

අවසාන වාර පරීක්ෂණය ජුනි - 2018

Term End Test June - 2018

භෞතික විද්‍යාව I

Physics I

01

E

I

පැය දෙකයි

Two hours

## Instructions :-

\* Answer all 50 questions .

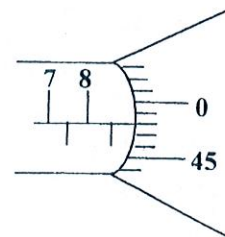
\* Mark the correct or most suitable answer with (x) out of the five choices given for each question from 1 to 50.

13- ශ්‍රේණිය Grade -13

3 - වන වාරය, 3<sup>rd</sup> Term Test

$$g = 10 \text{ Nkg}^{-1}$$

- (1) Gravitational field intensity on Earth's surface  $g = Krd$  where  $r$  - radius of Earth  $d$ - density of Earth, [assuming that Earth is a perfect sphere]. Units of the constant  $K$  is;  
 (1)  $\text{kgms}^{-2}$  (2)  $\text{kgm}^{-1}\text{s}^{-1}$  (3)  $\text{kgm}^{-3}\text{s}^{-2}$  (4)  $\text{kg}^{-1}\text{m}^3\text{s}^{-2}$  (5)  $\text{kg}^{-1}\text{m}^2\text{s}^{-2}$
- (2) Which of the following statement/s is/are true?  
 A - Due to a moving charge only a magnetic field is created.  
 B - A current carrying conductor placed in a magnetic field, always experiences a magnetic force acting on it.  
 C - There is always only an attractive force occurs between two parallel conductors carrying current towards the same direction.  
 (1) A only (2) B only (3) C only  
 (4) A and C only (5) B and C only
- (3) Shown in the diagram is a micrometer screwguage which consists of 0.5mm pitch and 50 divisions in its' circular scale. When checked for zero error, 48<sup>th</sup> circular division coincided with the horizontal line of the sleeve. The actual value of the measurement corresponding to the reading shown here is;  
 (1) 9.02mm (2) 8.48mm (3) 8.98mm  
 (4) 8.96mm (5) 9.00mm
- (4) A particle "A" is projected vertically upwards at  $30\text{ms}^{-1}$  velocity from a point 80m above ground level. After 5s another particle B is released from rest from a point 35m right below the point of projection of A. The time taken for particle A to pass B;  
 (1) 6s (2) 3s (3) 4.5s (4) 10s (5) 8s



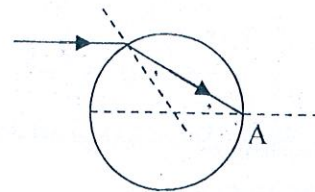


- (5) The path of an electron entering a magnetic field at a certain inclination with a certain velocity is a;  
 (1) Circle (2) Straight line (3) Parabola  
 (4) Spiral [helical] (5) doesn't move at all
- (6) A particle projected up at  $\theta$  angle with the horizontal from the level ground hit a point which is at  $d$  horizontal distance and  $h$  vertical height from the point of projection.  $\theta$  is equal to;

(1)  $\frac{g}{\cos\theta} \sqrt{\frac{d}{2(d\tan\theta-h)}}$  (2)  $\frac{d}{\cos\theta} \sqrt{\frac{g}{2(d\tan\theta-h)}}$  (3)  $\sqrt{\frac{gd^2}{\cos^2\theta}}$   
 (4)  $\sqrt{\frac{gd^2}{d-h}}$  (5)  $\frac{d}{\cos\theta} \sqrt{\frac{g}{2(d\tan\theta+h)}}$

- (7) Consider the following statements regarding a ray of light entering a spherical drop of water.

- A - incident rays are partially reflected at point A.  
 B - incident rays are totally reflected at point A.  
 C - incident rays are totally transmitted through A.



of the statements, .

- (1) Only A is true (2) Only B is true (3) Only A and B are true.  
 (4) Only A and C are true. (5) None of these is true.

- (8) A bullet of mass 100g flying at  $150\text{ms}^{-1}$  horizontal velocity gets embedded into a wooden cube of mass 2.9kg hanging from a string of length 50cm. The tension of the string (with the wooden block and the bullet init) when the system makes  $60^\circ$  angle with the vertical.

- (1) 135N (2) 125N (3) 140N (4) 90N (5) 100N

- (9) A plane with total extension of its' wings 50m flies  $360\text{kmh}^{-1}$  horizontal constant speed Vertical component of Earth's magnetic field is  $5 \times 10^{-4}\text{T}$ . EMF induced across the ends of the wingspan;

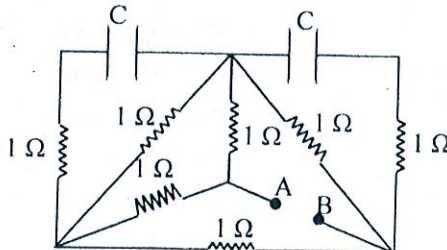
- (1) 0.25V (2) 2.5V (3) 25V (4) 40V (5) 50V

- (10) Water flows steadily through a horizontal tube of flow at  $1\text{ms}^{-1}$  speed through  $10\text{cm}^2$  cross section at 2kPa pressure. The pressure at  $5\text{cm}^2$  cross section of tube is;

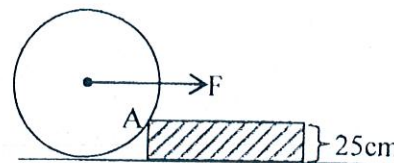
- (1) 200Pa (2) 400Pa (3) 500Pa (4) 800Pa (5) 1000Pa

- (11) The equivalent resistance across A and B is;

- (1)  $1\Omega$   
 (2)  $2\Omega$   
 (3)  $3\Omega$   
 (4)  $4\Omega$   
 (5)  $5\Omega$



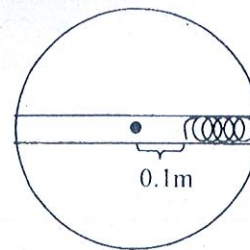
- (12) A plate of radius 50cm and mass 5kg is held vertically and is in contact with a step of height 25cm at A. What is the minimum value of the horizontal force  $F$  applied perpendicular to the axis of plate so that the plate could get into the step?



- (1) 50N (2)  $50\sqrt{3}\text{N}$  (3) 25N  
 (4) 100N (5) Non of the above

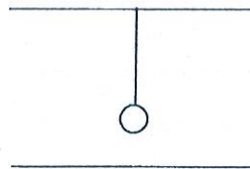
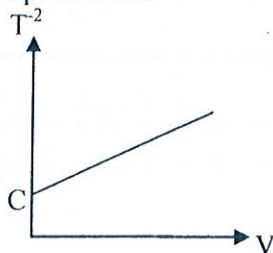


- (13) A smooth cavity is located along a diameter of a circular horizontal table of radius 0.5m. A ball of mass 90g connected to one end of a spring of spring constant  $19\text{Ncm}^{-1}$  is at rest at 0.1m distance from the centre of the table. The other end of the spring is fixed to the edge of the table. Now the table starts to rotate at  $100\text{ rads}^{-1}$



Constant angular velocity. The displacement of the ball from its' equilibrium position is;

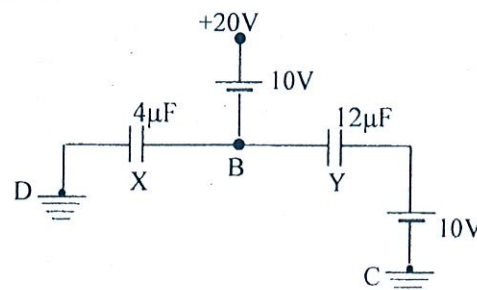
- (1)  $9 \times 15^{-1}\text{ m}$  (2)  $9 \times 10^{-2}\text{ m}$  (3)  $1 \times 15^{-1}\text{ m}$   
 (4)  $9 \times 10^{-3}\text{ m}$   
 (5)  $1 \times 10^{-2}\text{ m}$
- (14) Shown here is a string of length  $L$  attached to a positively charged particle oscillating inbetween two parallel horizontal plates under a potential difference.  $V$ . The variation of the reciprocal of the square of time period ( $1/T^2$ ) of the simple pendulum with the potential difference ( $V$ ) applied at the two parallel sheets is depicted here.



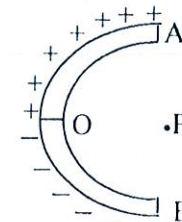
Which of the following statement/s is/are true?

- (a) Bottom plate is negatively charged while the upper plate is positively charged.  
 (b) Gradient of the graph increases if the separation between plates increases.  
 (c) Gravitational acceleration  $g = 4\pi^2 LC$
- (1) a only (2) a and b only (3) a and c only  
 (4) b and c only (5) All a, b and c
- (15) Two cubes A and B made of the same material are of similar surface nature, with different sizes, of sidelength " $2a$  and  $a$ " respectively. They are heated to the same temperature and allowed to cool under identical environmental conditions. The ratio between the initial rates of temperature loss of A and B is;
- (1) 1 : 2 (2) 2 : 1 (3) 4 : 1 (4) 8 : 1 (5) 1 : 6
- (16) Which of the following is true about the setup shown here?

- (1) Charge on capacitor Y is zero.  
 (2) Charge on capacitor Y is  $30\mu\text{C}$   
 (3) Charge on capacitor X is  $30\mu\text{C}$   
 (4) Charge on capacitor X is  $20\mu\text{C}$   
 (5) None of the above.



- (17) A thin glass rod is bent into a hemispherical shape of radius  $r$ .  $+Q$  charge is uniformly distributed on its' upper half and  $-Q$  on bottom half. The electric field intensity at P which is the centre of the hemispherical structure;



- (1)  $\frac{Q}{\pi^2 \epsilon_0 r^2}$  (2)  $\frac{2Q}{\pi^2 \epsilon_0 r^2}$  (3)  $\frac{4Q}{\pi^2 \epsilon_0 r^2}$  (4)  $\frac{Q}{4\pi^2 \epsilon_0 r^2}$  (5) 0

(3)



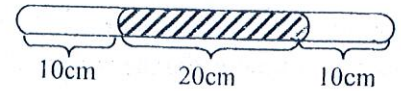
(18) Two identical spherical drops of Mercury each charged to a potential  $V$ , combines to form a single drop of potential;

- (1)  $V$  (2)  $2^{1/3} V$  (3)  $2^{1/2} V$  (4)  $2^{2/3} V$  (5)  $2V$

(19) A uniform metal rod of length  $L$  and mass  $M$  is rotated at a constant angular velocity  $\omega$  about an axis through one of its ends. Now the temperature of the system is raised by an amount of  $t^\circ\text{C}$ . The corresponding change in angular velocity is directly proportional to;

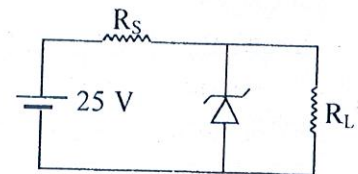
- (1)  $\sqrt{\omega}$  (2)  $\omega$  (3)  $\omega^2$  (4)  $\frac{1}{\omega}$  (5)  $\frac{1}{\omega^2}$

(20) A 40cm long capillary tube with 20cm length of a Mercury column rapped is sealed in an environment with 99Hgcm pressure, at the horizontal position shown here. When the capillary tube is held vertical, the length of space above Mercury is;



- (1) 12 (2) 11 (3) 15 (4) 9 (5) 16

(21) Zener Voltage of the Zener Diode shown here is 10V and the maximum current passed through it is 100mA. The minimum current at steady operational state is 20mA for  $R_L = 250\Omega$ . The ratio between minimum and maximum values of  $R_s$  is;

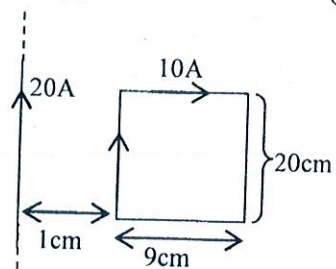


- (1)  $\frac{1}{5}$  (2)  $\frac{2}{5}$  (3)  $\frac{3}{5}$  (4)  $\frac{4}{5}$  (5) 1

(22) An AC voltage source  $V = 240 \sin(100\pi t)$  drives a current through  $50\Omega$  resistor. The time taken by the current through the resistor to reach its root mean square value from the peak value is; ( $I_{\text{peak}} \rightarrow I_{\text{rms}}$ )

- (1) 25s (2) 2.5s (3) 0.25s (4) 2.5ms (5) 25ms

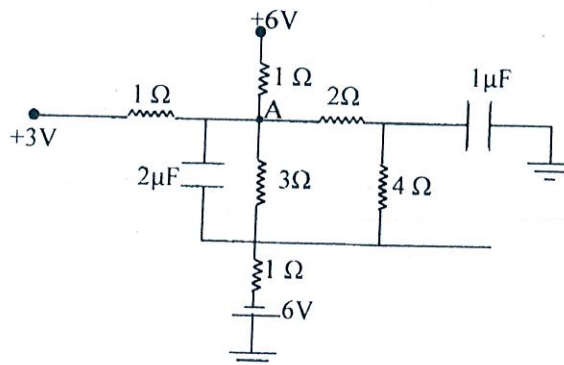
(23) A rectangular loop of Area (20cm x 9cm) is placed at 1cm distance from an infinitely long conductor carrying 20A current; both on the same plane. The resultant force on the loop when 10 A current circulates through it is;



- (1) 0N (2)  $3.6 \times 10^{-4}\text{N}$  towards left (3)  $3.6 \times 10^{-4}\text{N}$  towards right  
(4)  $7.2 \times 10^{-4}\text{N}$  towards left (5)  $7.2 \times 10^{-4}\text{N}$  towards right

(24) The potential at point A of the circuit shown here is;

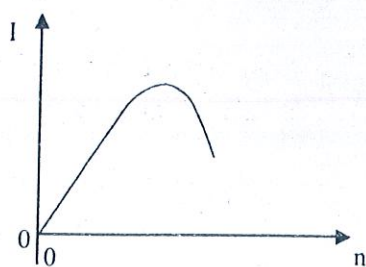
- (1) 1V  
(2) 2V  
(3) 3V  
(4) 3.6V  
(5) 4V



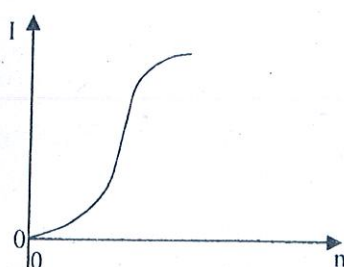
(4)



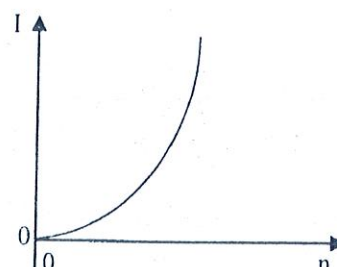
- (25) Which of the following correctly depict the variation of  $I$  with  $n$  where  $n$  is the no. of identical cells connected in parallel (cells having an internal resistance) and  $I$  is the current flowing through the circuit?



