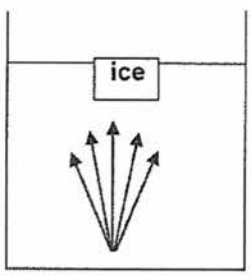
B The smoke particles are moving about due to convection currents.

C The smoke particles are bombarded continuously by the air molecules.

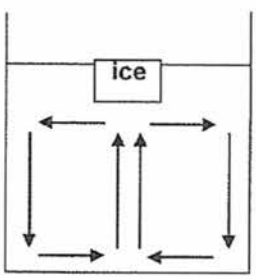
D The smoke particles are moving due to bombardment by other smoke particles.

13. An ice cube is placed in a beaker of water at the top of the surface. Which figure below best shows the convection currents form in the water?

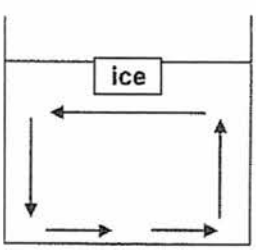
A



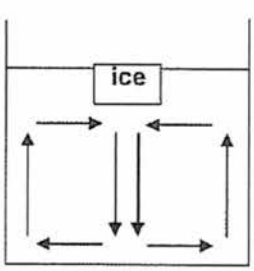
B



C



D



14. Which of the following in the table correctly shows examples of transverse and longitudinal waves?

	Transverse	**Longitudinal**
A	Gamma-rays	Sound
B	Infra-red	Water waves
C	Radio	Light
D	Sound	X-rays

15. Which of the following statement(s) about electromagnetic waves is/are *correct*?

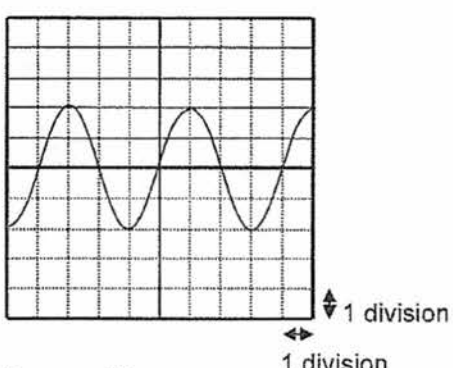
I All electromagnetic waves travel at 3.0×10^8 m/s in vacuum.

II All electromagnetic waves travel faster in air than in water.

III All electromagnetic waves have magnetic field around them.

A II only
B I and II only
C II and III only
D I, II and III

16. The diagram below shows oscilloscope trace of sound picked up by the microphone. The Y-gain is set at 2 V per division and the time base is set at 50 ms per division.



What is the frequency of the sound?

A 0.040 Hz
B 0.13 Hz
C 5.0 Hz
D 10 Hz

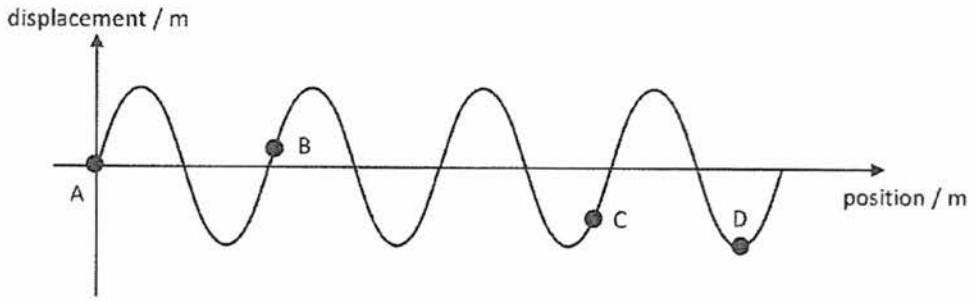
17. Two notes of different pitch but the same loudness are played on a musical instrument. The two sound waves produced will have

A same frequency and different speed.
B different frequency and different speed.
C different frequency and same speed.
D different speed and same amplitude.

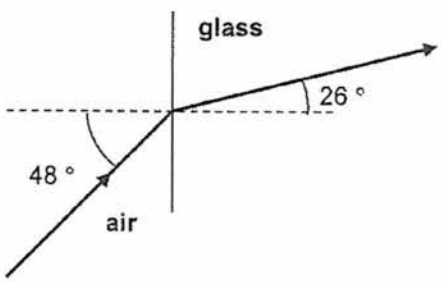
18. Which of the following is the approximate range of audible frequency for human?

A 1 Hz to 20 Hz
B 20 Hz to 20 kHz
C 20 kHz to 200 kHz
D 1000 kHz to 20 000 kHz

19. The graph below shows the displacement of particles on the wave against position. Which particle has the highest speed?



20. A ray of light travels from air into glass as shown below.

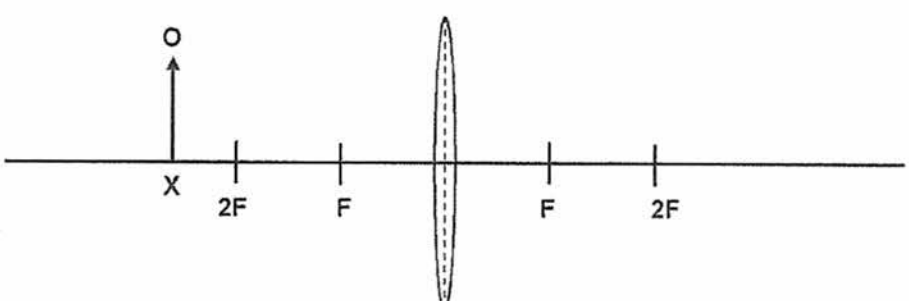


Given that the refractive index of air is 1.00, what is the refractive index of glass?

A 1.21 B 1.34

C 1.53 D 1.70

21. The diagram below shows a convex lens used to produce an image of an object **O** when it is placed at X.

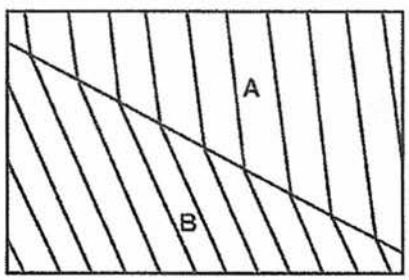


What of the following best described the image produced by object **O**?

A real and diminished B real and magnified

C virtual and diminished D real and same size as object

22. The diagram below shows water waves travelling from region **B** to region **A**.



Which of the following statements is **true**?

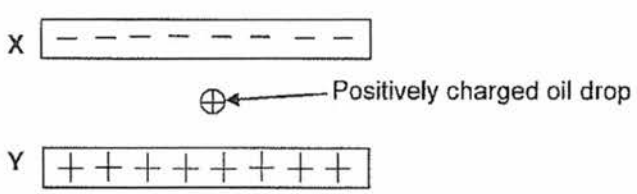
A The frequency of the waves in region **A** is smaller than in region **B**.

B The direction of the waves has changed because of the change in speed.

C Region **B** is deeper than region **A**.

D The speed of the waves in region **A** is slower than in region **B**.

23. A positively charged oil drop stays stationary between two charged metal plates **X** and **Y** as shown in the diagram.



What happen if the potential of plate Y is increased?

A The oil drop will remain stationary.

B The oil drop will move downwards.

C The oil drop will move upwards.

D The oil drop will move in circular motion.

24. A lightning strike was discharged in 1.2×10^{-4} s with a charge of 700 C that travels from the cloud to a building.

What is the number of electrons that travels from the cloud to the building?
(Each electron carries 1.6×10^{-19} C)

A 4.1×10^{6}

B 6.3×10^{18}

C 4.4×10^{21}

D 2.7×10^{25}

25. A current of 2.0 A passes through a cell of e.m.f 6.0 V.
What is the electrical energy supplied by the cell in 3.0 s?

