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Royal College - Colombo 07

Grade 13

Second Term Test – August 2023

Physics I

01 E I

Time : 2 hours

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

Answer all questions.

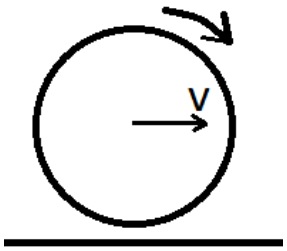
Part I

01) The SI units of sound intensity level and the sound intensity are given by,

1) B , W 2) Wm^{-2} 3) dB , W

4) dB , Wm^{-2} 5) dm , Jm^{-2}

02) The disk is rolling along a rough surface without slipping. The direction of angular velocity (ω) of the disk is given by,



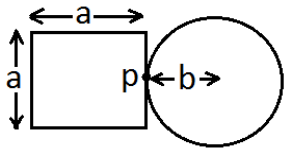
1) $\overrightarrow{\omega}$ 2) ↑ ω 3) ⊗ ω

4) ⊙ ω 5) ↗ ω

03) If there is no any external unbalanced torque on a rotating object.

1) The linear momentum is conserved.
2) The angular momentum is conserved.
3) Both linear and angular momentums are conserved.
4) Moment of inertia is conserved.
5) Non of above are conserved.

04) Figure shows a square spahed plate of side length 'a' and a circular plate of radius b which are made out of same matal. The centre of gravity of this combined object is at point P. The thickness of circular plate is twice that of square shaped plate. The ratio of a and b is given by,



1) 2π 2) 4π 3) $(2\pi)^{1/3}$ 4) $(4\pi)^{1/3}$ 5) $(\pi)^{1/3}$

05) The distance between an object and its real image formed by a lens is x. If the magnification is M, the focal length of the lens is given by,

1) $\frac{(M-1)}{M}x$ 2) $\frac{Mx}{M+1}$ 3) $\frac{(M-1)}{M^2}x$ 4) $\frac{Mx}{(M+1)^2}$ 5) $\frac{(M+1)}{M}x$

06) 80 % of volume of a wooden block is immerced in a liquid at 0 ^{0}C temperature. When the temperature of the liquid is increased up to 62.5 ^{0}C, the wooden block is completey immersed. The volume expansion of the liquid is given by,

1) $1 \times 10^{-3}\ K^{-1}$ 2) $2 \times 10^{-3}\ K^{-1}$ 3) $3 \times 10^{-3}\ K^{-1}$

4) $4 \times 10^{-3}\ K^{-1}$ 5) $5 \times 10^{-3}\ K^{-1}$

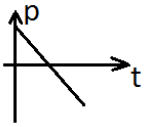
07) *W* weight is hung by a rubber rod of L initial length and *A* cross sectional area. When the hanging weight is decreased up to $\frac{W}{2}$, the extension is decreased in $\frac{1}{5}$. The young's modulus of the rubber is,

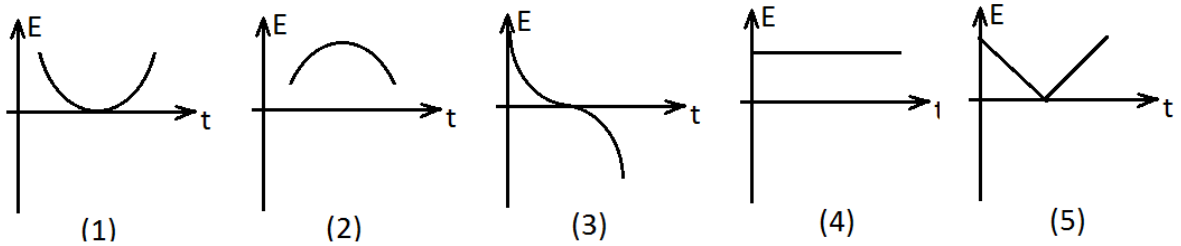
1) $\frac{5W}{2A}$ 2) $\frac{5W}{3A}$ 3) $\frac{W}{3A}$ 4) $\frac{10W}{3A}$ 5) $\frac{2W}{A}$

08) The apparent weight of a metal sphere of 10 kg mass when it is submerged in an oil of density 800 kg m^{-3} is 60 N. The resultant force acting on the curved surface of the sphere is given by,

1) 160 N 2) 60 N 3) 50 N 4) 40 N 5) 0 N

09) The figure shows a graph of a variation of momentum with time. The best representation of the variation of the kinetic energy with time is given by,





10) The magnitude of the mean velocity of an object at the maximum height which is projected with U velocity with θ angle to the horizontal is given by,

1) $\frac{U}{2}(1+\cos\theta)^{1/2}$ 2) $\frac{U}{2}(1+\cos^2\theta)^{1/2}$ 3) $\frac{U}{2}(1+3\cos^2\theta)^{1/2}$

4) $\frac{U}{2}(\sin\theta+\cos\theta)$ 5) $\frac{U}{2}$

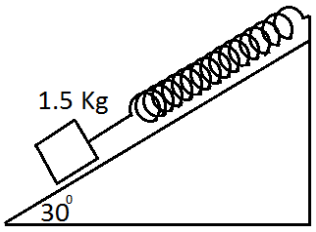
11) An object of mass 6 kg is under limiting equllibrium on an 30° inclined plane. If the inclination is increased up to 60° , an approximate extra force has to be applied to make it under equilibrium is,

1) 2.2 N 2) 22 N 3) 30 N 4) 34 N 5) 52 N

12) 22 g of Carbon Dioxide and 9 g of Hydrogen gases are existed in a vessel of having V volume under T absolute temperature. The pressure of the gasses is given by, (R – universal gas constant)