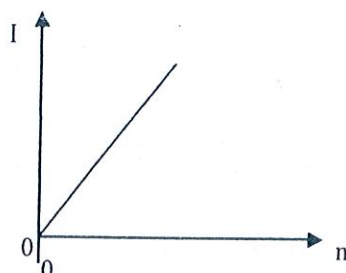
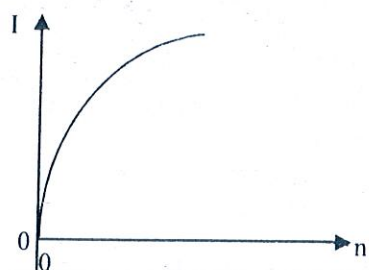
(1)



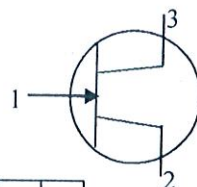
(2)



(3)



- (26) Which of the following shows the correct biasing polarities of JFET given here?



1	2	3
+	-	+

(1)

1	2	3
+	+	-

(2)

1	2	3
-	+	-

(3)

1	2	3
-	-	+

(4)

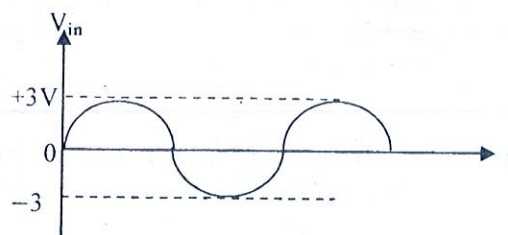
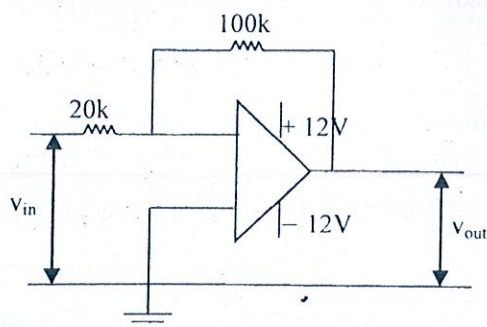
1	2	3
-	+	+

(5)

- (27) Current flows through a metal wire of temperature coefficient of resistance  $0.004\text{K}^{-1}$ . When the temperature of the wire is increased from  $20^\circ\text{C}$  to  $80^\circ\text{C}$ , for the current to remain the same as before, what should be the percentage increment of the potential difference across the wire?
- (1) 46.6%      (2) 40%      (3) 22.2%      (4) 20%      (5) 19%
- (28) A moving coil galvanometer shows 50 units deflection when a constant electric current flows through it. When a shunt of  $12\Omega$  is connected across the galvanometer, its deflection reduced to 10 units. The internal resistance of the galvanometer is;
- (1)  $36\Omega$       (2)  $48\Omega$       (3)  $50\Omega$       (4)  $54\Omega$       (5)  $72\Omega$
- (29) Two cylindrical containers A and B each contains  $V$  volume of an ideal gas at room temperature, covered with two smooth pistons.  $m_A$  mass of the gas in A,  $m_B$  mass of the gas in B. Now the two systems are allowed to expand isothermally up to  $2V$  volume each. Final pressure of gas samples in A and B are  $P$  and  $1.5P$  respectively. Which of the following is the correct relationship between  $m_A$  and  $m_B$ ?
- (1)  $4m_A = 9m_B$       (2)  $2m_A = 3m_B$       (3)  $3m_A = 2m_B$       (4)  $9m_A = 4m_B$       (5)  $2m_A = 9m_B$
- (30) The speed of sound in Oxygen ( $\text{O}_2$ ) at a certain temperature is ~~460~~<sup>355</sup> $\text{ms}^{-1}$ . The speed of sound in Helium (He) at the same temperature will be,
- (1)  $330\text{ms}^{-1}$       (2)  $1420\text{ms}^{-1}$       (3)  $500\text{ms}^{-1}$       (4)  $650\text{ms}^{-1}$       (5)  $400\text{ms}^{-1}$



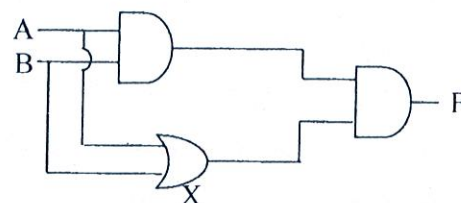
(31)



The input voltage signal fed to the operational Amplifier circuit is as shown here. What are the possible maximum and minimum values for the output voltage?

- (1) 15V, -15V      (2) 16V, -16V      (3) +12V, -12V      (4) 13V, -13V      (5) 3V, -3V

- (32) The Boolean expression for the output F of the Logic circuit shown here is  $F = (A \cdot B) (A + B)$  for output to be  $F = (A \cdot B) \cdot (A + B)$  the logic gate X is replaced with;

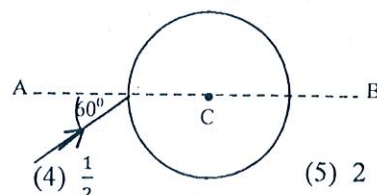


- (1) AND      (2) OR      (3) NOR      (4) NAND      (5) NOT

- (33) A cube of iron floats on Mercury (Hg) with  $K_1$  fraction of its' volume submerged at  $0^\circ\text{C}$  temperature and  $K_2$  fraction submerged at  $60^\circ\text{C}$ . Volume expansivity of Hg =  $\gamma_{\text{Hg}}$ . Volume expansivity of iron =  $\gamma_{\text{Fe}}$ . The ratio  $\frac{K_1}{K_2}$  is equal to;

- (1)  $\frac{1+60 r_{\text{Fe}}}{1+60 r_{\text{Hg}}}$       (2)  $\frac{1-60 r_{\text{Fe}}}{1+60 r_{\text{Hg}}}$       (3)  $\frac{1+60 r_{\text{Fe}}}{1-60 r_{\text{Hg}}}$       (4)  $\frac{1+60 r_{\text{Hg}}}{1+60 r_{\text{Fe}}}$       (5)  $\frac{1-60 r_{\text{Fe}}}{1-60 r_{\text{Hg}}}$

- (34) Figure shows a ray of light falls on a transparent sphere with center at C. The ray emerges from the sphere parallel to line AB. The refractive index of the sphere material is,



- (1)  $\sqrt{2}$       (2)  $\sqrt{3}$       (3)  $\frac{3}{2}$

- (4)  $\frac{1}{2}$       (5) 2

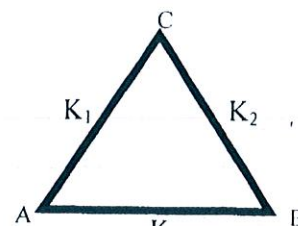
- (35) A uniform metal rod of length L and mass M is rotated at a constant angular velocity about an axis through one of its' ends. Now the temperature of the system is raised by an amount of  $t^\circ\text{C}$ . The corresponding change in angular velocity is directly proportional to;

- (1)  $\sqrt{\omega}$       (2)  $\omega$       (3)  $\omega^2$       (4)  $\frac{1}{\omega}$       (5)  $\frac{1}{\omega^2}$

- (36) Two identical containers with initial volume  $8.2\text{dm}^3$  temperature  $27^\circ\text{C}$  and at pressure "P" are connected using a thin tube. Now the temperature of one of the containers is made  $177^\circ\text{C}$  while the other remaining at  $27^\circ\text{C}$ . Now the pressure of the system would be;

- (1) 1P      (2) 1.2P      (3) 1.4P      (4) 1.6P      (5) 1.8P

- (37) Three rods having equal dimensions with thermal conductivities  $K_1$ ,  $K_2$  and  $K_3$  are connected as shown here. The ends A and B are maintained at two different temperatures. Heat flows through the paths ACB and AB at the same rate. Which of the following relationships is true?



- (1)  $K_3 = 2(K_1 + K_2)$       (2)  $K_3 = \frac{K_1 K_2}{K_1 + K_2}$   
 (4)  $K_3 = \frac{1}{2}(K_1 + K_2)$       (5)  $K_3 = \frac{1}{(K_1 + K_2)}$

(3)  $K_3 = K_1 + K_2$

(6)



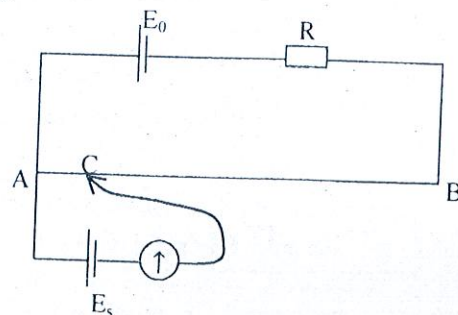
- (38) Radius of moon in terms of its mass (M) universal Gravitational constant (G) and gravitational acceleration (g) at "h" height above moon's surface is;

(1)  $\sqrt{\frac{GM+h^2}{g}}$  (2)  $\sqrt{\frac{GM-h^2}{g}}$  (3)  $\sqrt{\frac{GM}{g}} - h$  (4)  $\sqrt{\frac{GM}{g}} + h$  (5)  $\sqrt{\frac{GM}{g} - h^2}$

- (39) The balance point C of the circuit shown here is obtained closer to A.

In order to shift it closer to B;

- (1) The value of  $R$  should be reduced  
 (2) A resistor is connected in series with the cell  $E_s$  and the galvanometer.  
 (3) Interchange  $E_0$  and  $E_s$   
 (4) Increase the value of  $R$ .  
 (5) None of the above.



- (40) Which of the following expression/s is/ are true about the equation  $E = \sigma T^4$

Corresponding to a perfect blackbody radiator?

- a) T is measured either in  $^{\circ}\text{C}$  or K.  
 b) The value of  $\sigma$  is independent of the surface nature of the blackbody.  
 c) The above equation is valid for object of any geometrical shape.

- (1) a only (2) a and b only (3) a and c only  
 (4) b and c only (5) c only

- (41) Which of the following relationships is correct about kinetic energy of a moving particle (E) and its' De Broglie wavelength ( $\lambda_D$ ) ?

(1)  $\lambda_D \propto \sqrt{E}$  (2)  $\lambda_D \propto E$  (3)  $\lambda_D \propto \frac{1}{\sqrt{E}}$  (4)  $\lambda_D \propto \frac{1}{E}$  (5)  $\lambda_D \propto E^2$

- (42) A 16g sample of radioactive element having Half Life ( $T_{1/2}$ ) two days, decays for 14 days. The mass of radioactive element left undecayed after 14 days is;

(1) 1g (2) 0.5g (3) 0.25g (4) 0.125g (5) 1mg

- (43) A simple pendulum oscillating at time period "T" consists of a string of length "l" cross section "A" and Young's modulus "Y". When an additional weight mg is attached at the pendulum's bottom end, its' new period of oscillation ( $T'$ ) is given by;

(1) T (2)  $mgT$  (3)  $T\sqrt{mg/YA}$  (4)  $T\sqrt{1 + \frac{mg}{YA}}$  (5)  $T\sqrt{YA/mg}$

- (44) The work done in making a square shaped film of soap (10cm  $\times$  10cm) ; surface tension of soap =  $3 \times 10^{-2} \text{ Nm}^{-1}$

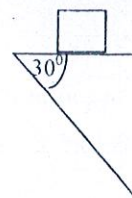
(1)  $6 \times 10^{-4} \text{ J}$  (2)  $3 \times 10^{-4} \text{ J}$  (3)  $6 \times 10^{-3} \text{ J}$  (4)  $3 \times 10^{-3} \text{ J}$  (5)  $3 \times 10^{-2} \text{ J}$

- (45) A piston of radius "r" and length "l" is sent at speed "u" through a thin layer of oil of viscosity  $\eta$  and thickness "d" which covers the inner surface of a cylinder. The resistive force on the piston is;

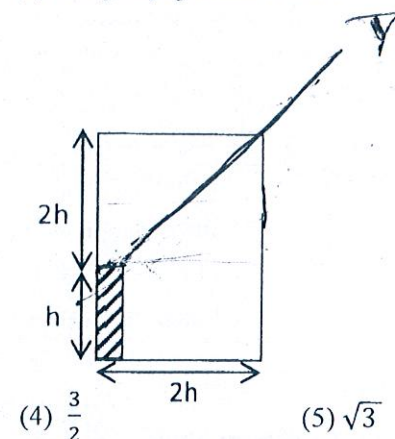
(1)  $\frac{2\pi r l \eta u}{d}$  (2)  $2\pi r l \eta u d$  (3)  $\frac{\pi r^2 l \eta u}{d}$  (4)  $\pi r^2 l \eta u d$  (5)  $2\pi r l \eta u$



- (46) A ray of light incident normally on the horizontal face of the glass slab and just fails to emerge from the diagonal face of the prism. The refractive index of the prism could be,



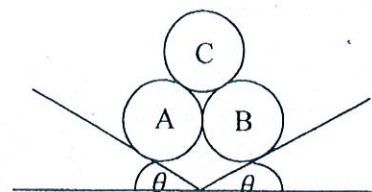
- (1)  $\sqrt{2}$  (2)  $\sqrt{3}$   
 (4) Slightly less than 2 (5) 2
- (47) An observer can see through a pin-hole the top end of a thin rod of height  $h$ , placed in a beaker as shown in the diagram. The height of the beaker is  $3h$  and its radius is  $h$ . When the beaker is filled with a liquid up to a height  $2h$ , he can see the lower end of the rod. The refractive index of the liquid is,



- (1)  $\frac{5}{2}$  (2)  $\sqrt{\frac{5}{2}}$  (3)  $\sqrt{\frac{3}{2}}$  (4)  $\frac{3}{2}$  (5)  $\sqrt{3}$
- (48) A radar emits a signal  $9 \times 10^9 \text{ Hz}$  towards an approaching aeroplane and detects the change in frequency on receiving the reflected wave as  $3 \times 10^3 \text{ Hz}$ . Speed of Radio Waves in air =  $3 \times 10^8 \text{ ms}^{-1}$ . Speed of the aeroplane is  $\text{ms}^{-1}$ ;
- (1) 150 (2) 200 (3) 50 (4) 25 (5) 2

- (49) A uniform rope of length 12m and mass 6kg hangs vertically from a rigid support. A block of mass 2kg is attached to the free end of the rope. A transverse pulse of wave length 0.06m is produced at the lower end of the rope. The wave length of the pulse when it reaches the top of the rope is,
- (1) 0.03m (2) 0.06m (3) 0.12m (4) 0.18m (5) 2.2m

- (50) A, B, C are three identical rigid cylinders in equilibrium in-between two smooth inclined planes at  $\theta$  inclination to horizontal. The minimum possible value of  $\theta$  would be;



- (1)  $\tan^{-1}\left(\frac{1}{2}\right)$  (2)  $\tan^{-1}\left(\frac{1}{3}\right)$  (3)  $\tan^{-1}\left(\frac{1}{2\sqrt{3}}\right)$  (4)  $\tan^{-1}\left(\frac{1}{3\sqrt{3}}\right)$  (5)  $\tan^{-1}\left(\frac{1}{4\sqrt{3}}\right)$

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General Certificate of Education (Adv. Level) Examination, June-2018

භෞතික විද්‍යාව II  
Physics II

01

E

II

13- ශ්‍රේණිය Grade -13

3 - වන වාරය, 3<sup>rd</sup> Term Test

පැය තුනයි  
Three hours

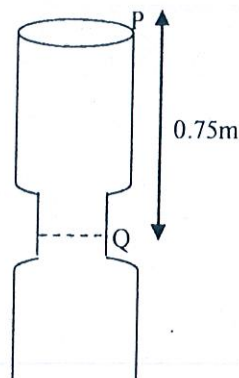
Part B - Essay

Answer 4 questions only.