A 1.0 J

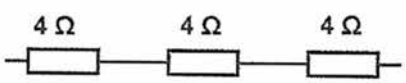
B 4.0 J

C 9.0 J

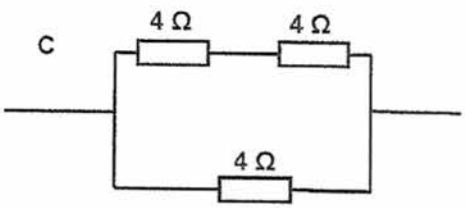
D 36 J

26. Three 4.0 Ω resistors are connected as shown below. Which of the following connections gives the lowest effective resistance?

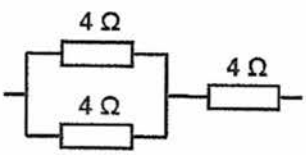
A



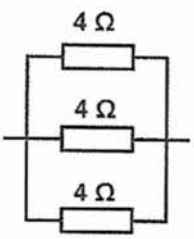
C



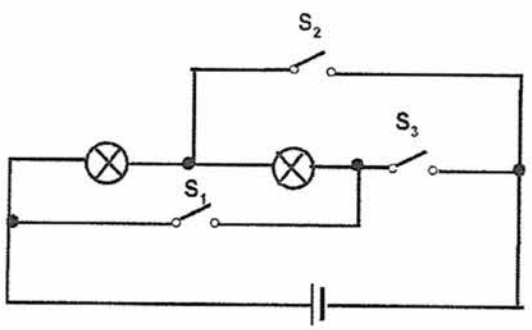
B



D



27. Two identical light bulbs and three switches S_1, S_2, and S_3 are connected together to a battery in
the circuit shown below.



To connect the two bulbs together in parallel, which switch/es should be closed?

A S_1

B S_1, S_2

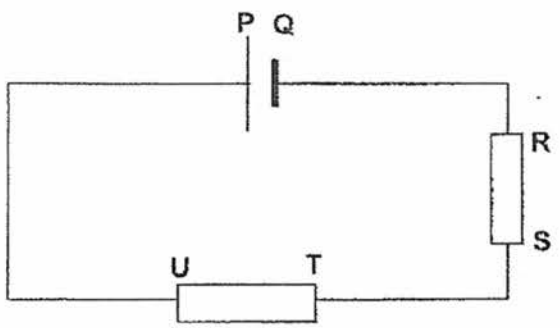
C S_2

D S_2, S_3

28. A piece of wire **X** that is made of a certain material has a resistance of 16 Ω. What is the resistance of another piece of wire **Y** of the same material with half the diameter and twice the length of wire **X**?

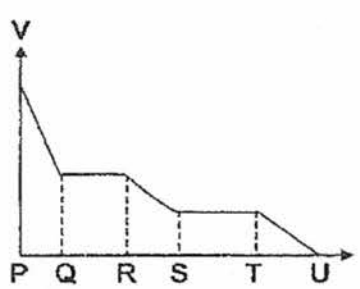
A 2.0 Ω
B 12 Ω
C 32 Ω
D 128 Ω

29. The diagram shows two resistors connected in series to a cell with wires of negligible resistance. The ends of the cell and resistors are marked **P**, **Q**, **R**, **S**, **T** and **U** correspondingly.

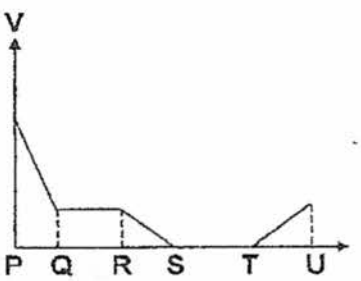


Which of the following graphs correctly shows how the potential, *V*, vary in the regions **PQRSTU**?

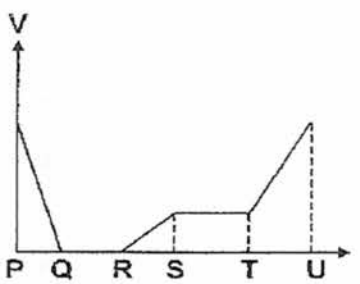
A



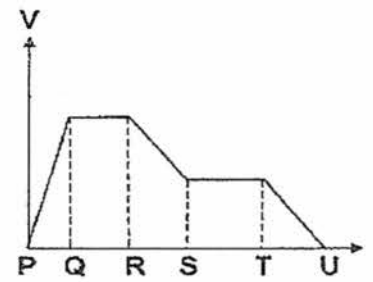
B



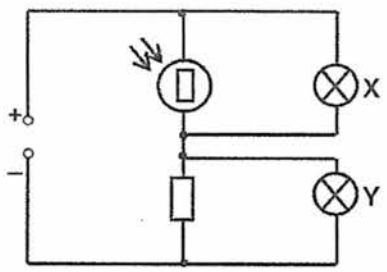
C



D



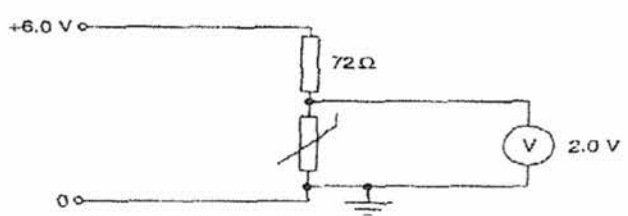
30. The diagram below shows an electrical circuit consisting of an **LDR**, a fixed resistor and two identical light bulbs connected to a power supply.



What will happen to the brightness of bulb **X** and **Y** when the light incident on the LDR decreases?

	Bulb X	Bulb Y
A	brighter	dimmer
B	brighter	brighter
C	dimmer	brighter
D	dimmer	same

31. A thermistor is connected in series with a 72 Ω resistor across a constant 6.0 V power supply. When the temperature of the thermistor is 30 °C, the potential difference across it is 2.0 V.



What is the resistance of the thermistor at 30 °C?

A 28 Ω **B** 36 Ω

C 108 Ω **D** 148 Ω

32. Four 200 W lamps and two 120 W fans are switched on for 8 hours.

What is the total cost if the energy consumption is 15 cents per kWh?

A $ 0.15 **B** $ 1.25

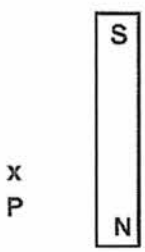
C $ 3.84 **D** $ 12.48

33. Two identical lamp each is labelled 230 V, 100 W are connected to a 230 V mains supply in series.

What is the current flowing through each lamp?

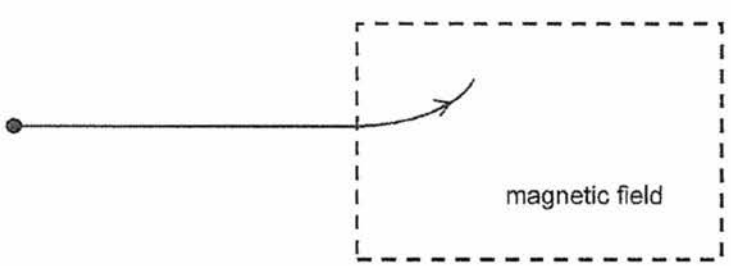
A 0.22 A
B 0.43 A
C 0.87 A
D 2.3 A

34. The diagram below shows a bar magnet.



Which of the following best represents the orientation of the compass at P if the magnetic field of the Earth is neglected?

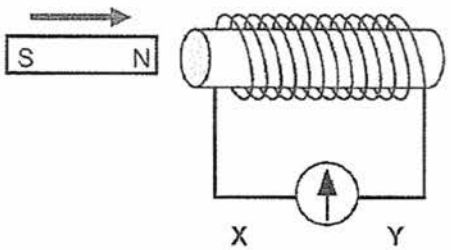
35. An electron enters a region with a magnetic field. It is deflected upwards as shown in the diagram below.



What is the direction of the magnetic field in the region?