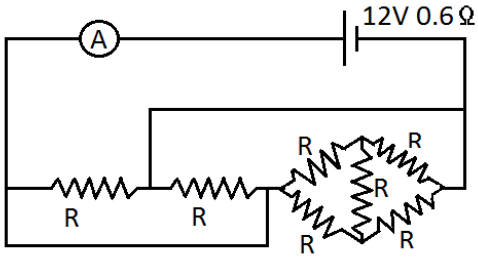
1) $\frac{RT}{V}$ 2) $\frac{2RT}{V}$ 3) $\frac{3RT}{V}$ 4) $\frac{4RT}{V}$ 5) $\frac{5RT}{V}$

13) One end of a light spring of 50 cm length is attached to the upper end of an inclined plane as shown in the figure. When a mass of 1.5 kg is attached to the spring, it's length was increased in 2.5 cm. The periodic time of the oscillation formed when the spring is extended in 1 cm and released is,



1) $\frac{\pi}{7}$ 2) $\frac{2\pi}{5}$ 3) $\frac{\pi}{5}$ 4) $\frac{\sqrt{2}\pi}{7}$ 5) $\frac{\sqrt{2}\pi}{10}$

14) Seven identical resistors are connected to a cell of having 12 V electromotive force and 0.6 Ω intern 5al resistance as shown in the figure. The reading of the ammeter is 2 A. The value of one resistor is,

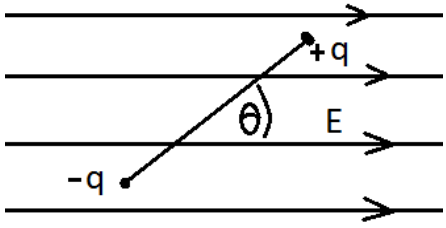


1) 3.6 Ω 2) 7.2 Ω 3) 16.2Ω
4) 10.8Ω 5) 12Ω

15) When three identical bulbs are connected in series the light is emitted with 10 W effective power. When those bulbs are connected inparallel and supplied the same potential difference, the effective power of emitted light is,

1) 9 W 2) 10 W 3) 30 W
4) 60 W 5) 90 W

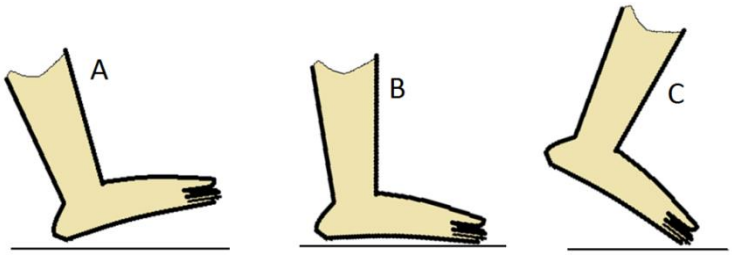
16) An insulating rod of length L is having two + q and – q charges at its two ends and released it in an electrostatic field of having intensity E as shown in figure. If the initial moment is t, then the correct relationship is



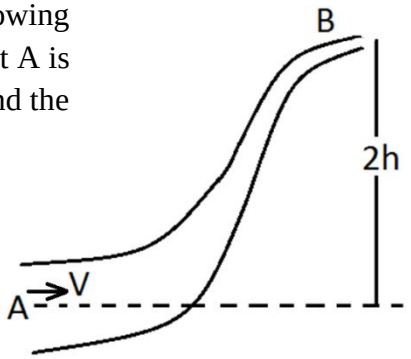
1) $t \propto Eq \sin\theta$ 2) $t \propto Eq^2 \sin^2\theta$
3) $t \propto E \sin\theta$ 4) $t \propto \dfrac{Eq}{\sin\theta}$
5) $t \propto (Eq \sin\theta)^2$

17) Following figure shows the three positions of the foot when a man is stepping forward. The direction of the frictional force applied on the foot at three instances is correctly represented by,

1)	→	←	→
2)	→	0	→
3)	←	→	0
4)	←	0	→
5)	←	0	←



18) An incompressible non-viscous, streamline fluid is flowing steadily from A to B as shown in the figure. The area at point A is four times that of B. The vertical height from A to B is 2h and the velocity at point A is V. Consider the following statements.



A. The velocity at point B is V.

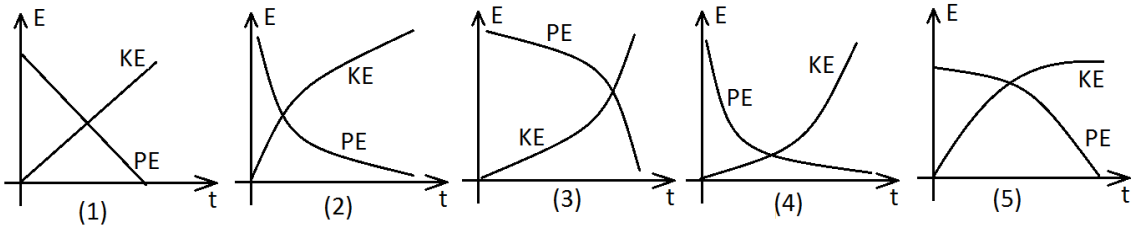
B. The total energy of unit volume at point B is $P + \frac{1}{2}\rho V^2$

C. The kinetic energy of unit volume at point B is $8\,\rho V^2$

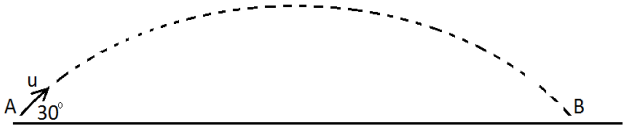
The correct statement/s from above is (are) ,