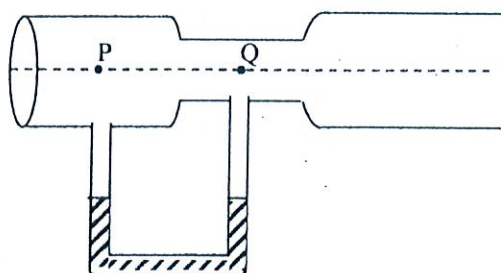
5. (a) State the conditions required for the validity of Bernoulli's principle.

(b) Show that the Bernoulli's equation is dimensionally correct.

(c) The tube shown in the figure can be used to measure speed of a fluid flow. Its diameters at P and Q are 0.8m and 0.4m respectively. Two pressure gauges are connected to the apparatus at P and Q to measure pressure inside it. A liquid of relative density 0.6 flows vertically downwards through the apparatus. P is at a vertical height 0.75m above Q. If both pressure gauges at P and Q read same value, calculate the volume of liquid flowing per second.

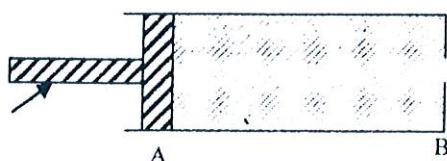


(d) A system of tubes with same cross-sections as the above tubes is placed as shown below and made air to flow through.



The density of the liquid in the U tube is  $1600\text{kgm}^{-3}$  and density of air is  $1.2\text{kgm}^{-3}$ . The velocity of air at P is  $20\text{ms}^{-1}$ . Find the height difference of the liquid columns in the U tube.

(e) A water sprayer used in a garden has a horizontal cylindrical tube as shown below.





It consists of a piston of cross-sectional area  $4\text{cm}^2$  at the end A and small hole of cross sectional area  $4\text{mm}^2$  at end B. Calculate speed of ejection of water through this small hole when a force of  $50\text{N}$  applied on the piston.

The speed of the piston is negligible and no frictional forces act on the piston. Density of water is  $1 \times 10^3 \text{kgm}^{-3}$ .

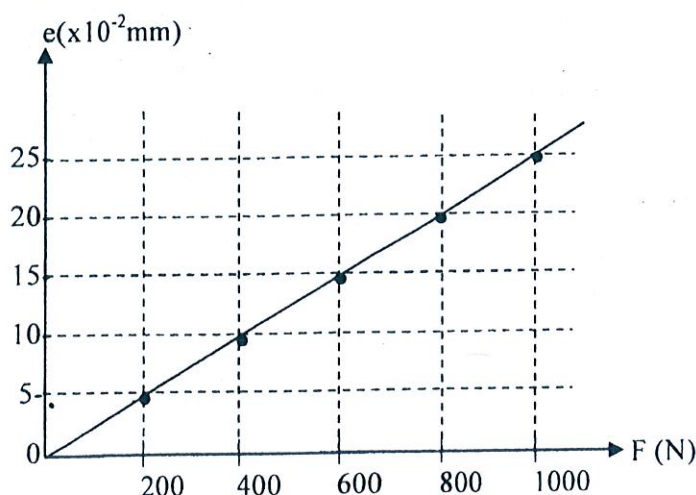
6. (a) To find the velocity of sound in air, a student uses a tube vertically clamped by a stand and changes the water level inside it. Initially the tube is completely filled with water. Then the water level in the tube is gradually lowered. A small loud speaker connected to a variable signal generator is placed above the open end of the tube. The air column inside the tube resonates for the first time for the length of air column  $130\text{mm}$  when the frequency of the sound of the speaker is  $600\text{Hz}$ . The second resonance is obtained at the length of air column  $414\text{mm}$  for the same frequency.

- 1) Draw the patterns of the variations of **pressure** inside the tube for the above two situations.
- 2) Calculate the end correction of the tube.
- 3) Find the velocity of sound in air.
- 4) Find the approximate diameter of the tube.

- (b) Next the frequency of the loud speaker is adjusted to a certain value and the air inside the tube at temperature  $39^\circ\text{C}$  is made to vibrate. Then the beats of frequency  $4\text{Hz}$  is heard. When temperature of air inside the tube is decreased to  $10^\circ\text{C}$ , heard beat frequency is  $1\text{Hz}$ . Calculate the frequency of the speaker.

- (c) The student next fixes the tube horizontally and makes the air inside the tube to vibrate with a certain frequency of the speaker. Then one end of the tube is suddenly closed. As a result it is found that the fifth harmonic of the closed tube is  $150\text{Hz}$  greater than the fundamental frequency of the open tube. Calculate the fundamental frequency of the open tube. (neglect the end corrections)

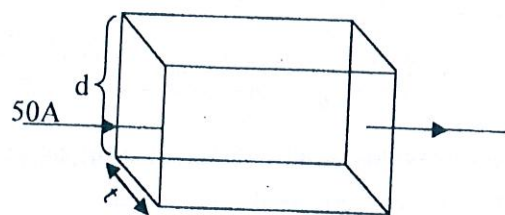
7. (a) Define Young's modulus ( $Y$ ) for a thin metal wire. Name two other physical quantities having similar dimensions to that of Young's modulus.
- (b) Shown here is the variation of contraction ( $e$ ) of a uniform hollow cylindrical plastic rod under a variable compressional force ( $F$ )





- (i) Write down the Law with which you can interpret this graph. What elastic potential energy (in mJ) is stored in the plastic rod under the external force of 500N?
- (ii) Calculate Young's modulus for plastic ( $\pi = 3$ ). External diameter of the plastic rod = 4cm, Diameter of the cavity = 2cm Length of the rod = 90cm
- (iii) The maximum compressional force applied on the rod is 3600N. What is the corresponding maximum contraction? What is your assumption for this calculation?
- (c) A sealed cubical container of external dimensions  $2\text{m} \times 2\text{m} \times 2\text{m}$  is resting at the bottom of a deep reservoir with still water. Its' total mass with the content is  $1 \times 10^4 \text{ kg}$ . Now it is being lifted gently under a constant force using 4 steel wires each of original length 10m and area of uniform cross section  $1\text{cm}^2$  connected at the 4 corners of the container, such that the wire remain straight and vertical while the container is horizontally stable. Young's modulus of steel =  $2 \times 10^{11} \text{ Nm}^{-2}$ . Density of water  $1000 \text{ kgm}^{-3}$  Proportionality limit for each steel wire  $4 \times 10^8 \text{ Nm}^{-2}$
- (i) Up to what maximum mass the four wires together can support? What is the corresponding extension in each wire?
- (ii) What is the extension of each wire in water, Once the container is just raised above the bottom of reservoir?
- (iii) Now the container is lifted with constant speed by uniformly decreasing the length of wires using a pulley mechanism. Once the box is completely raised out of water, extension of each string is 2.5mm. At this instance, what is the difference in height between the container and pulley?
- (iv) If the container is completely raised above water surface, by directly pulling up the wires (without reducing their length using pulley mechanism) what would be the corresponding extension of each wire?

8. (a) Write down an expression for the force acting on moving charged particle entering to a magnetic field at an angle  $\theta$  to the field. Introduce the symbols used.  
As shown in the following figure current of 50A flows through a thick Cu plate.



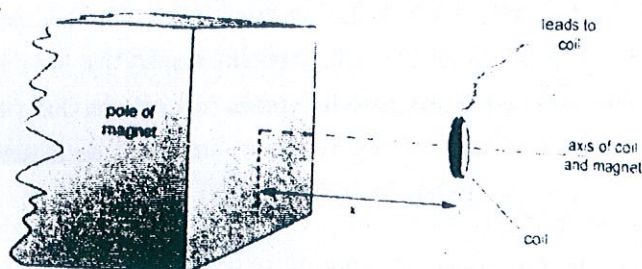
$$t = 0.1\text{cm}$$

$$d = 0.02\text{m}$$

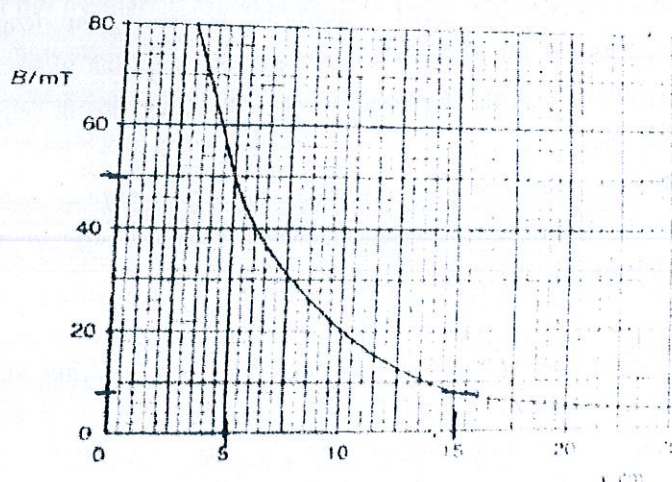
- (i) Find drift velocity of electrons.  
Charge of an electron =  $1.6 \times 10^{-19} \text{ C}$   
Number of electron per volume of Cu =  $2 \times 10^{29} \text{ m}^{-3}$
- (ii) Now consider there is a uniform magnetic field of flux density 2T acting perpendicular to the direction of the current in the Cu plate and directed out of the paper. What is the magnitude of magnetic force acting on electrons.
- (iii) What is the magnitude and direction of the electric field required to balance the above magnetic force.



- (iv) Find the required potential difference that should be on either side of conductor to obtain this electric field. State its polarity.
- (v) Without applying this potential difference externally, it can be obtained by the deviation of electrons. For this purpose what should be the magnitude and direction of electric field in the conductor.
- (b) In the following figure, it is shown a small wire coil placed near a large bar magnet. The axis of the coil is parallel to the axis of the magnet.



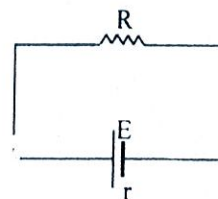
The cross-sectional area of the coil is  $0.4\text{cm}^2$  and has 150 turns. The variation of magnetic flux density ( $B$ ) of the bar magnet with the distance  $x$  from it is shown below.



- (i) What is magnetic flux density at a distance 5cm when the coil is at that position.
- (ii) What is the total magnetic flux through the coil.
- (iii) The coil is moved from the point at distance 5cm to the point at distance 15cm in time 0.2s, Calculate the induced electric motive force in it.

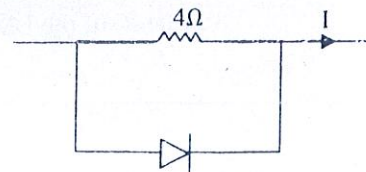
9. Answer either part A or part B only

- (A) (i) A cell of emf  $E$  and internal resistance  $r$  is connected across a resistor  $R$  as shown in the diagram. The current in the circuit is  $I$ . Write the expression for the power of the resistor  $R$  in terms of  $E$ ,  $I$  and  $r$ .

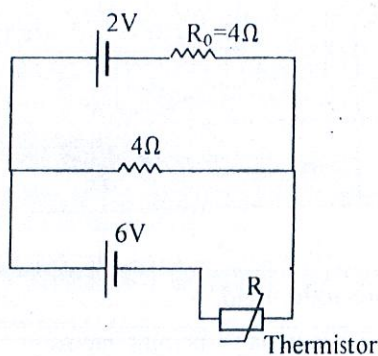




- (ii) To send a constant current through the resistor  $4\Omega$  a diode of barrier potential  $0.6V$  is connected across it as shown in the diagram. If the current through the forward biased diode is  $0.05A$ , find the current through the  $4\Omega$  resistor and the total current  $I$ .



- (iii) A circuit with a thermistor shown in the diagram is used to measure the temperature of a car engine.  $R$  is the resistance of the thermistor.



- Obtain an expression for the current  $I$  through  $R_0$  in terms of  $R$ .
  - When the engine temperature  $30^\circ C$ , the current through  $R_0$  is zero. Find the value of  $R$  at  $30^\circ C$ .
  - The current through  $R_0$  is  $0.15A$  when the engine temperature is  $100^\circ C$ . Find the value of  $R$  at  $100^\circ C$ .
  - Sketch the variation of the resistance of the thermistor with its temperature.
  - Find the temperature - resistance co-efficient of the thermistor.
- (iv) To limit the current to  $0.15A$  through  $R_0$ , the diode is used as in part (ii). Then find the value of  $R$ .