A into the plane of paper
B out of the plane of paper
C upwards
D downwards

36. A small coil is connected to a galvanometer as shown below.



When the magnet is allowed to move towards the coil, the current flows

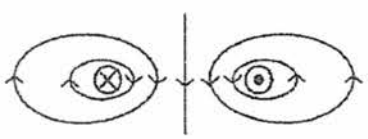
A momentarily from X to Y
B continuously from X to Y
C momentarily from Y to X
D continuously from Y to X

37. Each of the diagrams below is a cross-section through two parallel current-carrying conductors. Which diagram correctly shows the magnetic field pattern formed by the currents in the two conductors?

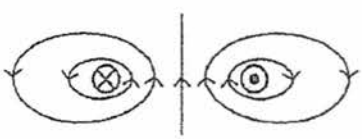
A

B

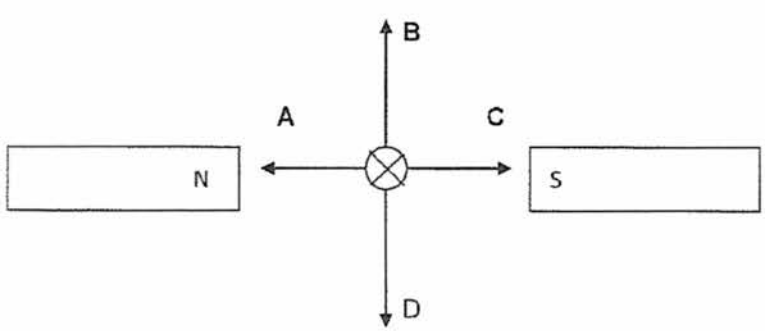
C



D



38. The diagram below shows an induced current flowing through a conductor while it is moving between two magnets. Which arrow indicates the direction of movement of the conductor?



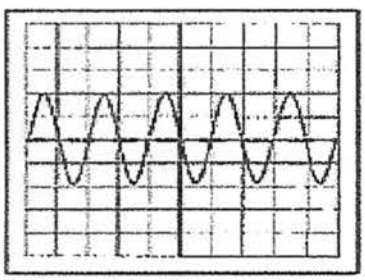
39. In the primary coil of a transformer, the current flowing through it is 2.5 A. The turn ratio of the transformer is 2.0 and the voltage in the secondary coil is given to be 100 V.
What is the power in the secondary coil if this is an ideal transformer?

A 50 W
B 125 W
C 250 W
D 500 W

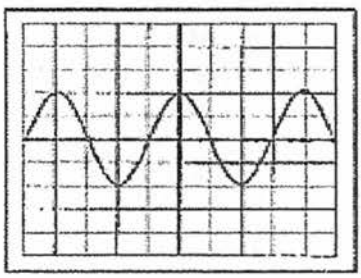
40. A cathode-ray oscilloscope (c.r.o.) is connected to a supply of amplitude 4.0 V and frequency 25 Hz. The time-base on the horizontal axis is set at 10 ms per division and the Y-gain on the vertical axis is set at 1.0 V per division.

Which of the following traces is obtained from the supply?

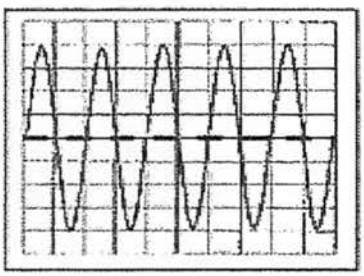
A



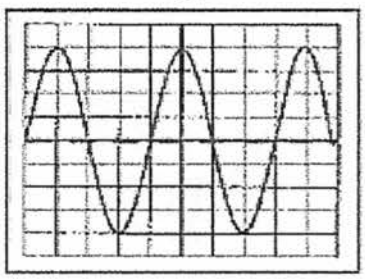
B



C



D



Name: Register Number: Class:

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南僑中學

NAN CHIAU HIGH SCHOOL
PRELIMINARY EXAMINATION TWO 2017
SECONDARY FOUR EXPRESS

PHYSICS **5059/02**

Paper 2 Theory **14 September 2017**
Thursday

1 hour 45 minutes

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

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (50 marks)
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B (30 marks)
Answer **all** questions. Question 12 has a choice of parts to answer.

Candidates are reminded that **all** quantitative answers should include appropriate units.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.
The number of marks is given in brackets [ ] at the end of each question or part question.

The total marks for this paper is 80.
g = 10.0 N/kg on earth

Setter: Teo Tai Wei

This paper consists of **20** printed pages including the cover page

Section A

Answer **all** the questions in this section.

1. Fig. 1.1 shows a light bulb of weight 15.0 N suspended at rest by two wires **X** and **Y** from the ceiling in a radio studio.

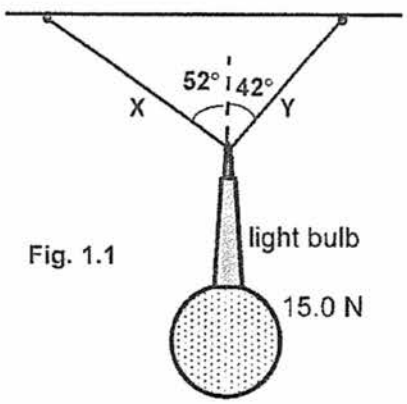


Fig. 1.1

Use an appropriate scale vector diagram to determine the magnitude of the tension of wire **X** and tension of wire **Y**. **[3]**

2. Fig. 2.1 shows an object of mass 500 g moving up a rough inclined plane. The object moves from **A** with an initial velocity of 9.00 m/s up the inclined plane to **B** and comes to a rest in 1.2 s. The horizontal distance between point **A** and **B** is 3.9 m.

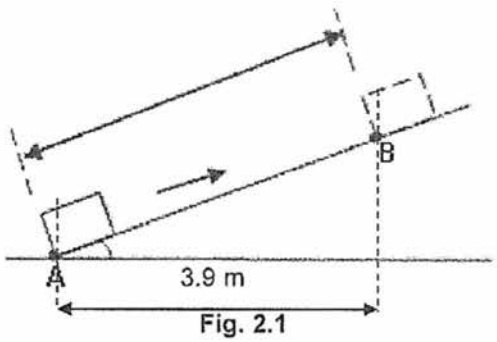


Fig. 2.1

(a) Calculate the distance **AB** along the inclined plane. [1]

(b) Calculate the

(i) gain in gravitational potential energy of object at **B**. [2]

(ii) loss in kinetic energy as it travels from **A** to **B**. [1]

(c) Suggest why the gain in gravitational potential energy is not equal in magnitude as the loss in kinetic energy of the object when moving the distance **AB**. [1]

3. (a) Fig 3.1 shows a stone drop at a certain height freely from rest near the surface of Earth. (Neglecting air resistance)

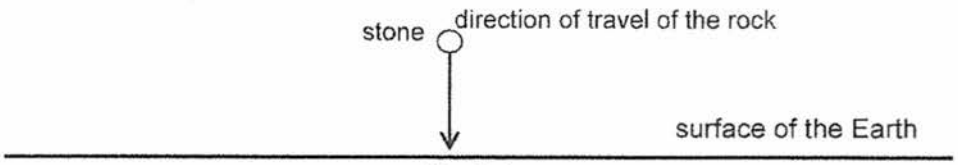


Fig. 3.1

On the axes given in Fig. 3.2, sketch the

(i) graph of the gravitational potential energy, label it as **P**, of the stone against time, t, just before it hits the ground. **[1]**

(ii) graph of the kinetic energy, label it as **K**, of the stone against time, t, just before it hits the ground. **[1]**

The graphs drawn should clearly show the relationship between them.
[no numerical value is required for the graphs]

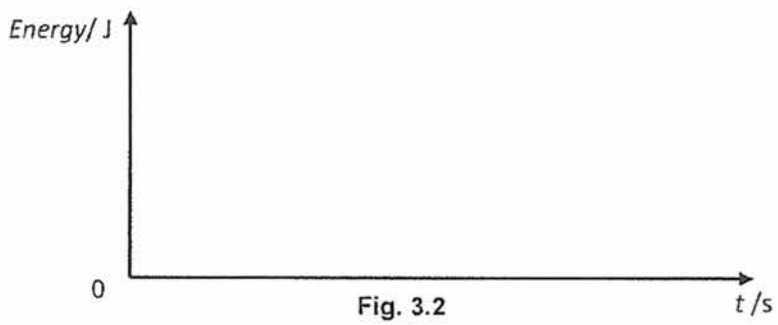


Fig. 3.2

(b) Fig. 3.3 shows a person hitting a billiard ball **X** on a smooth table. The billiard ball **X** will move straight and hit another ball **Y** at a velocity **v** m/s and come to a stop instantaneously while the ball **Y** will move forward at a certain velocity.