1) B only 2) A , B only 3) A , C only
4) B , C only . 5) A , B , C are true

19) An object is dropped from a tall building. The variation of the kinetic energy (KE) and the potential energy (PE) with time is best represented by,

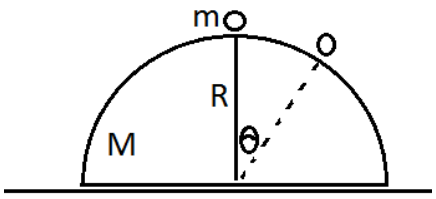


20) An object is projected with velocity u to the direction of 30^0 to the horizontal as shown in figure. When the object reaches to the point B, the change of momentum is given by, (neglect the air resistance)



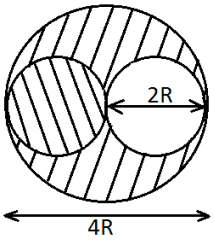
1) Zero 2) $\frac{1}{2}$ mu 3) mu 4) $\sqrt{3}$ mu 5) 2 mu

21) A small mass m is released at the top of the smooth solid hemsphere as shown in the figure. If the horizontal surface of the hemsphere and the floor is smooth, the angle θ to be the hemisphere to move along the floor $\frac{mR}{2(m+M)}$ distance is,



1) 0° 2) 30° 3) 45° 4) 60° 5) 90°

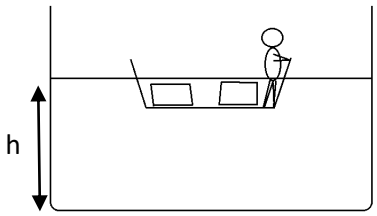
22) A circular disk of radius R is cut from a circular disk of radius 2R and pasted on the other side as shown in the figure. The distance to the centre of gravity of the new object from point O is,

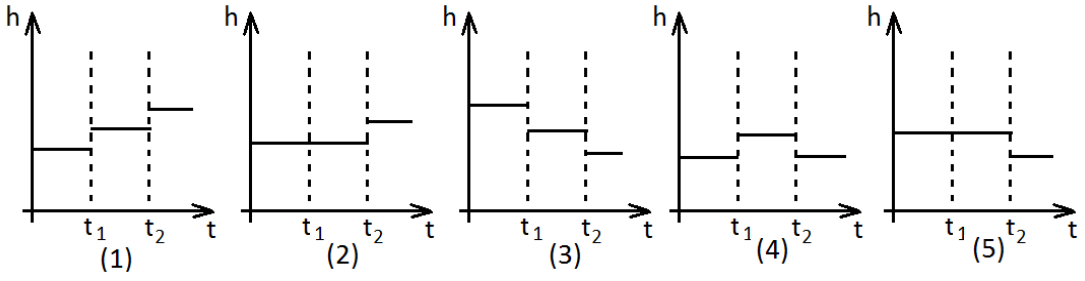


1) Zero 2) $\frac{R}{2}$ at left 3) R at left

4) $\frac{R}{4}$ at left 5) $\frac{3R}{2}$ at left

23) A boat with a man and goods is floating in a small pond. At the time t_1 he released a cork and at the time t_2, he released a metal block in to the water. The variation of the water level (h) with time (t) is best represented by,



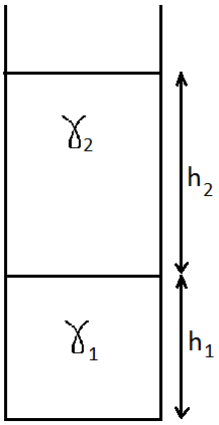


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24) A student can identify the sound source by hearing any note which are emitted by them. The main reason for this would be,

1) due to the pitch 2) due to the loudness 3) due to the intensity
4) due to the quality of the sound 5) Non of the above

25) When two liquids of having γ_1 and γ_2 volume expansivities are pourd into a vessel of having uniorm cross sectional area as shown in the figure. The heights of liquids are h_1 and h_2 respectively. When the temperature of the system increased by θ degrees, the height of both liquids is *h*. The linear expansivity of the material of the vessel is given by,

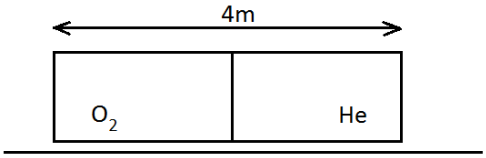


1) $\frac{h}{2\theta}[(1+\gamma_1\theta) + (1+\gamma_1\theta)]$

2) $\frac{1}{2\theta}\left[\frac{h_1(1+\gamma_1\theta)+h_2(1+\gamma_2\theta)}{h}-1\right]$

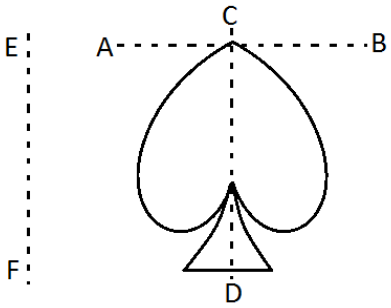
3) $\frac{r_1 r_2}{3}$ 4) $h\,(1+\gamma_1\theta)\,(1+\gamma_2\theta)$ 5) $\frac{h_1(1+\gamma_1\theta)+h_2(1+\gamma_2\theta)-1}{2\theta h}$