- (B) a) (i) Name the three configurations of the transistor and draw the relevant circuit diagrams for npn transistor. Clearly show the input and output.

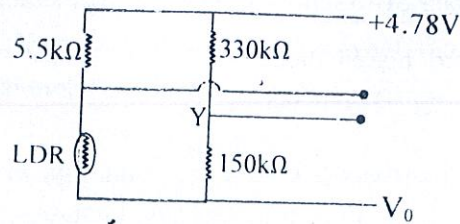
- (ii) The configuration having a voltage and current gain is used as an amplifier.

- Write three requirements in biasing the transistor.
- Draw the circuit diagram for the amplifier which is biased using a single  $9V$  power supply and two resistors  $R_B$  and  $R_C$ . Show clearly the input and output terminals.
- Calculate the value of  $R_B$  to produce  $40\text{ mA}$  base current. The transistor is a si-type and potential barrier is  $0.7\text{ V}$ .
- Taking the dc current gain a  $100$ . Find  $R_C$ .

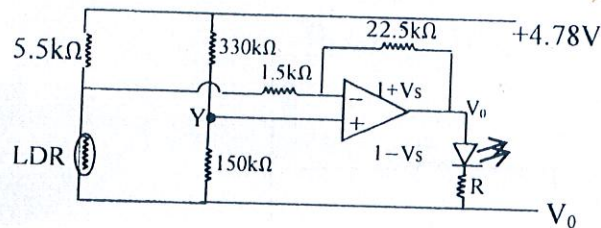
- (iv) What are the two biasing regions of the transistor when it is used as a switch.



- b) (i) Light dependent resistor (LDR) is used in a Wheatstone bridge as shown in the diagram. When light is incident with certain intensity on the LDR, the bridge is balanced. Find the resistance of the LDR under the light.

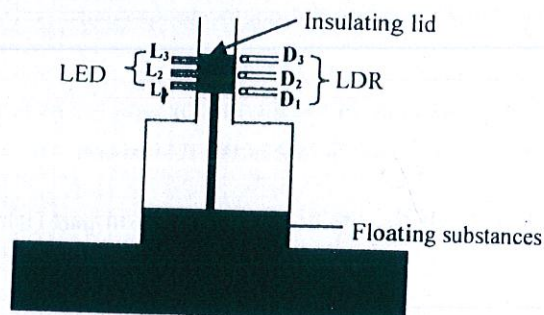


- (ii) The X and Y terminals of the Wheatstone bridge is applied to the two inputs of the operational amplifiers as shown in the diagram.



For certain light intensity incident on the LDR, the potential at X is 1.38V. Then the LED connected to the output emits light. Find,

- The resistance of the LDR under this light intensity.
  - The voltage gain of the amplifier.
  - Output voltage.
- c) The diagram below shows a part of a device used to inform people about the flood in a region where there is a flood threat due to over flow of a river.



$L_1$ ,  $L_2$  and  $L_3$  are laser beam directed to LDR's,  $D_1$ ,  $D_2$  and  $D_3$  respectively. Initially laser beams are covered by an opaque moveable knob connected to the piston. When the water level is 5m the knob is little lifted and the light from  $L_1$  falls on  $D_1$ . When the water level is 6m, the knob is further lifted and light from  $L_1$  and  $L_2$  fall on  $D_1$  and  $D_2$  respectively. When light falls on a LDR it produces a logic '1' and when no light is incident on a LDR it produces a logic '0'. When  $D_1$  receives light, a yellow colour LED is lighted to indicate the potential flood threat. When  $D_1$  and  $D_2$  both receive light orange colour LED is lighted to indicate minor flood threat. When  $D_1$ ,  $D_2$  and  $D_3$  all receive light from  $L_1$ ,  $L_2$  and  $L_3$  respectively, red LDD is lighted to indicate the major flood threat.

- Taking the input signals of  $D_1$ ,  $D_2$  and  $D_3$  as A, B and C prepare the relevant truth table.  $F_1$ ,  $F_2$  and  $F_3$  indicate the initial flood threat, minor flood and major flood respectively.
- Write the corresponding Boolean expression for  $F_1$ ,  $F_2$  and  $F_3$  respectively.
- Draw the corresponding circuit diagram using basic logic gates.



10. Answer either part A or part B only

- (A) (i) Write down an expression for the external work done by gas if its volume is increased from  $V_1$  to  $V_2$  under a constant pressure  $P$ . State whether this work is done by gas or on the gas.
- (ii) Mass of 1kg of water at temperature  $100^\circ\text{C}$  is converted into vapour under constant atmospheric pressure  $1.01 \times 10^5 \text{ Pa}$ . Therefore its volume increases  $1.00 \times 10^{-3} \text{ m}^3$  to  $1.671 \text{ m}^3$ . The specific latent heat of vapourisation of water is  $2260 \text{ kJ kg}^{-1}$  (Give all answers to its nearest integer value)
- (1) What is the amount of external work to be done in the process?
  - (2) Calculate amount of heat to be supplied to the system externally.
  - (3) What is the change of internal energy of system? In what form does this energy exist in gas.
  - (4) What percentage of energy is used to do external work, during the process?
  - (5) Can you name the above process as an isothermal process? Explain.

- (iii) (1) A certain mass of ether in a container at  $13^\circ\text{C}$  is transferred to a large container. As a result its pressure drops and ether starts boiling. In consequence to this the ether cools. What percentage of ether will evaporate when cooling to  $0^\circ\text{C}$ .  
The specific heat capacity of liquid ether  $= 2.4 \times 10^3 \text{ J kg}^{-1} \text{ K}^{-1}$  The specific latent heat of vapourisation of ether  $= 3.9 \times 10^5 \text{ J kg}^{-1}$ . Assume there is no heat exchange between the system and the surroundings.
- (2) 500g of water at initial temperature  $20^\circ\text{C}$  is placed in the freezer of a refrigerator. In 2 hours the its temperature falls to  $-10^\circ\text{C}$ . Calculate the rate at which the heat is released by water.  
Specific heat capacity of water  $= 4200 \text{ J kg}^{-1} \text{ K}^{-1}$   
Specific heat capacity ice  $= 2100 \text{ J kg}^{-1} \text{ K}^{-1}$   
Specific latent heat of fusion of ice  $= 336000 \text{ J kg}^{-1}$
- (3) What happens to the heat release by water in the freezer.
  - (4) The door of a refrigerator is kept open inside a room. But the temperature of the room does not fall. Instead the temperature in the room rises. Explain this.

- (B) The liberation of electrons from any surface of a substance is called **electron emission**. Any piece of metal block consists of plenty of free electrons. Although the free electrons move randomly inside, they can not leave the surface of the metal to initiate **electron emission**.

On reaching the extreme surface of the metallic block, the free electrons do not get any positive nucleus ahead of them, but they will have attractive force by the nuclei behind them inside the metallic block. So, to leave the metallic surface an electron must cross a potential barrier offered by the positive nuclei. This potential barrier which prevents a free electron to liberate from the metallic surface is called surface barrier. When a sufficient external energy is given to the free electrons, it can cross the surface barrier and liberate from the metallic surface.

A free electron possesses some kinetic energy. But this kinetic energy is not sufficient to overcome the surface barrier. The extra energy required to just overcome the surface barrier of any metal by an electron is called work function.



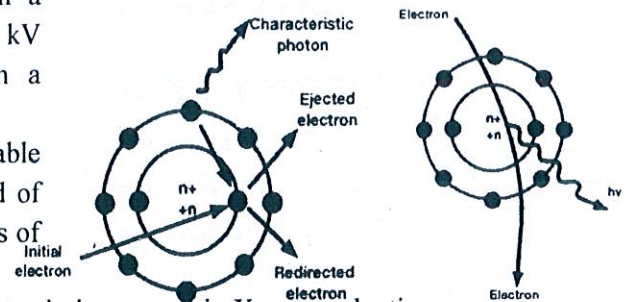
There are mainly four types of electron emission commonly used, thermionic, field, photo electric and secondary.

When a metal is heated sufficiently, the free electrons at the extreme surface of the metal get sufficient energy to overcome the surface barrier and emit from the metal. This is referred to as thermionic emission.

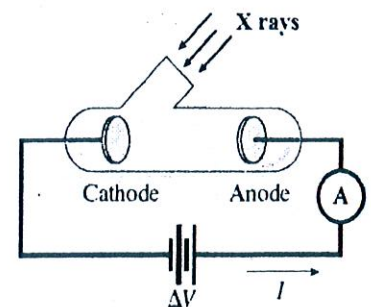
When high positive field is applied in front of the metal surface. The influence of this high electric field pulls the free electrons and help them to cross the surface barrier of the metal. This is referred as field emission

When a beam of high-velocity electrons strikes on the metal surface, the kinetic energy of the electrons is transferred to the free electrons on the metal surface. Thus the free electrons may get sufficient kinetic energy to overcome the surface barrier and start electron emission.

- (a) What is meant by the surface barrier and the work function according to the passage?
- (b) Surface barrier of a certain metal is 5eV. Kinetic energy of free electron is 1eV. Find the work function of the metal
- (c) What are the four types of electron emission? Explain each method briefly
- (d) Thermionic electron beam produced from a tungsten filament is accelerated by 200 kV potential difference and bombarded with a tungsten metal to produce X-rays



- (i) Copper filament is not practically suitable to produce thermionic electron instead of tungsten filament. Explain this in terms of their melting points
- (ii) Write one application of the thermionic emission except in X ray production
- (iii) Find the kinetic energy gained by an electron in electron volts(eV)
- (iv) Some electrons collide with K- cell electrons of tungsten atoms and they are knocked out creating empty spaces .L-shell electrons move into these empty spaces. This movement from high energy to low energy shells releases x-ray photons of wave length  $4 \times 10^{-11} \text{m}$  which is characteristic of the tungsten and it is called  $K_{\alpha}$ . Most elections are slowed down due to the repulsion from nucleus and their path is deflected. Due to this 8 keV is lost and it appears in emitted as x rays
  - (1) Find the binding energy difference between cells K and L
  - (2) Does the  $K_{\alpha}$  depend on the accelerating potential? Explain
  - (3) Find the wave length of x rays emitted by deviated electrons
- (e) X-rays of wave length  $2 \times 10^{-10} \text{m}$  hit with the cathode metal of photo shell. The work function of the cathode metal is 5 keV.



- (i) Find the maximum kinetic energy of the photoelectrons
- (ii) Find the stopping potential

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General Certificate of Education (Adv. Level) Examination, June 2018

භෞතික විද්‍යාව II  
Physics II

01

E

II

පැය තුනයි  
Three hours

13- ශ්‍රේණිය Grade -13

අවසාන වාර පරීක්ෂණය, Final Term Test

නම  
Name

$$g = 10 \text{ Nkg}^{-1}$$

**PART A -Structured Essay )pages 2 -6 (**

- \* Answer all four questions on this paper itself
- \* Write your answer in the space provided for each question. Note that the space provided is sufficient for your answer and extensive answers are not expected.

**PART B- Essay (Page 07-11)**

- \* Answer four questions only. Use paper supplied for this purpose .
- \* At the end of the time allocated For this paper, tie the two together so that part A is on the top of part B before handing over the supervisor.

**For Examiner's Use Only**

Part	Q.No	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
C	8	
	9A	
	9B	
	10A	
	10B	
Total		
Percentage		

**Final Marks**

In Number	
In words	



\* Answer all four questions.

$$g = 10 \text{ N kg}^{-1}$$

1. You are required to find the density of coconut oil from a graphical method. You are given a 100 mL graduated cylinder of mass 50 g, coconut oil and a triple-beam balance only for this experiment.

(a) What is the least count of the triple beam balance?

.....

(b) The cylinder is filled to the 100 mL level with oil and its mass is measured to be 132.6 g. Estimate the density of the oil

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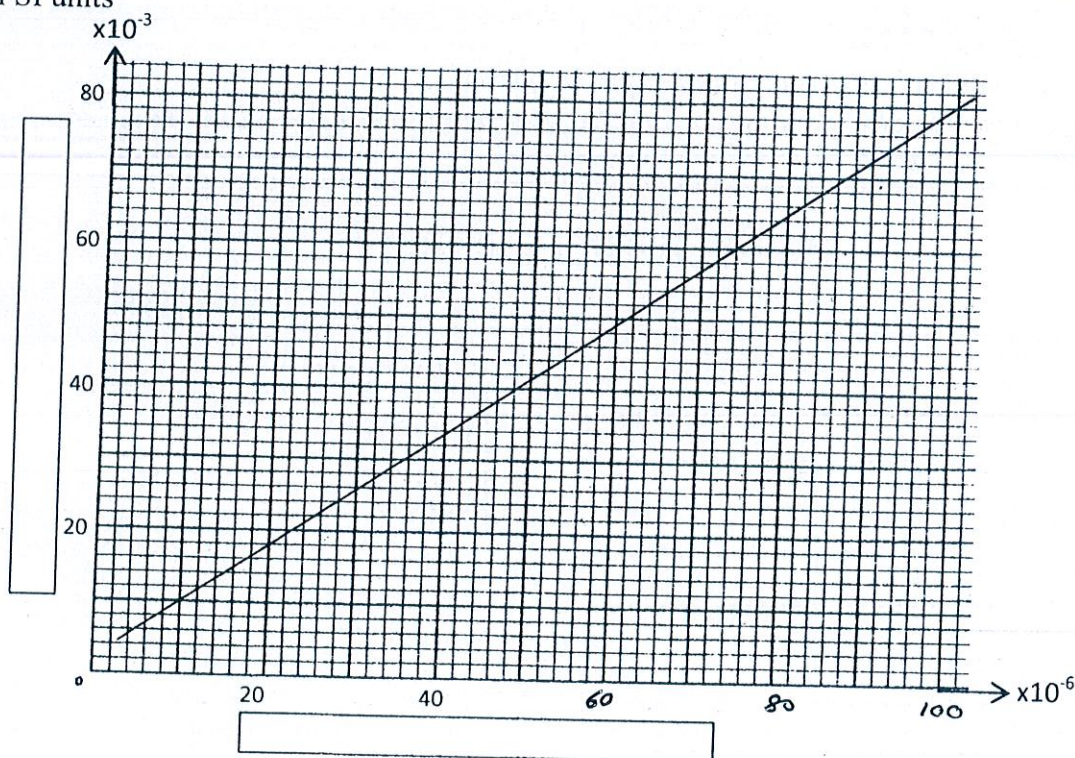
(c) Write the experimental procedure to find the density from the graphical method

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.....