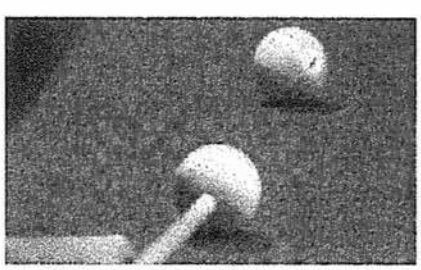


Fig. 3.3

Given that the mass of the ball **X** is larger than ball **Y**, state and explain if the velocity of ball **Y** be greater than, equal or less than **v** m/s. **[2]**

_____

_____

_____

4 (a) Fig. 4.1 shows a simplified form of the hydraulic press, also known as a force multiplier. The small piston has a cross-sectional area of 30.0 cm^2 and the large piston has a cross-sectional area of 0.15 m^2. An applied force, 4.0 N, is acting on the small piston to maintain the position of the load shown.

(Neglect the weight of the pistons and the hydrostatic pressure variation.)

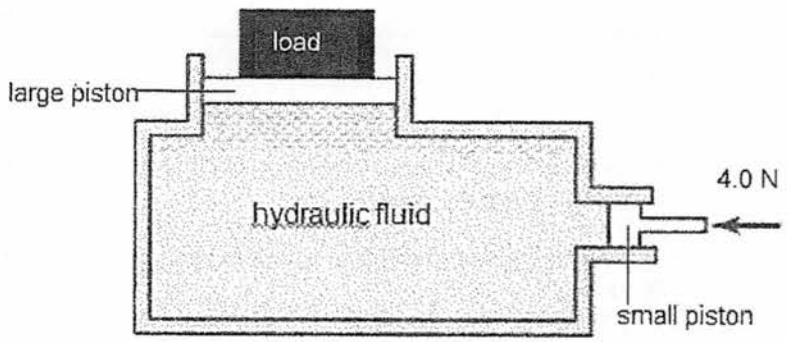


Fig. 4.1

(i) Calculate the weight of the load. **[2]**

(ii) State, if any, to the motion of the large piston is the cross-sectional area of large piston is increased while the weight is still as what is calculated in (i). **[1]**

(iii) Suggest why the hydraulic press will not function well if the fluid is changed into air. **[1]**

(b) Fig 4.2 shows the landscape of a mountain. The reading of a mercury barometer at the foot of the mountain is 76.0 cmHg.

On point **P** of the mountain, its reading drops to 70.0 cmHg. The density of mercury is 13 600 kg/m^3 and the density of air is 1.23 kg/m^3.

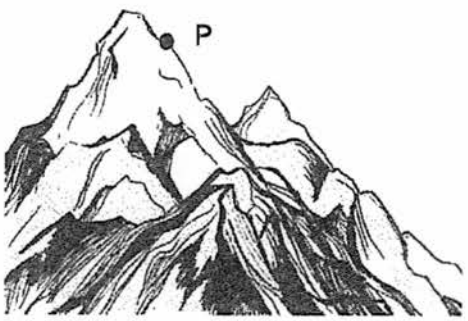


Fig. 4.2

(i) Calculate the height of the mountain. **[3]**

(ii) Water is heated up at point **P**. State and explain if the water is able to boil at 100 °C. **[2]**

5. A student used the set-up as shown in Fig. 5.1 to study the pressure *P* and volume **V** of a fixed mass of gas inside an elastic flask **A** at various thermodynamic temperatures *T*.

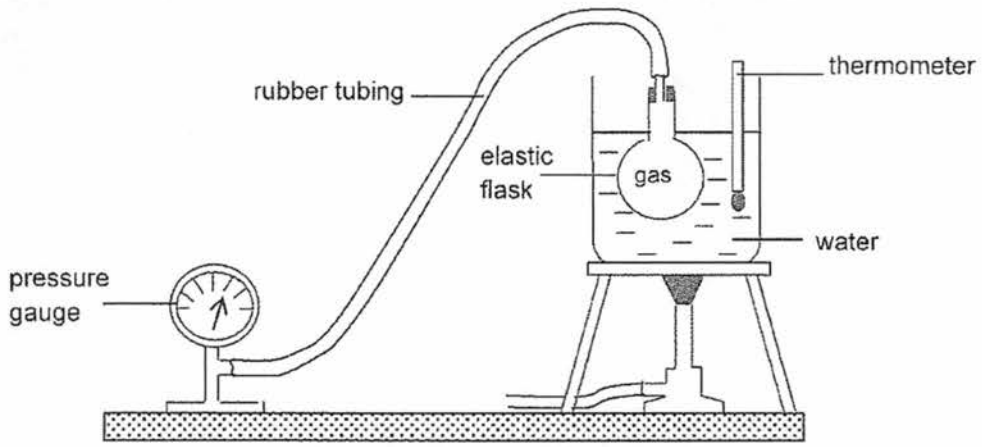


Fig. 5.1

The student's tabulated readings of *P* and *T* are shown in Fig. 5.2 below.

T / K	293	323	337	371
P / kPa	90	85	80	78
V / cm^3	40	42	45	47

Fig. 5.2

(a) Explain why the relationship between the pressure and volume of the gas is inverse when the temperature of the gas increases. **[2]**

(b) If the elastic flask is changed into a glass flask, state and explain, in terms of the kinetic theory of particles, what happens to the pressure of gas when the temperature of the gas increases. **[3]**

6. Fig. 6.1 shows a transverse wave on a rope that travels from right to left at a frequency of 5.0 Hz. The instance shown is taken to be at time t = 0 s. Particles **A**, **B** and **C** are found on the rope as shown. The horizontal distance between particle **A** and **B** is 5.5 cm.

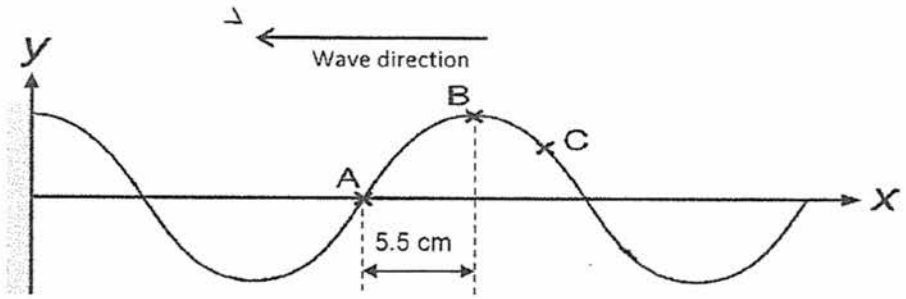


Fig. 6.1

(a) State what is a transverse wave. [1]