26) A closed uniform tube of 4 m length is devided into two equal parts by a light circular disk as shown in the figure. The two each parts of the tube are existed with O_2 and He. The pressure of He gas is two times that of O_2 gas. When the tube is kept on a smooth surface and smoothly removed the disk, the distance travelled by the tube in meters is, *(O_2=32, He=4)*



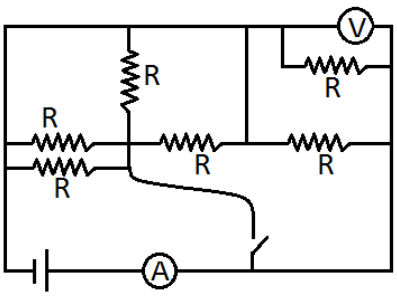
1) 0.2 m 2) 0.4 m 3) 0.6 m
4) 0.8 m 5) 0 m

27) The moments of inetia of the given figure about the axes of AB, CD and EF are I_{AB} , I_{BD} and I_{EF} respectively. The correct relationship is given by,



1) $I_{AB} > I_{CD} > I_{EF}$ 2) $I_{CD} > I_{AB} > I_{EF}$
3) $I_{AB} > I_{EF}$ I_{CD} 4) $I_{CD} > I_{AB} > I_{EF}$
5) $I_{EF} > I_{AB} > I_{CD}$

28) In the given circuit, the value of R is 6 Ω.The voltmeter and the ammeter are ideal. When the switch k is closed the readings of the voltmeter and the ammeter are 2V and 2A respectively. When the switch is opened the readings of the voltmeter and the ammeter are 3V and 1A respectively. The electromotive force and the internal resistance of the cell is respectively given by,



1) 4 V , 1 Ω 2) 4 V , 0.5 Ω 3) 2 V , 0.5 Ω
4) 2 V , 1 Ω 5) 3 V , 1 Ω

29) Air at 200 °C temperature is existed in a vessel of having constant volume. When the temperature is increased by 1 K with constant pressure, the fraction of mass of air which is removed by the vessel is given by,

1) $\frac{1}{473}$ 2) $\frac{1}{474}$ 3) $\frac{1}{273}$ 4) $\frac{1}{200}$ 5) 0

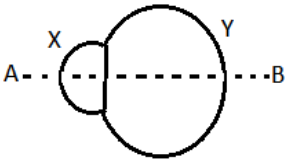
30) The velocity of sound in a liquid of having 800 kg m^{-2} density is 1500 ms^{-1}. When an external pressure of 200 MPa is applied on a 9 m^3 volume of this liquid, the change in volume is given by,

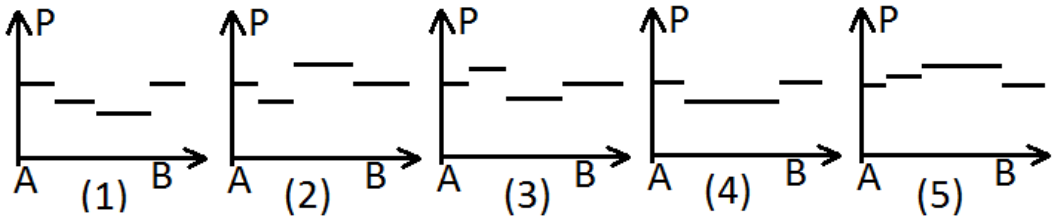
1) 1 x 10^{-4} m3 2) 2.2 x 10^{-2} m^3 3) 2.2 x 10^{-4} m^3
4) 1 m^3 5) 1.1 x 10^{-4} m^3

31) The full scale deflection of a galvanometer of having 20 Ω internal resistance is 1 V. When an 80 Ω resistor is connected with the galvanometer, the range of voltage that can be measured using this galvanometer is,

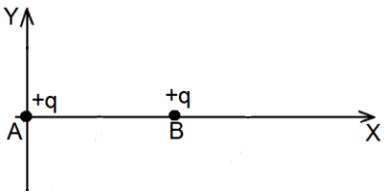
1) 0 – 1 V 2) 0 – 4 V 3) 0 – 5 V
4) 0 – 20 V 5) 0 – 80 V

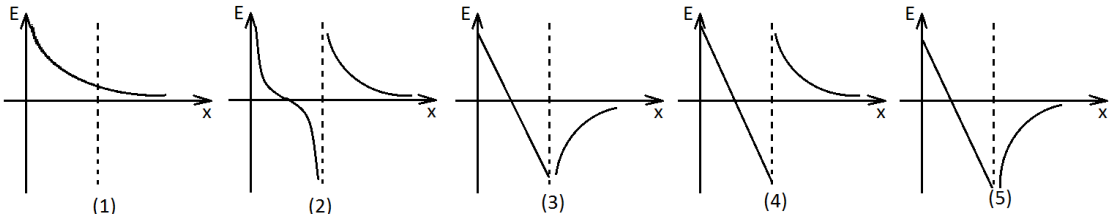
32) X is a soap bubble and Y is a balloon. The variation of the pressure along the AB line is best represented by,





33) Two point +q point charges are kept on the x axis as shown in the figure. The variation of the electric field intensity along the direction AX is best represented by,





34) A dc motor is drawn 3A current, when it works under 200Vpotential difference. Then its maximum rotating speed is 200 rpm. If the armature resistance is 7 Ω, the back e.m.f. the motor is given by,

1) 142 V 2) 159 V 3) 169 V
4) 179 V 5) 189 V

35) Consider the following statements regarding the electric and magnetic fields.

A. The forces can be created on a charge which is at rest due to both electric and magnetic fields.

B. The force exerted by the magnetic field on a charge at rest is always perpendicular to the field.

C. The forces exerted by the electric fields on the charges at rest are always towards the direction of the electric field.