(d) The graph plotted base on experimental data is given below. All quantities are marked in SI units



(i) Label the axis with SI units

(ii) Calculate the gradient. Show the two points clearly, which is used to find the gradient

.....

.....

.....



(iii) What is the density of the oil?

.....

(iv) Which value of the oil density calculated in part (b) and part (d) (iii) is more accurate? Explain

.....

.....

(e) As an indicator of the accuracy and precision of this method, the experiment is repeated for water having precisely known density.

(i) Sketch the shape of the relevant graph in previous two axis

(ii) How do you check the accuracy of the density of oil?

.....

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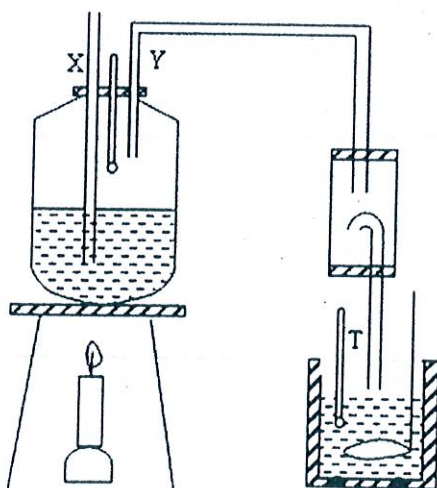
.....

(f) How do you use this set up to find the density of an irregular shape metal piece?

.....

.....

2. It is shown in the following figure, an experiential setup used to determine the specific latent heat of vaporization of water by the method of mixture.



(i) What is the use of the tube X?

.....

(ii) What is the use of the steam trap?

.....

(iii) Calorimeter is placed right below the tube T after it starts producing steam at steady rate. Give the reason for not placing it below T from the beginning?

.....

.....



(iv) Write down the measurements you take in the correct order (Introduce the symbols used)

.....  
.....  
.....  
.....  
.....

(v) Other than the above measurements, what are the other data required to calculate the latent specific heat of vapourisation of water.

.....  
.....  
.....

(vi) Write an expression for specific latent heat of vapourisation in terms of measurements in part (iv) and data in part (v). Assume the temperature of steam as  $100^{\circ}\text{C}$ .

.....  
.....  
.....  
.....

(vii) Other than the measurements and the data in parts (iv) and (v), what is the other important factor that you should handle with care? State why you should care it that much ?

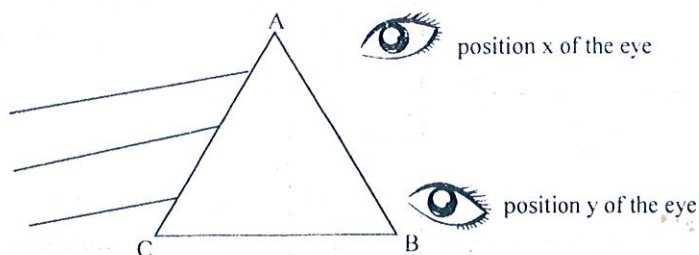
.....  
.....  
.....

(viii) What procedure do you follow to correct the error due to heat exchange with the surrounding ?

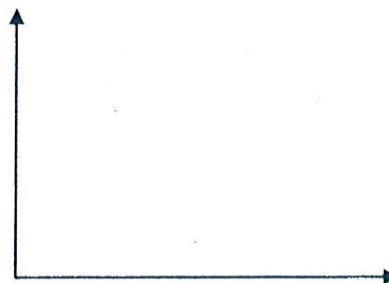
.....  
.....  
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.....  
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3. In an experiment to find refractive index of glass, using a glass prism, you are provided with a drawing board with a white sheet of paper fixed, an equilateral glass prism, pins, a pencil and a ruler. It is required to find angles of deviation for different angles of incidence.



- (i) Out of the three lines drawn, select the correct line as the incident ray and show the correct positions of placing pins  $P_1$  and  $P_2$  on it.  
.....  
.....
- (ii) To see the images of pins  $P_1$  and  $P_2$  through side AB, out of eye positions x and y, which position is more correct?  
.....
- (iii) State the experimental procedure you follow to trace the ray of emergence.  
.....  
.....  
.....
- (iv) What are the other apparatus you require to carry out this experiment?  
.....
- (v) Complete the path of the ray emerging from the prism on the above figure and mark the angle of incidence and angle of deviation.
- (vi) Draw the rough sketch of the graph you expect and label the axis.



- (vii) To calculate the refractive index of the prism you obtain the most important quantity, the angle of minimum deviation of the prism from the graph. What experimental procedure can you take to increase the accuracy of the minimum deviation?  
.....  
.....  
.....  
.....



(viii) If the angle of minimum deviation you found from the graph is  $37^\circ$ , what is the refractive index of the prism?

.....

.....

.....

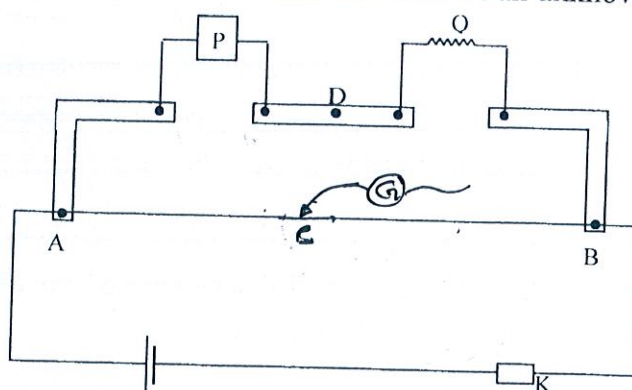
(ix) What difficulty do you find if you try to find the angle of deviation for the incident angle  $15^\circ$ .

.....

.....

.....

4. Following figure shows a setup circuit to find the value of an unknown resistor (Q) by a metre bridge.



(i) You are provided with an extra key S,  $-( )-$  and a resistor of  $1\text{ k}\Omega$ . Show how you connect them to the galvanometer for its safety?

(ii) If the resistance of resistance box P is zero, will you be able to find a balance point? Explain this in terms of potential.

.....

.....

.....

.....

(iii) If the resistance of the resistor box P is infinity, will you be able to find a balance point? Explain this in terms of potential.

.....

.....

.....

.....

(iv) While trying to find a balance point, no balance point is found. Write down two possible reasons for this.

- 1) .....
- 2) .....



(v) Derive the theoretical relation to plot a straight line graph to determine the value of  $Q$ .

.....

.....

.....

.....

.....

.....

.....

(vi) State how you calculate  $Q$  using the above graph.

.....

.....

.....

(vii) Explain, how you check the uniformity of the meter bridge wire.

.....

.....

.....

(viii) The wire may be heated up due to the a current flow in it. Explain the dependence of balance point on the heating effect.

.....

.....

.....

.....

(ix) How can you minimum the heating of the wire?

.....

.....

.....



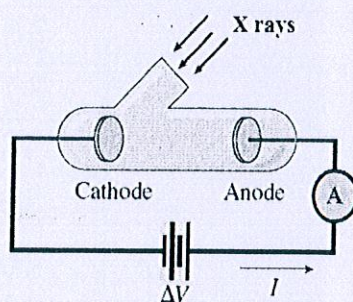




APB

G.C.E.(A/L)

PHYSICS



Marking Scheme

**2018 – June – Grade – 13**



**Grade 13 – June – 2018 – M.C.Q.**  
**Visakha Vidyalaya – Colombo - 05**

Q.No.	Answer
1.	4
2.	3
3.	5
4.	5
5.	4
6.	2
7.	1
8.	1
9.	2
10.	3
11.	1
12.	2
13.	2
14.	3
15.	1
16.	1
17.	1
18.	4
19.	5 $E^M(2)$
20.	2
21.	3
22.	4
23.	4
24.	3
25.	5

	Answer
26.	4
27.	3
28.	2
29.	3
30.	2
31.	3
32.	3
33.	1
34.	2
35.	2
36.	2
37.	2
38.	3
39.	4
40.	4
41.	3
42.	4
43.	4
44.	1
45.	1
46.	3
47.	2
48.	3
49.	3
50.	4



Gr. 13

June 2018.

APB

① - 4	⑪ - 1	⑲ - 3	⑳ - 3	④① - 3
② - 3	⑫ - 2	⑳ - 4	③② - 4 3	④② - 4
③ - 5	⑬ - 2	㉑ - 4	③③ - 1	④③ - 4
④ - 5	⑭ - 3	㉒ - 3	③④ - 2	④④ - 1
⑤ - 4	⑮ - 1	㉓ - 5	③⑤ - 2	④⑤ - 1
⑥ - 2	⑯ - 1	㉔ - 4	③⑥ - 2	④⑥ - 3
⑦ - 1	⑰ - 1	㉕ - 3	③⑦ - 2	④⑦ - 2
⑧ - 1	⑱ - 4	㉖ - 2	③⑧ - 3	④⑧ - 3
⑨ - 2	⑲ - 5 3 EM02	㉗ - 3	③⑨ - 4	④⑨ - 3
⑩ - 3	㉘ - 2	㉙ - 2	④⑩ - 4	⑤① - 4

Final T. T.

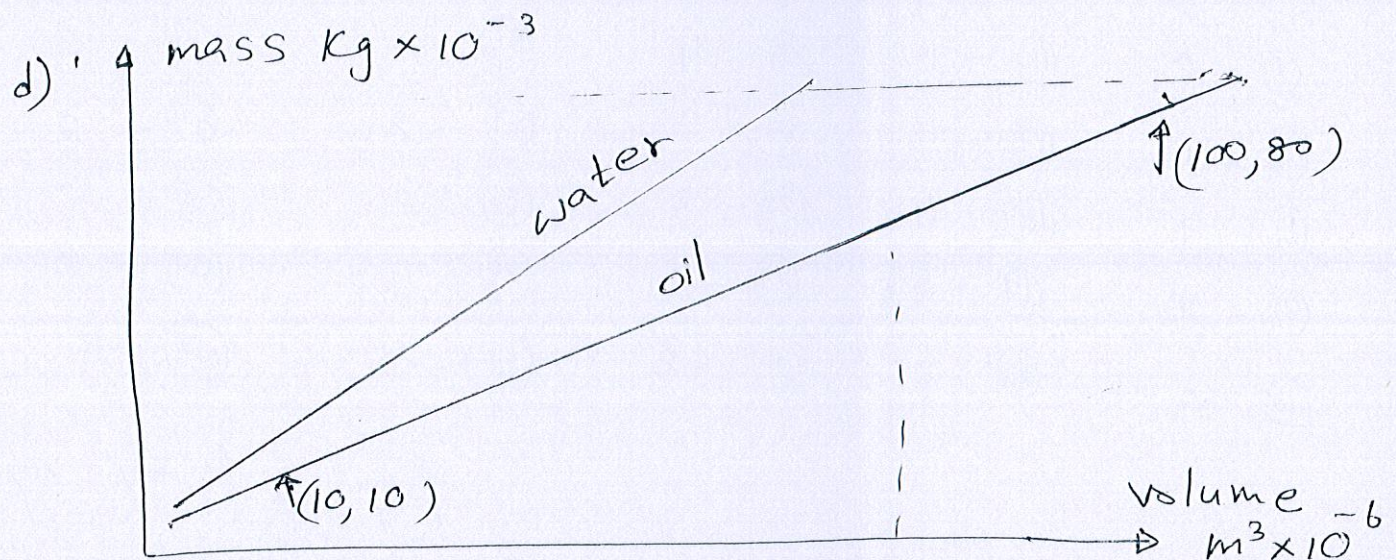


# Structured - (1)

a) 0.1 g - (01)

b)  $d = \frac{m}{V} = \left( \frac{132.6 - 50}{100} \right) = 0.826 \text{ g cm}^{-3}$  (01)

c) By adding oil to the cylinder by 15 ml, measure the total mass each time (01)



i) - (01)

ii) (m) gradient =  $\frac{(80 \times 10) \times 10^{-2}}{(100 - 10) \times 10^{-6}} = \frac{70}{90} \times 10^3 = 778 \text{ kg m}^{-3}$  (01)

iii)  $\rho = |m| = 778 \text{ kg m}^{-3}$  - (01)

iv) Part (d) (01)

It is a graphical method. Therefore more readings are taken. But in (b) only one reading is used.

e) i) (01)

ii) Find the density of water from the graph. (01)  
Compare it with the standard value. If the experimental value is closer to the standard value, then method is accurate. And the density of oil found from the experiment is accurate.

f) Put the piece of metal into the measuring cylinder having water in it. Measure the increase of volume which is equal to the volume of the piece of metal. Then measure the mass of the piece of metal. (01)  $d = m/v$ .