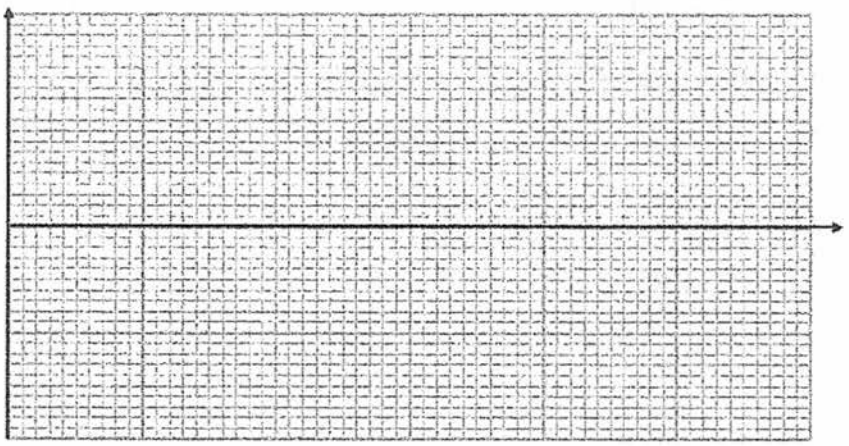
(b) In Fig. 6.1, indicate with arrow, to show the direction of the motion of the particle **C** at the next instant. [1]

(c) (i) Calculate the period of the wave. [1]

(ii) Calculate the speed of the wave. [1]

(d) Sketch on Fig. 6.2 the displacement against time graph of particle A for one complete oscillation. [2]

Fig. 6.2



7 A diamond, refractive index of 2.4, has an excellent cut where it has the shape shown at the sectional view in Fig. 7.1 with a certain percentage of the build to be the crown and pavilion. This cut allows light rays falling on the diamond to be reflected multiple times inside the diamond. A light ray is also shown emitting from the diamond at an angle 50° about the surface of the diamond.

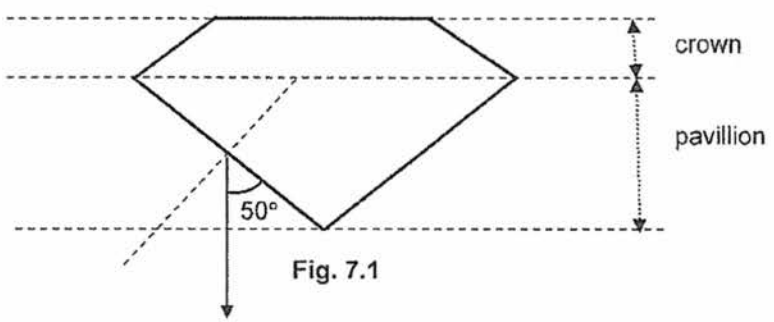


Fig. 7.1

(a) Suggest how does the cut of diamond allow light rays to be reflected multiple times. [2]

(b) (i) Calculate the critical angle of the diamond. [2]

(ii) Calculate the angle of incidence for the light ray that emits from the diamond shown in Fig. 7.1. [2]

8. Fig.8.1 shows a negative charged metal plate **X**, an uncharged metal plate **Y** and a connection to earth. Plate **X** and Plate **Y** are on insulating stands.

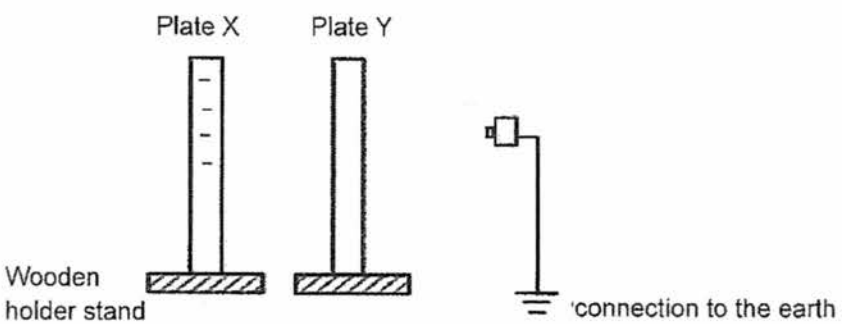


Fig. 8.1

(a) Define electrostatic induction. [1]

(b) With the aid of the items shown in Fig. 8.1, describe clearly the steps to attain a positive charged plate **Y**. [3]

(c) Suggest the need for the holder stand to be wooden. [1]

_____

_____

9. Fig. 9.1 shows a circuit with an e.m.f supply of 15.0 V. All the resistors in the circuit are identical with resistance of 10.0 Ω each.

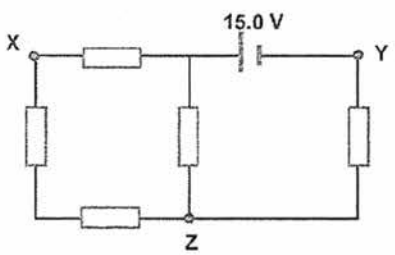


Fig. 9.1

(a) (i) Calculate the effective resistance of the whole circuit shown in Fig. 9.1. [2]

(ii) Calculate the current supplied by the battery. [2]

(iii) Determine the potential difference between point **X** and **Y**. [2]

(b) Determine the effective resistance of the whole circuit if a wire is used to connect point **X** and **Z**. [1]

Section B

Answer **all** the questions in this section.
Answer only one of the two alternative questions in **Question 12.**

10. Fig. 10.1 shows a space rocket being launch from a lunch pad at sea level. The space rocket has rocket boosters and main engines that helped the shutter to blast off from the Earth. It is said that a rocket must reach a breaking speed in order to escape from Earth. Fig. 10.2 shows information on the data about the launch. In the space after the rocket escapes, the rocket exhaust is propelling the rocket forward

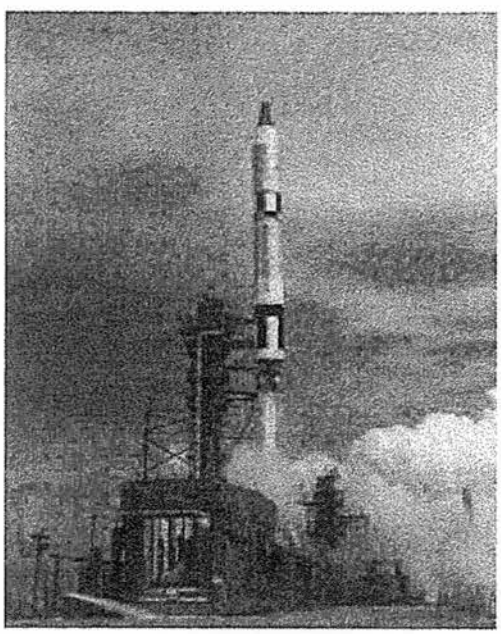


Fig. 10.1

Altitude (height) of the rocket at the escape speed just before it hit the outer space (assuming uniform acceleration)	825 000 m
Mass of space shuttle	22 700 kg
Breaking speed	11 000 m/s

Fig. 10.2

(a) Assumptions:
1) the mass of the space rocket is the same throughout the launch.
2) uniform acceleration

(i) Determine the time taken for the rocket to reach breaking speed. **[2]**

(ii) Determine the vertical acceleration of the rocket. [2]

(iii) Calculate the upward thrust of the rocket. [2]

(b) "In the space after the rocket escapes, the rocket exhaust is propelling the rocket forward. " Explain, using the concept of forces, what this sentence means. [2]

(c) In reality, during launching, the space rocket will burn solid fuel that is inside the fuel compartment. Once the compartment is empty, the compartment will be detached from the main body. State how this affects the acceleration and the velocity of the rocket. [2]

11 Cappuchino is an Italian, coffee-based drink prepared with espresso (a type of coffee), steam milk and milk foam. To make steamed milk, hot steam is passed into the cold milk to heat up the milk. Fig. 11.1 shows a machine where hot steam is passed into the milk.

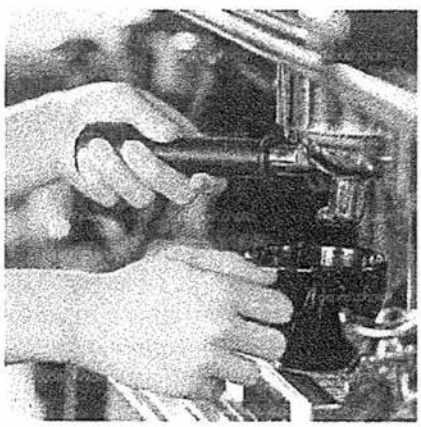


Fig. 11.1

Table 11.1 and 11.2 shows some of the specific heat capacities for different substances. You may assume that milk and water have the same specific heat capacity.