The true statement(s) is/are,

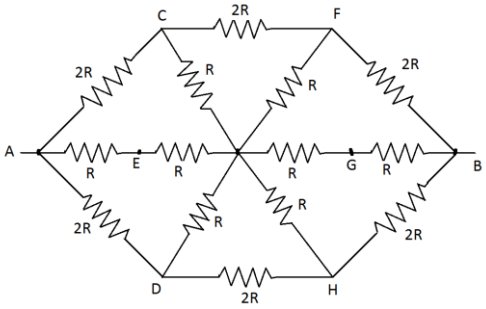
1) A only 2) A , B only 3) B , C only 4) C only 5) A , B , C are false

36) The electric field intensity which sould be appled between two parallel metal plates to keep an oil drop having 3×10^{-4} Charge and 10^{-4} g mass under equilibrium is

1) $32.7\ NC^{-1}$ 2) $3.3 \times 10^{-1}\ NC^{-1}$ 3) $0.03\ NC^{-1}$

4) $294 \times 10^{-8}\ NC^{-1}$ 5) $41.5\ NC^{-1}$

37) When a potential difference is applied between two points A and B in the given figure.



A. The potential at point C is equal to the potential at point E.

B. The potential at point C is equal to the potential at point D.

C. The potential at point C is equal to the potential at point F.

The true statement(s) is/are,

1) A only 2) B only 3) C only

4) A and B only 5) B and C only

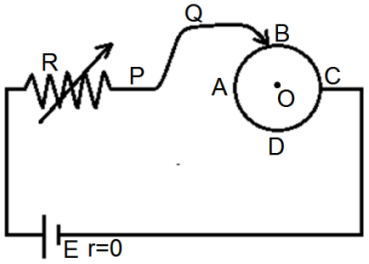
38) Six identical charges having +q (c) charge are kept at each vertice of regular hexagon. One charge of them is removed and kept it at the centre of hexagon. The net force applied on the charge at the centre is,

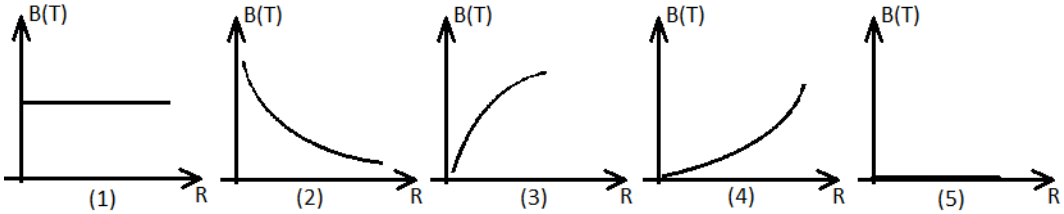
1) $\frac{1}{\pi\varepsilon_0}\left(\frac{q}{a}\right)^2$ 2) $\frac{2}{\pi\varepsilon_0}\left(\frac{q}{a}\right)^2$ 3) $\frac{1}{2\pi\varepsilon_0}\left(\frac{q}{a}\right)^2$ 4) $\frac{1}{\pi\varepsilon_0}\left(\frac{2q}{a}\right)^2$ 5) $\frac{1}{\pi\varepsilon_0}\left(\frac{q}{2a}\right)^2$

39) An electric field of intensity E is acting towards the same direction of a magnetic field of having B magnetic flux density. A particle of having charge ***q*** and mass ***m*** is projected with V_0 velocity towards a direction, which is perpendicular to the both fields. The time taken to become the velocity of the particle is $2V_0$ velocity is,

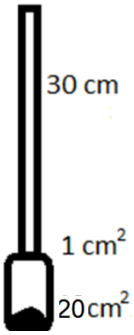
1) $\frac{3mv_0}{qE}$ 2) $\sqrt{3}\frac{mv_0}{qE}$ 3) $\sqrt{3}\frac{Bq}{mv_0}$ 4) $\frac{2Bq}{mv_0}$ 5) $\frac{2mv_0}{qE}$

40) R is a variable resistor and A, B,C,D,A is a circular wire of having uniform resistance. The points A and C are on the diameter of the circle. When the value of R is varied from zero to infinity, the variation of magnetic flux density at point O is best represented by (neglect the effect due to PQB wire)



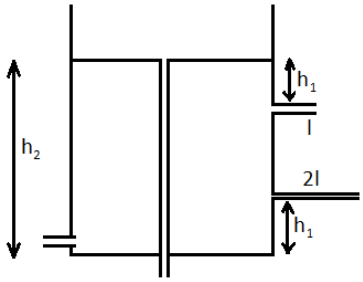


41) The volume of the bulb, the cross sectional of unform stem and the length of the stem of a hydrometer are 20 cm^3, 1 cm^2 and 30 cm respectively. If the mass of the hydrometer is 50g, the range of the densities whih can be measured using this hydrometer is,



1) 0 – 1000 kg m^{-3} 2) 0 – 2500 kg m^{-3} 3) 1000 kg m^{-3} – 2500 kg m^{-3}
4) 1000 kg m^{-3} - α 5) 2500 kg m^{-3} - α

42) A constant pressure apparatus is having two tubes of lengths *l* and 2 *l* and radii *a* and *a/2* as shown in the figure. The heights from the water levels to the tubes are marked in the figure. If the water is flowing with same volume rates from both tubes, the value of $\frac{h_1}{h_2}$ is given by,