(2) (i) ජලයෙහි දියවනු ලබන ද්‍රව්‍ය / වලය හි කිසිදු ලක්ෂණය වෙනස්වීමක් ප්‍රතික්ෂේප කළ යුතුය. — (01)

(ii) විශේෂ ප්‍රමාණයක් <sup>ලබා ගන්නා</sup> / ඊට වලයෙන් තොරව ප්‍රමාණයක් <sup>ලබා ගන්නා</sup>. — (01)

(iii) බරපතල දාහකයෙන් නිදහස් තත්ත්වයේ කැබනිට්ටුව හා වලය හි විෂය ලක්ෂණයන්. — (01)

- (iv) (1) නිවැරදි කැබනිට්ටුව + මන්දිතයේ ස්කන්ධය ( $m_1$ )  
 (2) වලය + කැබනිට්ටුව + මන්දිතයේ ස්කන්ධය ( $m_2$ )  
 (3) වලයේ ද්‍රාවණයේ උෂ්ණත්වය ( $\theta_1$ )  
 (4) ප්‍රමාණය යනු පසු විශ්ලේෂණයේ ද්‍රාවණයේ උෂ්ණත්වය ( $\theta_2$ )  
 (5) පද්ධතියේ ද්‍රාවණයේ ස්කන්ධය ( $m_3$ ) සාධකය ✓ හරි (02)

(v) වලයේ විශේෂය තාප සංගුණකය ( $S_p$ )  
 කැබනිට්ටුවේ ස්කන්ධය දැන ගන්නා විට. කැබනිට්ටුවේ ( $S_{\text{කැ}}$ ) } — (01)

(vi) ප්‍රමාණය  $m_1$  + ප්‍රමාණය  $m_2$  ලැබෙන } = කැබනිට්ටුව හා වලයේ  
 කැබනිට්ටුවේ තාපය + වලයේ තාපය } වලයේ තාපය.  

$$(m_3 - m_2)L + (m_3 - m_2)S_p(100 - \theta_2) = m_1 S_{\text{කැ}}(\theta_2 - \theta_1) + (m_2 - m_1)S_p(\theta_2 - \theta_1)$$

(vii) නිදහස්වීමේ ස්කන්ධය — (01)

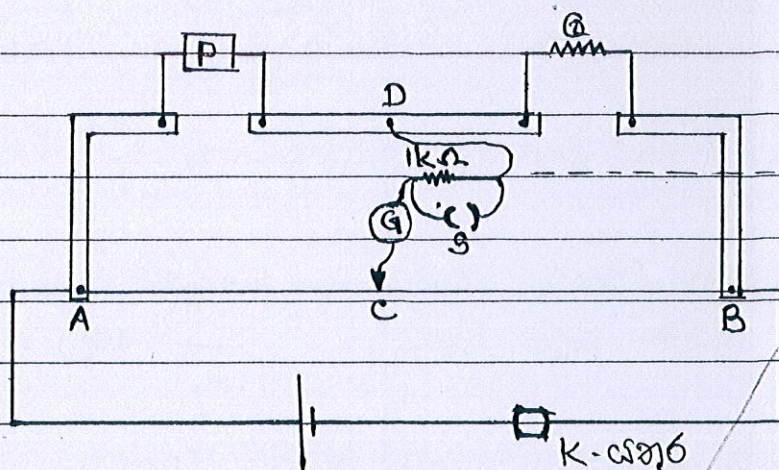
නිදහස්වීමේ ස්කන්ධය සමඟ ප්‍රමාණයේ උෂ්ණත්වය (වලයේ තාපය) වෙනස් විය යුතුය. — (01)

(viii) කැබනිට්ටුවේ දමන වලයේ ද්‍රාවණයේ උෂ්ණත්වය කාමර උෂ්ණත්වයට වඩා  $5^\circ\text{C}$  කින් වැඩි විය යුතුය. කැබනිට්ටුවේ දමන ද්‍රාවණයේ උෂ්ණත්වය කාමර උෂ්ණත්වයට වඩා  $5^\circ\text{C}$  කින් වැඩි විය යුතුය. කැබනිට්ටුවේ දමන ද්‍රාවණයේ උෂ්ණත්වය කාමර උෂ්ණත්වයට වඩා  $5^\circ\text{C}$  කින් වැඩි විය යුතුය. — (01)



4

a)



(01)

b) P හි දූශය ශුන්‍ය වූ විට D හි විභවය C හි විභවයට වඩා වැඩිවීමට හේතු වන්නේ ඇල්වෙන්ටරය හරහා විද්‍යුත් ධාරාවක් D සිට C වෙත ගමන් කරයි.

(01)

c) P හි දූශය දෘශ්‍යය වූ විට P හරහා ධාරාවක් ගමන් නොකරයි. එවිට C හි විභවය D හි විභවයට වඩා වැඩිවී ඇල්වෙන්ටරය හරහා C සිට D වෙත විද්‍යුත් ධාරාවක් ගමන් කරයි.

(01)

d) (1) සම්බන්ධතා ස්වරූපය ලියන්න. (01)  
(2) සන්නිවේදනය කරන ප්‍රතිරෝධ දෙකෙන් එකක් ලෝහ කැබලි වීම. (01)

$$e) \frac{P}{Q} = \frac{l}{100-l}$$

$$\frac{Q}{P} = \frac{100-l}{l}$$

$$\frac{1}{l} = \left(\frac{Q}{100}\right)\left(\frac{1}{P}\right) + \frac{1}{100}$$

(01)

$$y = mx + c$$

$$f) \text{ දෘශ්‍යාංශය } m = \frac{Q}{100}$$

$$Q = 100m$$

(01)



VIII

$$n = \frac{\sin \left[ \frac{A+D_m}{2} \right]}{\sin(A_2)}$$

$$n = \frac{\sin \left( \frac{60 + 37}{2} \right)}{\sin \left( \frac{60}{2} \right)} \quad \text{--- (01)}$$

$$n \approx 1.5 \quad \text{--- (01)}$$

IX

ଚୋରସ ଦିଗରୁ ଖରାବ AB  
ପରଦାୟ ଯାଏଁ ଯେଉଁ ଦିଗରୁ  
ପ୍ରାପ୍ତହେଲା ତାହା ଚୋରସ  
ସହର ଯେଉଁ ଯୁଦ୍ଧରେ  
ଠିକ୍ ହେଲା.

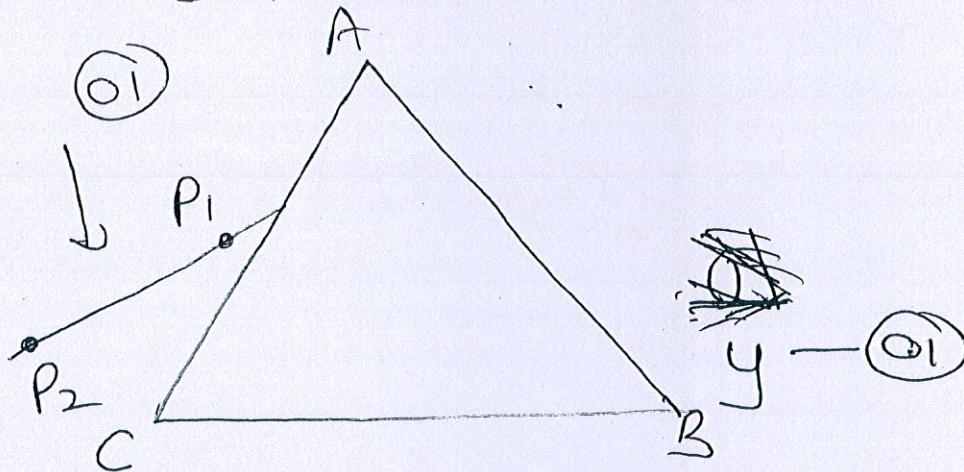
--- (01)

10



(03)

ව්‍යුහගත විචිත්‍ර



III

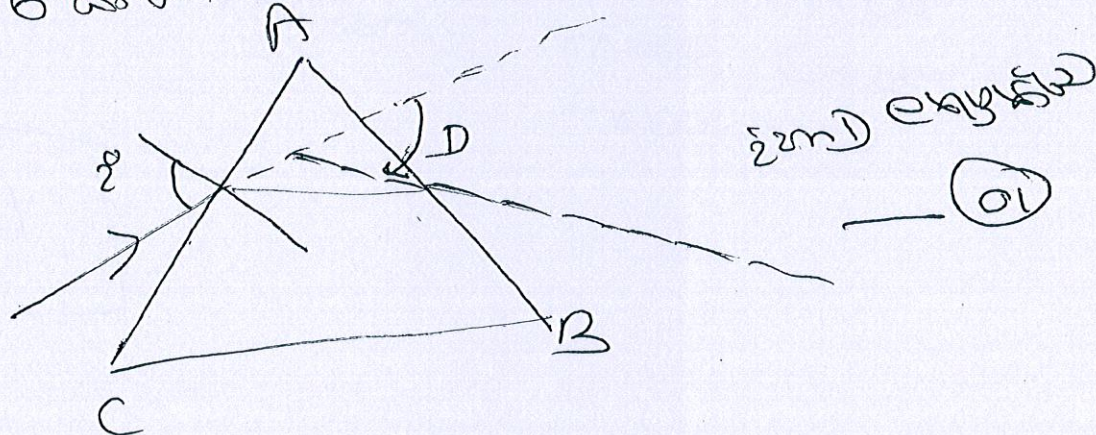
Y විචලනය වූයේ නම්  $P_1$  හා  $P_2$  වෙත  
දෘඪමාණය වල වෙනස ප්‍රකාශයක් ලෙස  
එක රේඛාව වැනිව නම් දෘඪමාණය 2න්

විචලනය

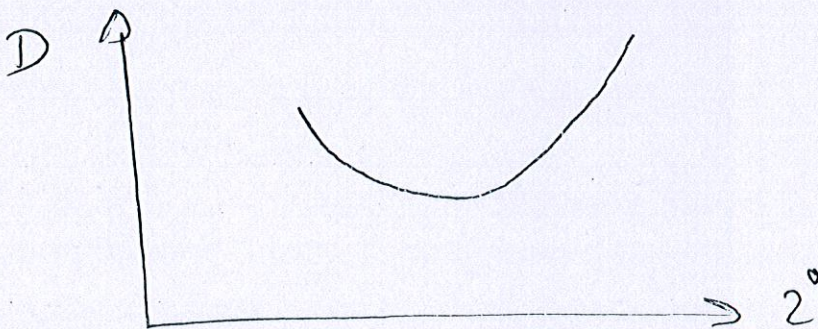
IV

සංකෝචනය, ව්‍යාප්තිය, කෙටුම්පත්

V



VI



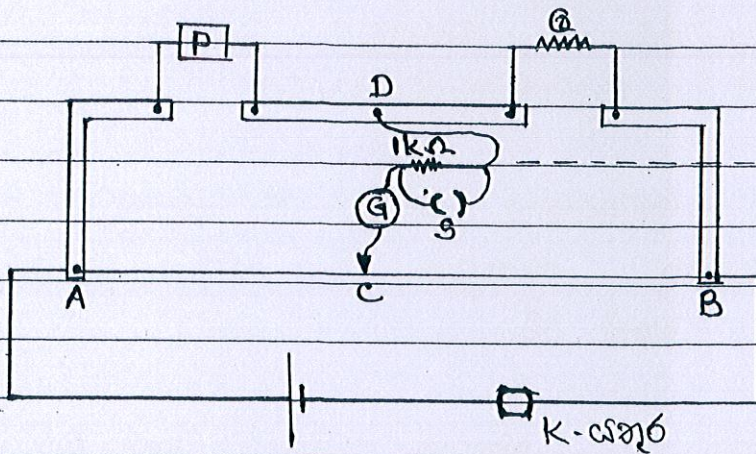
VII

ද්‍රව තත්ත්වයේ සංකෝචනය ලෙසින් වන  
සංකෝචනය සැලකිය යුතු නම් ද්‍රව තත්ත්වය  
වන තත්ත්වය වන විට



4

(a)



(01)

(b) <sup>No</sup> P හි දෘශ්‍ය ඔත්තය වූ විට D හි විභවය C හි විභවයට වඩා වැඩිවීමට හේතු වන්නේ ඔත්තුවෙන් වර්ධනය වන විද්‍යුත් ධාරාවක් D සිට C ට ගමන් කරයි.

(01)

(c) <sup>No</sup> P හි දෘශ්‍ය දෘශ්‍යතාවය වූ විට P හරහා ධාරාවක් ගමන් නොකරයි. එවිට C හි විභවය D හි විභවයට වඩා වැඩිවීමට හේතු වන්නේ වර්ධනය වන විද්‍යුත් ධාරාවක් C සිට D ට විද්‍යුත් ධාරාවක් ගමන් කරයි.

(01)

(d) (1) සම්බන්ධතා ස්ථාන කිරීමේදී වී නිශ්චය. (01)

(2) සන්නිවේදනය කරන ප්‍රතිරෝධ දෙකෙන් එකක් භ්‍රමා කළ විට. (01)

$$(e) \frac{P}{Q} = \frac{l}{100-l}$$

$$\frac{1}{l} = Q \cdot \frac{1}{P} + 1$$

$$\frac{Q}{P} = \frac{100-l}{l}$$

$$\frac{1}{l} = \left(\frac{Q}{100}\right)\left(\frac{1}{P}\right) + \frac{1}{100}$$

(01)

$$y = mx + c$$

$$(f) \text{ දෘශ්‍යතාවය } m = \frac{Q}{100}$$

$$Q = \text{gradient.}$$

$$Q = 100m$$

(01)



(g) P හා Q මාරු කළ විට සමතුලන ලක්ෂ්‍යය Q හිට  
(100-1) දුරින් ආනතවී ඇත්තේ නම්. (01)

(h) ඔව්හු කාමයෙන් ප්‍රතිරෝධය වෙනස් වී සමතුලන දිග  
වෙනස් වේ. එවිටත් සමතුලන දිග සඳහා ලැබෙන  
අගය වරින් වර වෙනස් වේ. (01)

(i) ප්‍රධාන පරිපථයට යතුරක් සම්බන්ධ කර ධාරාව අවශ්‍ය  
විට පමණක් ස්විචය සංරක්ෂණ කිරීම. (01)



Non viscous Incompressible steady streamlined flow.

(5) (1) ગુરુત્વાકર્ષણ, સ્પંદનશીલ, સ્પંદનશીલ સ્પંદનશીલ પ્રવાહનું સૂત્ર લખો.

(2)  $P + \frac{1}{2}\rho v^2 + \rho gh = \text{const}$   
 $[P] = \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$

$[\frac{1}{2}\rho v^2] = M L^{-3} (L T^{-1})^2 = M L^{-1} T^{-2}$   
 $[\rho gh] = M L^{-3} L T^{-2} L = M L^{-1} T^{-2}$

$\therefore$  સમીકરણનું યોગ્ય સ્પંદનશીલ સૂત્ર છે.

The equation is dimensionally correct.