Substances	Specific heat capacity / J kg $^{-1}$ °C $^{-1}$
Glass	837
Ice	2090
Water	4200
Steam	2010

Table 11.1

Substance	Melting point / °C	Specific latent heat of fusion / J kg $^{-1}$	Boiling point / °C	Specific latent heat of vaporization /J kg $^{-1}$
Water	0.0	3.3×10^5	100	2.26×10^6

Table 11.2

(a) Define the term specific heat capacity of a substance. [1]

(b) Suggest why the value of the specific latent heat of vaporisation is higher than the specific latent heat of fusion of water. [1]

(c) 300 g of milk is poured into a 100 g of glass container. With the aid of the information from Table 11.1 and 11.2,

(i) calculate the thermal energy required to warm the 300 g of milk in a 100 g of glass container from 20 °C to 55 °C. [2]

(ii) if hot steam of initial temperature 120 °C is used to warm the 300 g of milk in a 100 g of glass container instead, calculate the minimum mass of steam required to heat the milk and the container from 20 °C to 55 °C. [2]

(d) A person suggested to use a 10.0 kW heating lamp to heat up a cup of milk as shown in Fig. 11.2. However, he found that this process of heating up 250 g of milk in the 150 g of glass container from 20 °C to 40 °C is only 5.0 % efficient.

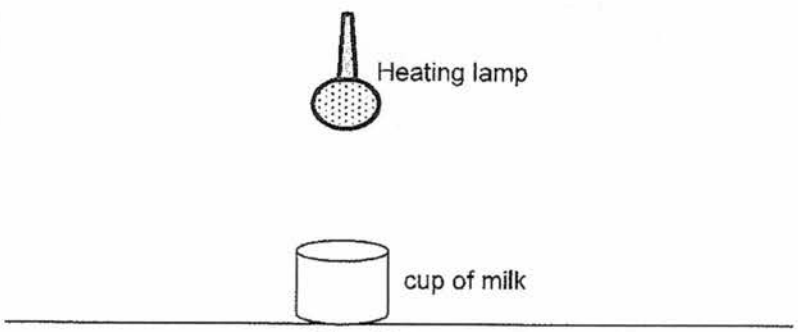


Fig. 11.2

(i) State the main mode of thermal transfer from the heating lamp to the cup of milk. [1]

(ii) Suggest a reason for the low efficiency. [1]

(iii) Calculate the time required to warm the milk in (d) using the heating lamp. [2]

12. EITHER

A student builds a motor which consists of a coil **ABCD**, two metal rings and two magnets. The two ends of the coil are soldered to the two metal rings as shown in Fig. 12.1.

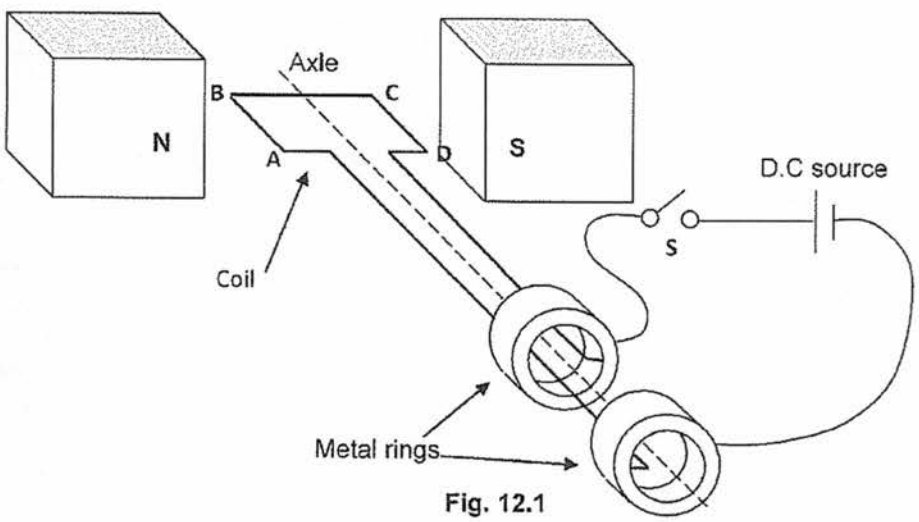


Fig. 12.1

(a) **(i)** Fig. 12. 1 shows the front view of the design of the motor. On Fig.12.1, draw the direction of the force acting on wire parts **AB** and **CD** when switch **S** is closed. **[1]**

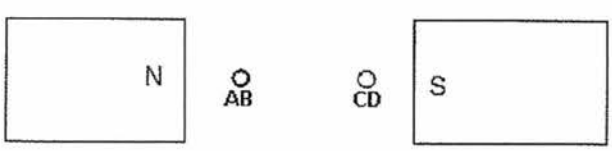


Fig. 12.2

(ii) Hence, state the direction in which the motor turns when switch **S** is closed. **[1]**

(iii) It is observed that due to momentum, the coil moves to the position as shown in Fig. 12.3. On Fig. 12.3, draw the direction of the force acting on wire parts **AB** and **CD**. **[1]**

Fig. 12.3

(iv) There is a fault with the design of this motor set up by the student. Explain what is wrong with the set up. [1]

(v) State a solution and explain briefly how it can help to rectify the motor's design. [2]

(b) Fig. 12.4 shows two towers that support a single cable of total length 20.0 km, which links a factory to the electrical grid. The voltage at the tower A is at 6000 V while the voltage at the factory is at 5500 V.

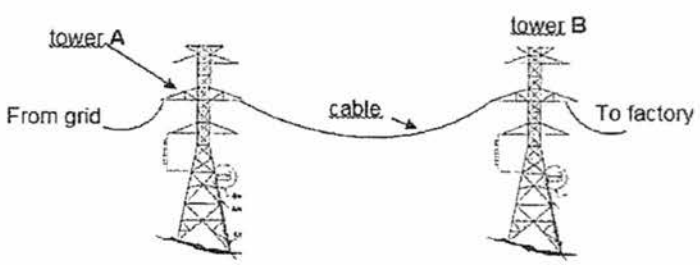


Fig. 12.4

The cable used is made from aluminium which has a resistance of 3.6 Ω per 1.0 km.
Calculate the

(i) power loss in the cable. [2]

(ii) cost of the power loss for a day given that 1 kWh costs $0.15. [2]

OR

(a) Fig. 12.5 shows an experimental set-up where a copper ring is fitted loosely over an iron core that has been placed inside a solenoid that is connected to a D.C supply.

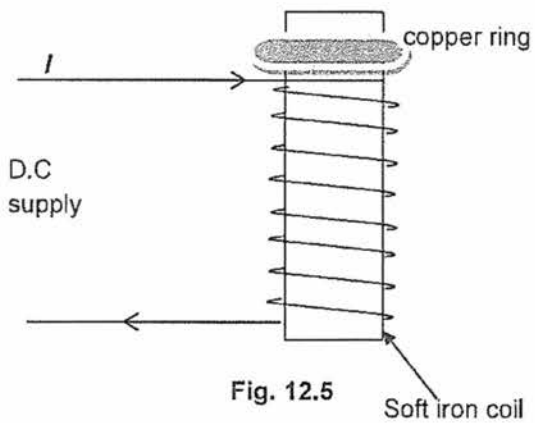


Fig. 12.5

Fig. 12.6

(i) At the instant when the switch is closed, state what happen to the ring. [1]

(ii) Explain the observation stated in (a)(i). [3]

(iii) State what will happen to the copper ring at the instant when the switch is closed if the current flows in the opposite direction in the coil. [1]

(iv) State what will happen if the solid copper ring is now replaced with a slit copper ring as shown in Fig.12.6 at the instant the switch is closed. [1]

(b) Fig 12.7 shows an ideal transformer connected to an a.c. input voltage of 240 V. The transformer has 2000 turns in Primary coil and 100 turns in Secondary coil. A current of 8.0 A flows in the secondary coil.