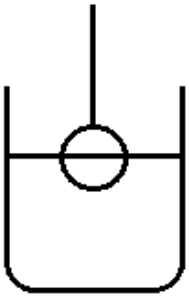


1) $\frac{1}{4}$ 2) $\frac{1}{8}$ 3) $\frac{1}{16}$ 4) $\frac{1}{32}$ 5) $\frac{1}{33}$

43) A capacitor of 2 μF capacitance is charged by a 15 V voltage and connected with another capacitor of 4 μF capacitance which is charged by a 30V voltage parallely. The final potential of the system is

1) 15 V 2) 22.5 V 3) 25 V 4) 30 V 5) 45 V

44) A circular disk of mass ***m***, radius ***a*** and thickness ***b*** is immersed in a liquid as its half of the volume is inside the liquid as shown in the figure. The surface tension of the liquid is T, the angle of contact is zero, the density of the liquid is ρ. The tension of the string is givn by



1) $mg + \frac{\pi}{2} \rho g a^2 b + (4a + 2b)\, T$

2) $mg - \frac{\pi}{2} \rho g a^2 b + (4a + 2b)\, T$

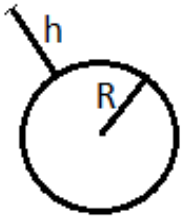
3) $mg + \frac{\pi}{2} \rho g a^2 b - (4a + 2b)\, T$

4) $mg - \frac{\pi}{2} \rho g a^2 b + (2a + 2b)\, T$ 5) $mg - \frac{\pi}{2} \rho g a^2 b - (2a + 2b)\, T$

45) The radius of the earth is R, periodic time is T, The gravitational field intensity of the earth surface is g.The height to the geostationary satellite from the earth surface is,

1) $\left(\frac{gR^2T^2}{4\pi^2} - R\right)^{1/3}$ 2) $\sqrt{\frac{gR^2T^2}{4\pi^2}}$ 3) $\left(\frac{gR^2T^2}{4\pi^2}\right)^{1/3} - R$

4) $\sqrt{\frac{gR^2T^2}{4\pi^2}} - R$ 5) $\frac{gR^2T}{2\pi} - R$



46) A transformer is used to light a bulb at the correct rates which is rated as 12 V, 100 W By 230 V supply. The current in the primary coil of the transformer is 0.5 A. The efficiency of the transformer is,

1) 20 % 2) 50 % 3) 67 % 4) 77 % 5) 87 %

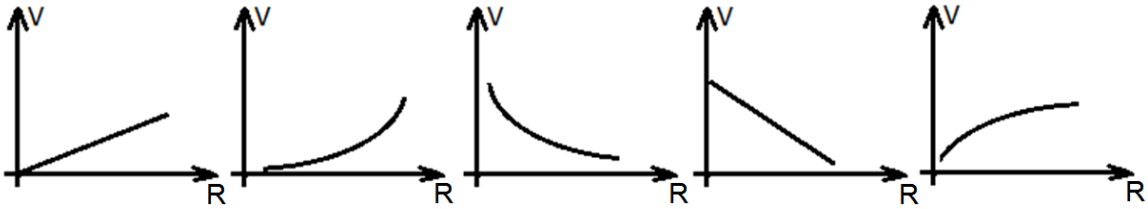
47) A point object is at the centre of a glass sphere of diameter 24 cm. The refractive index of glass is 1.5. The distance to the image from the surface is

1) 4 cm 2) 8 cm 3) 12 cm 4) 18 cm 5) 24 cm

48) A large water droplet is formed by combining 64 identical small water droplets having like charges. The ratio of capacitance between the small and large water droplets is

1) 1 : 2 2) 1 : 4 3) 1 : 6 4) 1 : 16 5) 1 : 64

49) The variation of the escape velocity at the surface of the plannets of having same densities with the radius of the plannet is given by



50) The balancing length of a potentiometer for a cell of having 1.2 V electromotive force and 2 Ω internal resistance is 240.0 cm. The balancing length for a 500 Ω resistor of an external circuit is 200.0 cm . The power consumption of the resistor is,

1) 1×10^{-3} W 2) 2×10^{-3} W 3) 3×10^{-3} W

4) 4×10^{-3} W 5) 5×10^{-3} W

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Royal College - Colombo 07

Grade 13

Second Term Test – August 2023

Physics II

01 E II

Time : 3 hours.
Reading Time 10 minutes.

Important :

- *The question paper consists of **18** pages*
- *The question paper comprises **Part A** and **Part B.** The time allotted for both part is **3 hours***
- *Use of calculators is **not** allowed*

Part A - Structured Essay

(08 pages)

*Answer all the questions on this paper itself**.** Write your answers in this spaces provided is sufficient for your answers and that extensive are not expected.*

Part B - Essay

(09 pages)

*This part contains six questions. Answer only four questions. Use the papers supplied for this purpose. At the end of the time allotted for this paper, tie the two papers so that **Part A** is on top of **Part B** before handing them over to the Supervisor.*

*You are permitted to remove **only Part B** of the question paper from Examination hall.*

g = 10 Nkg^{-1}

For Examiner's use only

For the second paper		
Part	Question nos.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
	8	
	9	
	10	
Total		

Final Marks

In numbers	
In words	

Part A – Structured Essay

Answer all the questions.

1. Density of an object is defined as mass per unit volume. Different methods are used to find the density in day to day life. A student has decided to find the density of a liquid at home by using a scale and an empty bottle.

   (a) If the mass of the empty bottle is m_1, mass of the bottle when it completely filled with water is m_2, mass of the bottle when it is completely filled with an oil after removing water is m_3, and volume of the empty bottle is V.