(3) P અને Q ના બિંદુ પર વેગ

$P_1 + \frac{1}{2}\rho v_p^2 + \rho gh_p = P_2 + \frac{1}{2}\rho v_q^2 + \rho gh_q$

$P_p = P_q$   $h_q = 0$   $h_p = 0.75 \text{ m}$

$g(h_p - h_q) = \frac{1}{2}(v_q^2 - v_p^2)$  — (1) — (01)

$A_p v_p = A_q v_q$

$\pi (0.4)^2 v_p = \pi (0.2)^2 v_q$

$4v_p = v_q$  — (01)

$\Rightarrow g(h_p - h_q) = \frac{1}{2}((4v_p)^2 - v_p^2)$

$10 \times 0.75 \times 2 = 15v_p^2 \Rightarrow v_p^2 = 1$

$v_p = 1 \text{ m s}^{-1}$  — (01)

$\therefore$  1 સેકન્ડમાં પાણીનું પ્રવાહનું પ્રમાણ =  $A_p v_p$

$= \pi (0.4)^2 \times 1 = \frac{22}{7} \times 0.4 \times 0.4 \times 1$

$= \frac{3.52}{7}$

$= 5.03 \times 10^{-1} \text{ m}^3 \text{ s}^{-1}$  — (01)



$$A_P V_P = A_Q V_Q$$

$$\pi (0.4)^2 20 = \pi (0.2)^2 V_Q$$

$$V_Q = 80 \text{ m s}^{-1} \quad \text{--- (01)}$$

P and Q are at the same level

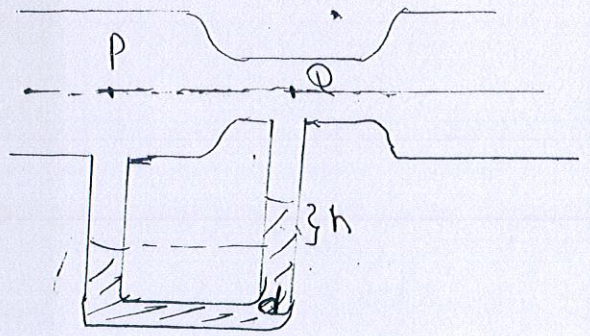
$$P_P + \frac{1}{2} \rho V_P^2 = P_Q + \frac{1}{2} \rho V_Q^2$$

$$P_P - P_Q = \frac{1}{2} \rho (V_Q^2 - V_P^2) \quad \text{--- (01)}$$

$$h \rho g = \frac{1}{2} \rho (80^2 - 20^2) \quad \text{--- (07)}$$

$$h = \frac{1.2 \times 60 \times 100}{2 \times 1600 \times 10} = \frac{9}{40}$$

$$h = 0.225 \text{ m} \quad \text{--- (01)}$$



$$A_P > A_Q$$

$$V_P < V_Q$$

$$P_P > P_Q$$

$$P_P - P_Q = h \rho g$$

$P_0 + \frac{F}{A}$  atmospheric pressure  
+  
extra pressure due to push.

(5) A and B are at the same level

$$\left( P_0 + \frac{F}{A} \right) + \frac{1}{2} \rho V_A^2 = P_0 + \frac{1}{2} \rho V_B^2$$

$$\frac{50}{A \times 10^4} = \frac{1}{2} \rho (V_B^2 - V_A^2) \quad \text{--- (01)}$$

$$1.25 \times 10^5 = \frac{1}{2} \rho (V_B^2 - V_A^2) \quad \text{--- (1)}$$

$$A_A V_A = A_B V_B$$

$$4 \times 10^4 V_A = 4 \times 10^6 V_B$$

$$V_A = 10^{-2} V_B \quad \text{--- (01)}$$

$$\text{① d; } 1.25 \times 10^5 = \frac{1}{2} \times 10^3 (V_B^2 - (10^{-2} V_B)^2) \quad \text{--- (01)}$$

$$1.25 \times 10^5 \times 2 = 10^3 \times 1.01 \times 0.99 V_B^2$$

$$V_B^2 = \frac{250 \times 10^4}{101 \times 99}$$

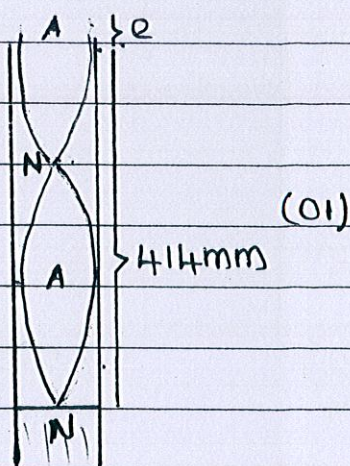
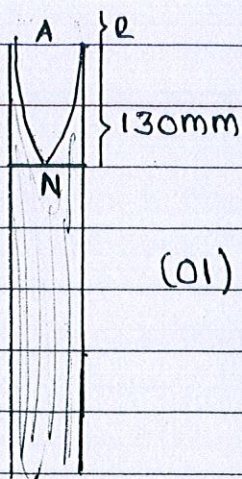
$$V_B = \sqrt{250.03}$$

$$V_B = 15.81 \text{ m s}^{-1} \quad \text{--- (01)}$$

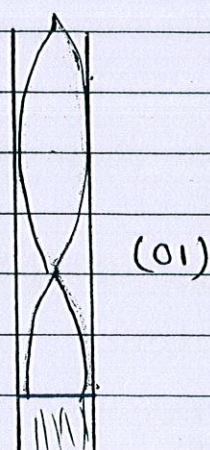
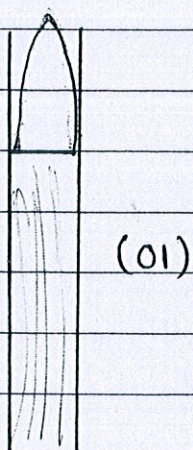


06

(i)



(ii)



(iii)  $\frac{\lambda}{4} = 130 + e$  — (1)

① or ② — (01)

$\frac{3\lambda}{4} = 414 + e$  — (2)

$3(130 + e) = 414 + e$

$390 + 3e = 414 + e$

$2e = 24$

$e = 12 \text{ mm}$  — (01)

(iv)  $v = f\lambda$

$v = 600 (130 + 12) 10^{-3}$

$v = 600 \times 142 \times 10^{-3}$

$v = 340.8 \text{ ms}^{-1}$  — (01)



$$\boxed{\begin{array}{l} e = 0.3d \\ d = \frac{12}{0.3} \end{array}}$$

$d = 40 \text{ mm}$  \_\_\_\_\_ (01)

(b)  $v = \sqrt{\frac{8RT}{M}}$   $v \propto \sqrt{T}$

දී ඇති වාග්වක් සඳහා ඊ.ල නා M නිශ්චයේ.

$\downarrow T \quad \vee \downarrow \quad f \downarrow$

$$v \propto \sqrt{T}$$

$$F \propto \sqrt{T}$$

ସୂଚକୀ ଦେଖାଯିବ ୨ ଶିକ୍ଷା ପ୍ରଥମ ଶିକ୍ଷା

$f \propto \sqrt{T}$  වේ.

$$f-4 \qquad f \qquad f+4$$

විකෘතියේ සංඛ්‍යාතය F හි සිනු,  $596 \rightarrow 600 \rightarrow 604$

$$(01) - \frac{f+H}{F+1} = \sqrt{\frac{312}{283}} - (01)$$

$599 \rightarrow 600 \rightarrow 601$

$$f^{-1} \qquad f_{+1}$$

$$\frac{F+4}{F+1} = \sqrt{1.1025} \approx 1.05$$

$$F+H = 1.05F + 1.05$$

$$F_1 = 5942$$

(01)

(C)

$$\frac{\lambda}{2} = l$$

$$\lambda = 2l' \quad \text{---}$$

$$f = \frac{V}{2l} \quad \text{--- (1) (oi)}$$

$$\frac{2}{4}(5) = 1.$$

$$\lambda = 42.15$$

$$f + 150 = \frac{5V}{41} \quad \text{--- (2) (OI)}$$

$$\frac{f+150}{f} = \frac{5V}{11V} \cdot \frac{2l}{V}$$

$$2f + 300 = 5f$$

$$f = 100 \text{ Hz}$$

5<sup>th</sup> harmonic  $\rightarrow$   
2<sup>nd</sup> overtone,

$f_0, 3f_0, 5f_0$

(a1)



Grade 13 - June 2018 (Final)  
Marking scheme - Essay.

7) සමානුපාතික සීමාව තුළදී ප්‍රත්‍යාවලය ( $\frac{F}{A}$ )  
චක්‍රියාවට ( $e/l$ ) දරණ අනුපාතය — (01)

පීඩනය, ප්‍රත්‍යාවලය — (01)

a) i) ප්‍රශ්නේ නියමය : සමානුපාතික සීමාව තුළදී  
කම්බියක සිදුවන විතරිය යොදා ලබන වලයා  
අනුලෝමව සමානුපාතික වේ. — (01)

ii)  $500 \text{ N} \rightarrow 12.5 \times 10^{-2} \text{ mm}$   
$$EPE = \frac{1}{2} Fe = \frac{1}{2} \times 500 \times 12.5 \times 10^{-5} \text{ m}$$
$$= 31.25 \text{ mJ} \text{ — (01)}$$

iii)  $A = \pi r_1^2 - \pi r_2^2 = 3 (2 \times 10^{-2})^2 - (1 \times 10^{-2})^2$   
 $A = 3 \times 10^{-4} (4 - 1) = 9 \times 10^{-4} \text{ m}^2$

$\frac{F}{A} = y \frac{e}{l}$  හෝ  $y = \frac{F/A}{e/l} = \frac{Fl}{Ae} \text{ — (01)}$

$$y = \frac{1000 \text{ N} \times 0.9 \text{ m}}{9 \times 10^{-4} \text{ m}^2 \times 25 \times 10^{-5} \text{ m}} = \underline{\underline{4 \times 10^9 \text{ Nm}^{-2}}} \text{ (01)}$$

iv) දී ඇති හේදක ලක්ෂ්‍යය දක්වා සමානුපාතික  
සීමාව තුළ පවතින වට උපකල්පනය කෙරේ. (01)

$\frac{F}{A} = y \frac{e}{l} \rightarrow e = Fl / Ay$

$$e = \frac{3600 \text{ N} \times 0.9 \text{ m}}{9 \times 10^{-4} \text{ m}^2 \times 4 \times 10^9 \text{ Nm}^{-2}}$$
$$= 0.9 \text{ mm} = 9 \times 10^{-4} \text{ m} \rightarrow \text{(01)}$$

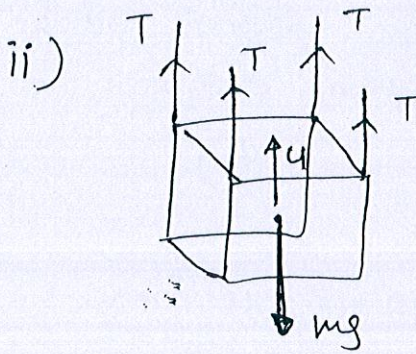
හෝ  $\left( \frac{25 \times 10^{-2} \text{ mm}}{1000 \text{ N}} \right) \times 3600 \text{ N} = 0.9 \text{ mm}$   
 $= 9 \times 10^{-4} \text{ m}$



$$b) i) 4 \times 10^8 \text{ Nm}^{-2} \times 10^{-4} \text{ m}^2 \times 4 = 16 \times 10^4 \text{ N} \\ = 16 \times 10^3 \text{ kg} - \textcircled{01}$$

එක් කම්බියක් සඳහා :

$$\frac{F}{A} = Y \frac{e}{l} \rightarrow e = \frac{Fl}{AY} = \frac{4 \times 10^8 \times 10 \text{ m}}{2 \times 10^{11}} = 2 \text{ cm} \\ \textcircled{01}$$



$$4T + U = mg \rightarrow \textcircled{01}$$

$$T = \frac{mg - U}{4}$$

$$= \frac{10^5 \text{ N} - (2 \times 2 \times 2 \times 10^3 \times 10)}{4}$$

$$T = \frac{(10 \times 10^4) - (8 \times 10^4)}{4} = 5 \times 10^3 \text{ N}$$

$$e = \frac{Fl}{AY} = \frac{5 \times 10^3}{10^{-4}} \times \frac{10}{2 \times 10^{11}}$$

$$e = 2.5 \text{ mm} \rightarrow \textcircled{01}$$

$$iii) F = mg/4 = 10 \times 10^4 / 4 = 2.5 \times 10^4 \text{ N} - \textcircled{01}$$

$$l = AeY/F = \frac{10^{-4} \times 2.5 \times 10^{-3} \times 2 \times 10^{11}}{2.5 \times 10^4}$$

$$= 2 \text{ m} \rightarrow l + e = 2 \text{ m} + 2.5 \text{ mm} \\ \textcircled{01} \text{ කම්බිය ඉහළින් පවතී.}$$

$$iv) e = \frac{Fl}{AY} = \frac{2.5 \times 10^4 \times 10 \text{ m}}{10^{-4} \text{ m}^2 \times 2 \times 10^{11}}$$

$$= 12.5 \text{ mm} \rightarrow \textcircled{01}$$



60m 2021 KCF

⑧

A

$$F = B q v \sin \theta \quad \text{--- (1)}$$

$F, B, q, v$  known ~~value~~ ~~value~~

I

$$I = N \cdot A \cdot V_d \cdot e$$

$$50 = 2 \times 10^{29} \times (0.1 \times 10^{-2} \times 0.02 \times 1.6 \times 10^{-19}) \cdot V_d$$

$$V_d = 7.8 \times 10^{-5} \text{ m/s} \quad \text{--- (1)}$$

II

$$F = B q V_d \quad \theta = 90^\circ \sin \theta = 1$$

$$F = 2 \times 1.6 \times 10^{-19} \times 7.8 \times 10^{-5}$$

$$F = 24.96 \times 10^{-24}$$

$$F = 25 \times 10^{-24} \text{ N} \quad \text{--- (1)}$$

III

$$F = E q$$

$$25 \times 10^{-24} = E \times 1.6 \times 10^{-19}$$

$$E = 15.6 \times 10^{-5} \text{ N/C} \quad \text{--- (1)}$$

2m



--- (1)

$$15.6 \times 2 \times 10^{-8}$$

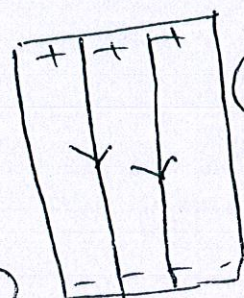
$$3.12 \times 10^{-6}$$

IV

$$E = \frac{V}{d}$$

$$15.6 \times 10^{-5} = \frac{V}{0.02}$$

$$V = 3.12 \times 10^{-6} \text{ V} \quad \text{--- (1)}$$



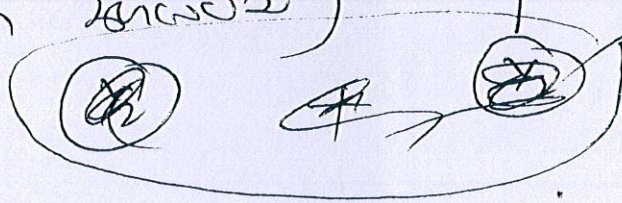


b

V

$$E = 15.6 \times 10^{-5} \text{ NCT}$$

(8mm 2x10000)