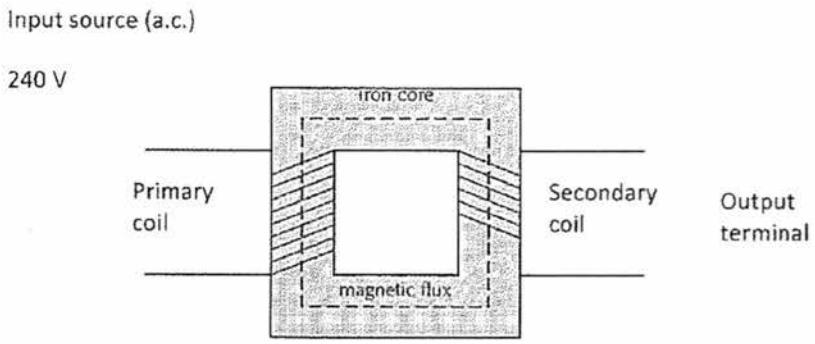


Fig. 12.7

(i) State what is meant by an ideal transformer. [1]

(ii) Calculate the output voltage and input current. [2]

(iii) It is recommended to have laminated iron sheets instead of iron core. Suggest a reason why is this so. [1]

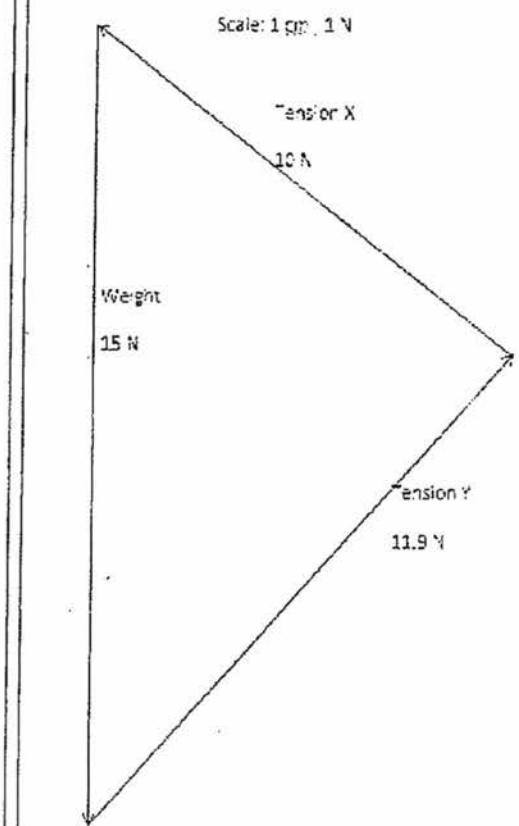
END OF PAPER

Answers to Sec 4 Prelim 2 2017 (NCHS)

MCQ

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

1. (a)



Marking scheme

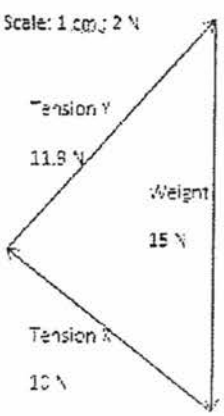
Correct closed loop (no resultant vectors): B1

Tension X = 10.0 N

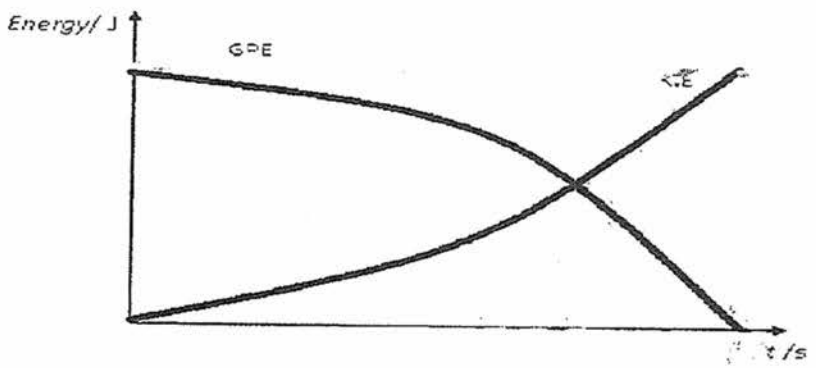
Tension Y = 11.9 N

Correct tension with +/- 0.5 N

Deduct 1 m for odd scale eg 1 cm: 3 N or 1 cm: 1.5 N



2	(a)	Distance AB along the inclined plane = 0.5 x 9.0 x 1.2 = 5.4m	B1

	(b)(i)	5.4^2 = vertical distance – 3.9^2 Vertical distance = 3.735 m Gain in G.P.E = 0.5 x 10 x 3.735 =18.67 J =18.7 J	M1 A1
	(ii)	Loss in K.E = 0.5 x 0.5 x $(9.0)^2$ = 20.25 J = 20.3 J	A1
	(c)	Loss in K.E is the sum of the gain in GPE and work done against friction	A1
3	(a)		Shape 1 Inverse proportio nal 1
.	(b)	Velocity of ball Y is higher. Conservation of energy, T.E changed in X is equal to T.E changed in Y. Given no change in GPE, change in K.E of X is equal to change in K.E of Y. $\frac{1}{2} m_x v^2 = \frac{1}{2} m_y v$ Since a larger m_x than m_y, v will be greater than v **Wrong concept** RESULTANT FORCE = m X a a higher, v higher.	[1] [1]
4	(a)(i)	**Pressure** = $\frac{force}{area}$ **$F_{on\ load} = F_{applied} \times (A_{applied} / A_{on\ load})$** **$F_{on\ load}$ = 4.0 x (0.15 x [30 / 10 000]** **= 200 N**	M1 A1
	(ii)	It will move **upwards**. **Answers not accepted** • It move lesser / move more • Motion that direction is not stated	B1
	(iii)	Air can be **compressed** and the **pressure** exerted at a piston will not be transmitted to the other piston. or Additional **work done** against compressing the air. **Wrong concept** Force exerted will not be accepted. The correct concept is the	A1

		pressure is consistently transmitted through throughout a incompressible fluid.	
	(b)(i)	76-70 = 6.0 cm Hg Pressure difference in Pa = 0.06 x 10 x 13600 = 8160Pa 8160 = 1.23 x 10 x h Height = 663.4 m = 663 m (3sf)	C1 C1 A1
	(ii)	No. Atmospheric pressure is lower than at sea level and at lower atmospheric pressure boiling point will be lower. Alternatively, students can explain that latent heat is lesser as there is lesser atmospheric pressure acting on the surface of the liquid.	B1 B1
5.	(a)	As the temperature increases, **the pressure will increase.** However, as the **flask is able to expand,** the **volume of the flask will increase,** thus allow the drop in the pressure.	B1 B1
	(b)	As the temperature of the gas increases, **the average speed of the molecules will increase**, there **will be an increase in the force exerted per unit area** of the surface of the flask, as **P = F / A,** the pressure per unit area will increase.	B1 B1 B1
6	(a)	A transverse wave oscillates perpendicular to the direction of wave travel .OR It is a wave in which particles in the medium travel perpendicular to the direction of wave motion.	M1
	(b)	Down	A1
	(c)(i)	F = 1 / T 5.0 = 1 / T , T = 0.20 s	 A1
	(c)(ii)	V= 5.0 x 0.22 = 1.1 m s^{-1} or 110 cm/s	A1
	(c) (ii)	Sine wave starting from origin position. Period 0.20 s for one complete oscillation.	B1 B1
7	(a)	The cut allows **the angle of incidence in the diamond to be greater than the critical angle** thus allowing the light to experience **total internal reflection** multiple times.	B1 B1
	(b)(i)	Sin c = 1 / 2.4 C = 24.6 °	