   (i) Write down and expression for density of water (ρ_ω)

   .....

   (ii) Write down and expression for density of oil ρ_l

   .....

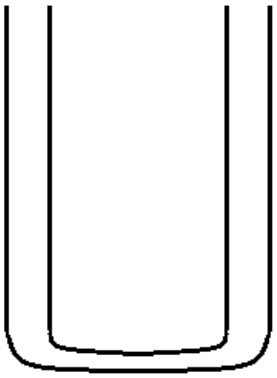
   (iii) Write down and expression for relative density of oil using m_1, m_2 and m_3

   .....

   (iv) If $m_1 = 12g$, $m_2 = 32g$, $m_3 = 30g$ find the density of oil in kgm^{-3}

   .....

   (b) Capillary Tubes with a radius less than 0.2 cm are used in the laboratory for various experiments. The figure shows a "U" tube which is made with a glass tube of radius 0.5mm. By using this, a student hopes to conduct an experiment to find the density of a specific oil.

   (i) Explain if this tube is a capillary tube or not by considering it's radius.

   .....

   .....

   (ii) A syringe is used to add both specific oil and water to the U-tube. Assume that the density of the specific oil is lesser than the density of water. Mark how the specific oil and water columns will be in the tube considering that the specific oil is inside the left hand side arm of the tube.

   Mark the height of water column inside the right hand side arm from the common interface as h_w and the specific oil column in the left side arm as h_l.

(iii) The surface tension of water and oil are T_w and T_l respectively. Write down an expressions for pressure of left hand side from the common interface as P_A and pressure of right hand side P_B by taking the internal radius of the capillary tube as r. Consider the contact angle made with the glass by both liquids equal to zero.

P_A = ...

P_B = ...

(iv) What is the relationship between P_A and P_B

.....

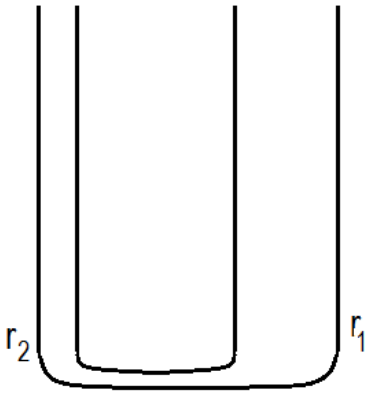
(v) The student hope to draw a graph by adding the oil into capillary U tube and measure the height of oil column h_l and the relevant water column h_w. What is the

independent variable .....
dependent variable .....

(vi) Rearrange the above relationship as y = mx + C.

.....

(c) Another student suggested another method.
He chooses another U tube with different radii as r_1 and r_2. He states that the density can be calculated by using only the liquid that ρ_l density needs to be calculated. r_1 is large and is not capillary tube. r_2 is small and it is a capillary tube.



(i) Draw the position of liquid levels after adding a liquid half of the height of the U tube.

(ii) Construct the needed equation to determine the density ρ_l by considering the contact angle between the capillary tube and the liquid as zero. Take the height difference of liquid columns as h.

.....

.....

(iii) Find the value of ρ_l in kgm^{-3} if coefficient of surface tension T_l = 4.2 x 10^{-3} Nm^{-1}, h = 5 mm, r_2 = 0.2 mm.

.....

.....

(iv) Student Y says that the graphical method in part (b) is better than method C. Explain the accuracy of his statement.

.....

.....

(v) By considering the statement of student Y, water is added to the U tube with different sizes of arms and oil is added to the narrow arm. Write an expression for ρ_l. The heights of water and oil columns from the common interface are h_w and h_l respectively.

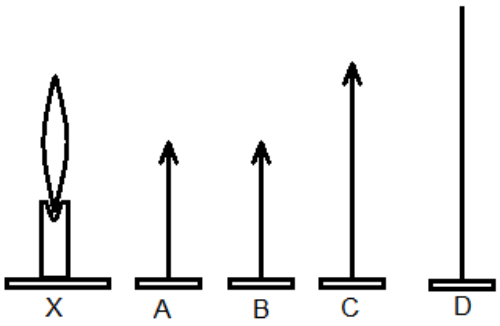
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2. Following items has been provided to carry out the experiment of finding the focal length of convex lens.

A , B , C – Observation pins
D – Screen
X – Convex lens which is placed on a stand.



(a) (i) What is the initial rough measurement that you have to take before starting the experiment.

.....

(ii) What is the experimental procedure that you have to follow to get above reading?

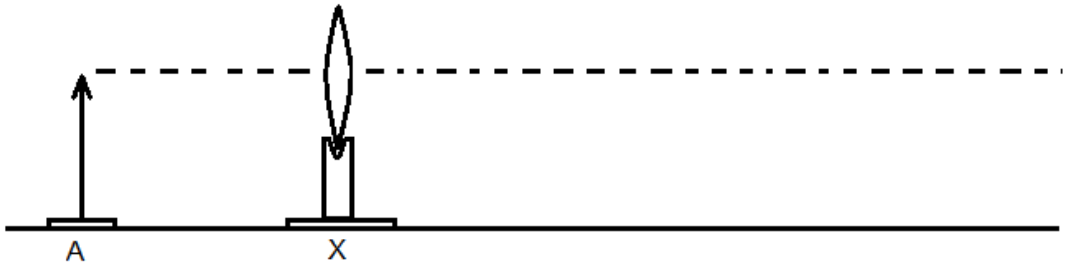
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(iii) What is the advantage of taking above (a) (ii) reading?

.....

(b) Below figure shows how the A optical pin and the lens from the given items are placed on the table to obtain a real image.