(B)

ii

$$I \quad 50 \times 10^{-3} \text{ T} \quad \text{--- (01)}$$

II

$$\phi = BAN$$

$$\phi = 50 \times 10^{-3} \times 0.4 \times 10^{-4} \times 150$$

$$\phi = 3 \times 10^{-4} \text{ wb} \quad \text{--- (01)}$$

III

$$\phi = 8 \times 10^{-3} \times 0.4 \times 10^{-4} \times 150$$

$$= 4.8 \times 10^{-5} \text{ wb}$$

$$E = \left( \frac{\phi_1 - \phi_2}{t} \right)$$

$$= \frac{[3 \times 10^{-4} - 4.8 \times 10^{-5}]}{0.3}$$

$$E = \frac{2.52 \times 10^{-4}}{0.3}$$

$$E = 8.4 \times 10^{-4} \text{ V} \quad \text{--- (01)}$$

115



9)

A)

I ଭୋଲଟେଜ୍ ସର୍କିଟ୍ = {ସର୍କିଟ୍ ପ୍ରତିରୋଧ} + {ଭୋଲଟେଜ୍ ସର୍କିଟ୍}

$$E = Ir + IR$$

$$EI = I^2 r + I^2 R$$

$$EI = I^2 r + P$$

$$P = I^2 R$$

$$P = EI - I^2 r$$

$$P = EI - I^2 r \quad \text{--- (01)}$$

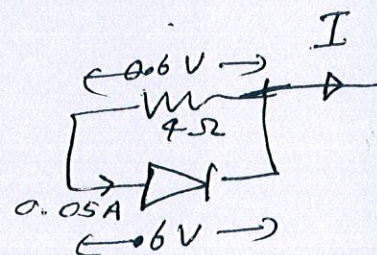
II  $V = IR$  ରେ

$$0.6 = I_1 \times 4 \quad \text{--- (01)}$$

$$I_1 = 0.15 \text{ A} \quad \text{--- (01)}$$

$$I = 0.15 + 0.05$$

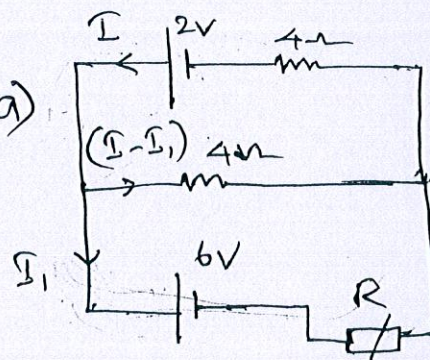
$$I = 0.2 \text{ A} \quad \text{--- (01)}$$



$$\sum E = \sum IR$$

III)

a)



$$2 = 4I + 4(I - I_1) \quad \text{--- (01)}$$

$$1 = 4I - 2I_1 \quad \text{--- (1)}$$

$$-4 = 4I + I_1 R \quad \text{--- (2) --- (01)}$$

$$(1) \times R + (2) \times 2 \text{ d;}$$

$$I = \frac{R - 8}{(4R + 8)} \quad \text{--- (01)}$$

b)

$$\frac{R - 8}{4R + 8} = 0 = I \text{ (at } 30^\circ \text{C)}$$

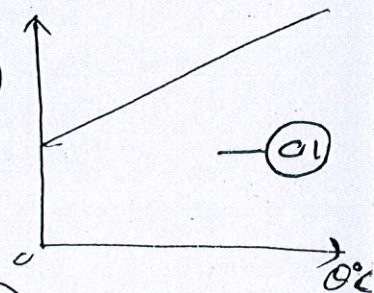
$$\therefore R = 8 \Omega \quad \text{--- (01)}$$

c)

$$\frac{R - 8}{4R + 8} = \frac{15}{100} = I \quad \text{--- (01)}$$

$$R = 23 \Omega \quad \text{--- (01)}$$

d)



e)

$$\left. \begin{aligned} R_{30} &= 8 = R_0 (1 + 30\alpha) \\ R_{100} &= 23 = R_0 (1 + 100\alpha) \end{aligned} \right\} \quad \text{--- (01)}$$

$$R_{\alpha} = R_0 + R_0 \alpha \Delta \theta$$

$$R_{\alpha} = R_0 \alpha \Delta \theta + R_0$$

$$y = mx + c$$

$$\alpha = \frac{m}{c} = \frac{R_0 \alpha}{R_0}$$

$$R_{\alpha} = R_0 (1 + \alpha \Delta \theta)$$

$$\alpha = 1.36 \times 10^{-3} \text{ } ^\circ \text{C}^{-1} \quad \text{--- (01)}$$



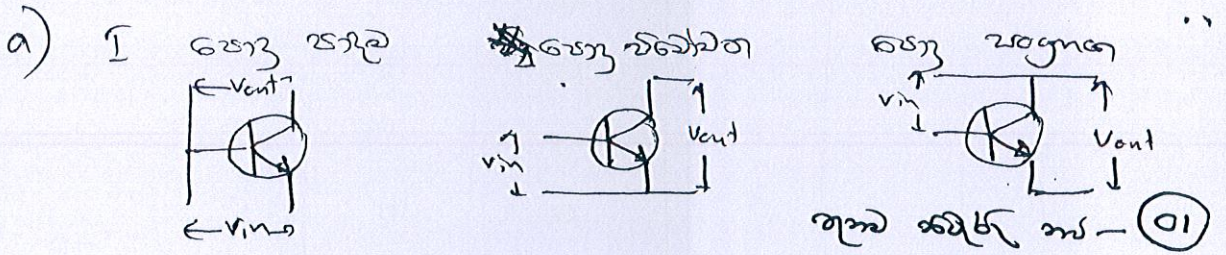
$$I = \frac{R-8}{4R+8} = \frac{2}{10} A \quad \text{--- (01)}$$

$$R = 48 \Omega \quad \text{--- (01)}$$

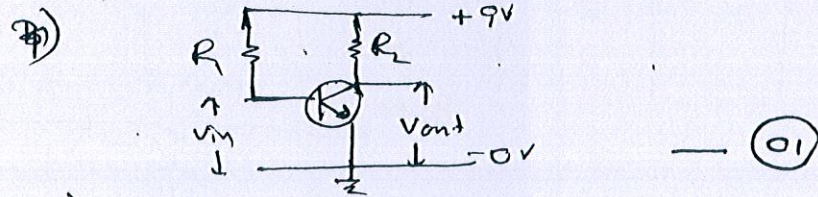
15



9(B)



- 3) 1) BE ජාත්‍යවේදය වෙබ් අඩු වේදය  
2) BC ජාත්‍යවේදය වෙබ් අඩු වේදය  
3)  $V_{CE} = \frac{1}{2} V_{CC}$  වේදය
- අනුමාන - 01



(7)  $R_1 \text{ ව } V = I R$   
 $9 - 0.7 = \frac{40}{1000} \times R_1$

$R_1 = 207.5 \Omega$  — 01

(92)  $I_C = \beta I_B$   
 $I_C = 100 \times \frac{40}{1000} = 4 \text{ A}$  — 01

$R_2$   $V = I R$   
 $9 - 4.5 = 4 \times R_2$   
 $R_2 = 1.125 \Omega$  — 01

II ON - වෙනම අවස්ථාව } — 01  
 Off - වෙනම අවස්ථාව }

(b) I  $\frac{R}{5.5} = \frac{150}{330}$   
 $R = 25 \text{ k}\Omega$  — 01

II (7)  $\frac{R}{5.5} = \frac{1.28}{(4.8 - 1.28)}$  (92)  $\frac{V_o}{V_{in}} = \left(1 + \frac{R_f}{R_L}\right)$   
 $R = 2 \text{ k}\Omega$  — 01  $= 1 + \frac{22.5}{1.5}$   
 $= 16$  — 01

(7)  $V_o = 16 V_{in} + 1.5$   
 $= 16(1.5 - 1.28) + 1.5$   
 $= 16 \times 0.22 + 1.5$   
 $= 4.72 \text{ V}$  — 01



c)

1

A	B	C	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>
1	1	1	0	0	1
1	1	0	0	1	0
1	0	1	1	0	0
1	0	0	0	0	0
0	1	1	0	0	0
0	1	0	0	0	0
0	0	1	0	0	0
0	0	0	0	0	0

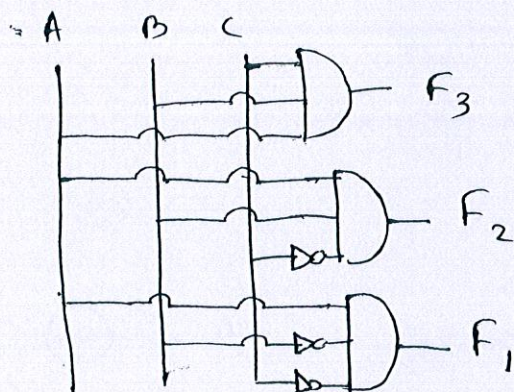
$A \cdot \bar{B} \cdot \bar{C}$

$A \cdot B \cdot \bar{C}$

$A \cdot B \cdot C$

01

11



2

15



$$10(A) (i) W = P(V_2 - V_1) \text{ ————— } (01)$$

අර්බුදය මගින්  $\rightarrow$  පරිණාම වන්නා වන, ————— (01)

$$(ii) (i) W = 1.01 \times 10^5 (1.671 - 1 \times 10^{-3}) \\ = \underline{\underline{1.6867 \times 10^5 \text{ J}}} \text{ ————— } (01)$$

$$2) (i) = mL + \text{ ————— } (01) \\ = 1 \times 2260 \times 10^3 \\ 2.26 \times 10^6 \text{ J} = \underline{\underline{2260 \text{ kJ}}} \text{ ————— } (01)$$

$$3) \Delta U = mL = 2.260 \times 10^6 \text{ J} \text{ ————— } (01) \\ \text{පුනර් වාෂ්පීකරණය වීමේදී මෙම කාර්යය. ————— } (01)$$

$$4) E\% = \frac{W}{Q} \times 100\% \\ = \frac{1.6867 \times 10^5}{2.26 \times 10^6} \times 100 \text{ ————— } (01) \\ = \underline{\underline{7.46\%}} \text{ ————— } (01)$$

5) ප්‍රදායනීය ශක්තිය. —————  
 නිශ්පාදනය නොවේ. දැක්වීමක්  
 නිශ්පාදනය වුවද  
 එය  
 අපහසු වේ  
 ක්‍රියාත්මක නොවේ. ————— (01)

Heat lost from  
 earth at  $13^\circ\text{C} \rightarrow 0^\circ\text{C}$ .  
 Latent heat of  
 vaporisation.

$$(iii) \text{ වාෂ්පීකරණය වීමේදී } - m \\ \text{ මෙම වාෂ්පීකරණය } - M \\ m \times 3.9 \times 10^5 = M \times 2.4 \times 10^3 \times 13 \\ mL = MS \Delta \theta \text{ ————— } (01)$$

$$\left. \begin{array}{l} \text{වාෂ්පීකරණය} \\ \text{ප්‍රතිශතය} \end{array} \right\} = \frac{m}{M} \times 100\% \\ = \frac{2.4 \times 10^3 \times 13}{3.9 \times 10^5} \times 100\% = 8\% \text{ ————— } (01)$$



2)  $20^{\circ}\text{C}$  ചെല  $\xrightarrow{\text{mgt}}$   $0^{\circ}\text{C}$  ചെല  $\xrightarrow{\text{mL}}$   $0^{\circ}\text{C}$  ചുടല  $\xrightarrow{\text{mgt}}$   $-10^{\circ}\text{C}$  ചുടല

$$\left. \begin{array}{l} \text{സംവ ഉത്കരത} \\ \text{ജ്യോതര} \end{array} \right\} = \frac{0.5(4200 \times 20 + 336000 + 2100 \times 10)}{3600 \times 2} \text{ W}$$

$$= \underline{\underline{30.625 \text{ W}}} \quad (01)$$

3) തെക്കൻക ഗുരവ താഴെവിരര രചരൻ . (01)

4) തുറൻ നരരൻ രാരിൻ തെക്കൻകാല ചുടലരൻ m  
താരിൻ ചരിരൻ രരരൻ താഴെവിരൻ രെ.  
ഗരൻ തെക്കൻകാല തുറൻകരൻ രാരിൻ രാരിൻ രരരൻ  
തെരൻ തുറൻകരൻ നരരൻ തുറൻകരൻ സംവ രാരിൻ  
രരരൻ തുറൻകരൻ തുറൻകരൻ തുറൻകരൻ . (01)



- (a) The potential barrier which prevents free electron leaving from the surface / free electrons on the surface have attractive force by the nuclei behind them this is called Surface Barrier Potential. (01)

The extra energy required to <sup>just</sup> overcome the surface barrier potential is called the work function. (01)

(b)  $\phi = 5 - 1 = 4 \text{ eV}$ . (01)

(c) Thermionic, Field, photoelectric and secondary. (01)

- (d) (i) To produce thermionic electrons, the temp. of the filament should be very high. Under this temp, copper can melt as its melting point is relatively low. But tungsten melting point is very high so it can produce thermionic electrons without melting. (01)

(ii) Electron microscope. (01)

(iii) K.E. is equal to the work done by the field to accelerate it. (01)

$$W = Vq = 200 \times 10^3 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-14} \text{ J}$$

$$= \frac{3.2 \times 10^{-14}}{1.6 \times 10^{-19}} = 2 \times 10^5 \text{ eV} = 200 \text{ keV} \quad (01)$$

(iv) (1)  $\Delta E = hf = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{4 \times 10^{-11}} = 5 \times 10^{-15} \text{ J}$  (01)

(2) No.  $K_\alpha$  is the energy difference of the K and L shells of the tungsten atom. (01)

(3)  $E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{8000 \times 1.6 \times 10^{-19}} = 1.5 \times 10^{-10} \text{ m}$  (01)



$$2) (1) \quad hf = \phi + K_{max}$$

Energy of the radiation

$$E = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{2 \times 10^{-10} \times 1.6 \times 10^{-19}} \text{ eV}$$

$$= 6.2 \times 10^3 \text{ eV}$$

$$= 6.2 \text{ keV.}$$

$$hf = \phi + K_{max} \quad \text{--- (1)}$$

$$6.2 = 5 + K_{max}$$

$$K_{max} = 1.2 \text{ keV.} \quad \text{--- (2)}$$

(11)

$$K_{max} = eV_s \quad \text{--- (3)}$$

$$V_s = 1.2 \text{ kV.} \quad \text{--- (4)}$$

15







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