	(ii)	sin i / sin r = 1/2.4 sin i / 40 = 1/2.4 Angle of incidence = 15.5 °	M1 A1
8	(a)	**Electrostatic Induction is a process of causing charges to move in conductors without contact between the conductor and the charging body.**	B1
	(b)	1) Place plate X **close** to plate Y. 2) **connect** the contact of the wire that link to Earth to plate Y 3) **remove** the connect of the contact of the wire from plate Y. 4) move plate X away from Y	B1 B1 B1
	(c)	Stand needs to be wooden so that charges will not flow away or to the plate	B1
9	(a) (i)	Effective resistance = $(1/30 + 1/10)^{-1} + 10$ = 17.5 Ω	M1 A1
	(ii)	V = R I 15.0 = 17.5 x I I = 0.85714 = 0.857 A	 M1 A1
	(iii)	Potential method Potential at Z = $\frac{10.0}{17.5} \times 15.0 = 8.5714\ V$ Potential across XY= $\frac{2}{3} \times (15.0 - 8.5714) + 8.5714 = 12.857$ = 12.9 V (note that potential at Y = 0 V) Current divider method $I_{30\Omega} = \frac{10.0}{40.0} \times 0.85714 = 0.21429 = 0.214$ A V = R I P.D across first 10 Ω resistor, between the cell and X = 10.0 X 0.21429 = 2.1429V Potential at X is 15.0 - 2.1429 = 12.857 V = 12.9 V. As potential at Y is 0 V, hence potential difference between X and Y = 12.9 - 0.0 = 12.9 V	M1 A1
	(b)	Effective resistance = $(1/10 + 1/10)^{-1} + 10$ = 15.0 Ω	A1

Section B (30 marks)

Qn.	Answer	Remarks
10 (a)(i)	>Distance under v-t = 0.5 x 11000 x t 825 000 = 0.5 x 11000 x t >t = 150 s or s=[(u+v)/2]t 825 000 =[(0 + 11 000)/2]t	M1 A1

	t= 150 s or Fd=KE + GPE = ½mv² + mgh F=[0.5 x 22 700 x 11 000 x 11 000 + 22 700 x 10 x 825 000] / 825 000 F =15.60625 x 10^{11}/ 825 000 = 1 891 666.667 a = F/m = 1 891 666.667 / 22 700 = 83.333 t = (v – u) / a = (11 000 – 0) / 83.33 = 132 s	
(ii)	a = (v-u) / t = (11 000 – 0) / 150 = 73.3 m/s	M1 A1 (allow ecf)
(iii)	Resultant force = m a Upward thrust – W = ma Upward thrust = W + mA = (22 700 x10) + (22700 x 73.3) = 1890910 N = 1.89 x 10^{6} N	M1 A1 (allow ecf)
(b)	>The rocket is exerting a force on the rocket exhaust in a backward direction. From Newton's third law, the exhaust gases is exerting a force on the rocket in the forward direction. >In space with no resistive force, the force of exhaust gases on the rocket is the net force which causes acceleration in the forward direction in accordance to Newton's second law. Note: No marks are given when using N1L to explain as it is not answering the question.	B1 B1
(c)	Assuming the breakup of the fuel compartment is in space which has no air resistance and the main engine thrust remains constant, the total mass of the rocket decreases and from N2L, F=ma, the acceleration will increases and consequently its velocity as a=(v-u)/t OR Assuming the breakup of the fuel compartment is in space which has no air resistance and there is no more fuel in the rocket, the engine thrust becomes zero and from N2L, acceleration becomes zero and the velocity of the rocket remains constant. OR Assuming the breakup of the fuel compartment is in the atmosphere which has air resistance. When there is no more fuel in the rocker, the engine thrust becomes zero and from N2L, acceleration and velocity decreases due to the net opposing force of its weight and air resistance.	B1 B1
11(a)	Specific heat capacity is the amount of thermal energy required to raise the temperature of 1K per unit mass of an object.	B1
(b)	Specific latent heat of vaporisation is higher than the specific latent heat of fusion of water because for water to change state to gas, it requires more energy per unit mass **as the distance between each molecule is much further from water to gas than from solid to water.**	B1
I(i)	Thermal energy gained = mc Δ θ (milk) + mc Δ θ (glass) = Δ θ [mc (milk) + mc (glass)] = 35 [(0.3)(4200) + 0.1 x837] = 47029.5 J = 47.0 kJ	M1 A1
(ii)	mc Δ θ (Steam 120 °C to 100 °C)+ m lv + mc Δ θ (water 100 °C to 55 °C) = T.E gained by the milk and glass m (2010 x 20 + 2.26 x 10^{6} + 4200 x 45) = 47029.5 J mass of steam = 0.0189 kg	M1 A1

	= 18.9 g	
(d) (i)	Thermal radiation.	B1
(ii)	Thermal energy from the heating lamp will be transferred to the surrounding air as well hence it explains the low efficiency of this method.	B1
(iii)	$E = P \times t$ 5% efficiency $0.05 \times (P \times t) = mc\Delta\theta$ (milk) + $mc\Delta\theta$ (glass) $0.05 \times 10\,000 \times t = 0.25 \times 4200 \times 20 + 0.15 \times 837 \times 20$ $t = 47$ s	M1 A1
Either		
12 (a) (i)	Use ruler to draw arrow to indicate AB up and CD down	B1
(ii)	Clockwise direction	B1
(iii)	Use ruler to draw arrow to indicate AB up and CD down	B1
(iv)	The rectangular coil will only swing in a clockwise manner and turn anticlockwise after passing through the vertical position. It will oscillate about the vertical position. (not the question is about the fault and not what should be done)	B1
(v)	The ends of coil **ABCD** should be connected to a **split ring commutator. Each half of the** commutator presses against a **carbon brush in good contact.** The **commutator reverses the direction of the current in the coil every half a revolution whenever the split ring changes contact from one carbon brush to the other brush.**	B1 B1
(b) (i)	Resistance of the wire = $1000 \times 3.6 = 3600\ \Omega$ Power loss = p.d. ^{2} / R $=500^2/\ 3600$ $=69.4$ W Note that the power loss is related to the drop in potential across the length of wire. In other words, the difference in potential between the 2 points.	M1 A1
(ii)	$\frac{69.4}{1000} \times 0.15 \times 24$ = \$ 0.249 = \$ 0.25	M1 A1
OR		
(i)	The copper ring will jump upwards	B1
(ii)	At the instant when the switch is closed, current starts to flow through the solenoid, causing a magnetic field to be build up in the solenoid forming a North pole adjacent to the copper ring. During the building up of magnetism in the solenoid, an increase in the rate of change of magnetic flux linkage occurs thus inducing an electromotive force (e.m.f.) in the copper ring according to Faraday's law. According to Lenz's Law, as the copper ring has a closed loop, an induced current will flow to form a North pole in the lower half of the copper ring to oppose the change in magnetic flux in it. Thus the copper ring is repelled and moves upwards. Note that copper is not a magnetic object but a good electrical conductor.	B1 B1 B1
(iii)	The copper ring will still do the same as (i) (note that this time a South pole is formed at the lower half o the copper ring to oppose the South pole formed in the solenoid nearer to the copper ring)	B1
(iv)	It will not move from this position or there is no change from its rest position.	B1

	(as it is impossible to have an induced current flowing across the broken ring to form a magnetic pole)	
(b) (i)	In an ideal transformer, there will be no power loss between the primary and the secondary coil	B1
(ii).	2000 / 100 = 240 / output voltage Output voltage = 12 V 8.0 x 12 V = 240 x I I = 0.40 A	A1 A1
(iii)	To reduce formation of eddy currents so that there will be minimum power lose due to eddy current.... (note: there is no way to <u>prevent</u> formation of eddy currents in the soft iron core)	B1