(ii) Draw the location of the Observation pin B which should be placed on the diagram in order to get the image distance.

(iii) Draw the screen D on the diagram.

(iii) Draw the position where the eye should be placed on the diagram and labeled it as E.

(iv) When observing the image of A, and the image of A is coincided with observation pin B, draw the positions of them in the above diagram.

(v) When observing the image of A , the image seen is not clear. What is the reason for it?

.....

(vi) How do you correct that without changing the position of A?

.....

(vii) The above observation pin B is moved towards the eye from the place of the image formed. How do you identify this?

.....

.....

(c) (i) Write down the lens formula after applying the sign convention for the real images. Use the usual symbols.

.....

(ii) Draw below the rough sketch according to the lens formula which has applied the sign convention. Label the axes (take the reciprocal of the image distance as independent variable).

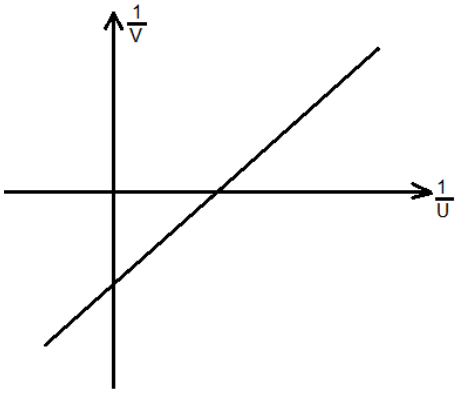


(d) Assume that the following readings are taken by the student for the below given instances, using a table of distances with signs

(A) for real objects and virtual images.
(B) for real objects and real images.
(C) for virtual objects and real images.

The graph, shown on the right, has been drawn between 1/V and 1/U for the above readings.

Mark the data points as A, B, C in relevant areas on the graph.



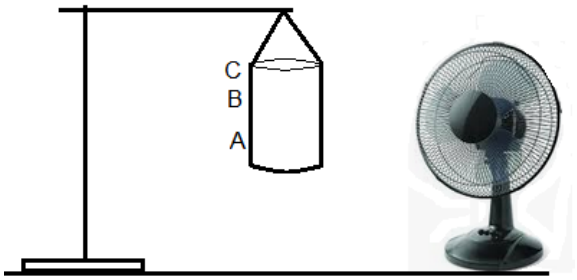
(e) (i) If the gradient of the d graph is 0.1 cm^{-1} , calculate the focal length.

.....

(ii) What is the value that (u+v) should be higher than, to obtain a real image from the above lens?

.....

3. (a) The figure shows an incomplete diagram with a calorie meter which is used to determine the specific heat capacity of coconut oil by Newton's cooling law done in a school laboratory which has only few calorie meters with different sizes.



(i) Write down the Newton's cooling law.

.....

.....

.....

(ii) What are the conditions that are needed in order for the above law to be valid?

.....

.....

(iii) What is the reason for using a polished calorie meter?

.....

.....

(iv) Complete the above diagram by drawing the essential items.

(v) What are the additional laboratory items that are needed in order to carry out the experiment?

.....

.....

(vi) It is decided to add water first to the calorie meter. Identify the most suitable water level out of A, B, C in above diagram and mark the relevant water level on it. Explain separately, the reasons to reject the other two water levels.

.....

.....

.....

(b) (i) After conducting the experiment for water, it was decided to carry out the experiment for coconut oil. Is it essential to use the same calorimeter that was used for water? Explain.

.....

.....

(ii) What is the required liquid level for coconut oil out of the above A, B, C positions?

.....

(iii) Instead of hanging the calorie meter by a thread, is it possible to carry out the experiment by placing it on a thermal insulated regifoam board which is placed on a tripod? Explain.

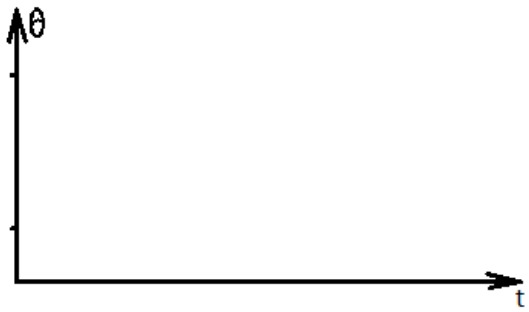
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(iv) What can you observe if the experiment is carried out as (b) (iii)?

.....

(v) Plot the shapes of cooling curves for both cases when (i) hanging it using thread (A) (ii) placing it on a thermal insulated regifoam board (B). Name the curves.



(vi) What is the essential thing that you need to do while doing the experiment? What is the reason for doing so?

.....

.....

(c) (i) What are the readings that you should obtain when determining the specific heat capacity of coconut oil?

.....

.....

(ii) What are the additional data you require when doing the calculations?

.....

.....

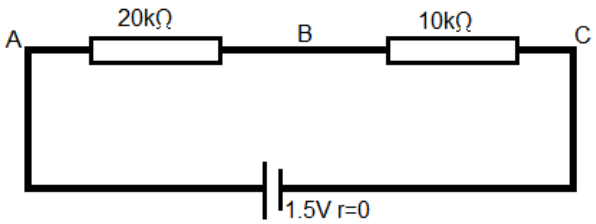
4. The Potentiometer is an instrument that can be used in the laboratory to measure even the small potential differences in a circuit which has a current flow. The internal resistance of a Analog Voltmeter which can obtain separate ranges is about 20kΩ/V and the internal resistance of a Potentiometer is infinity.

(a) (i) If the range of the above Analog Voltmeter is directed to 0-5V and measure the potential difference of a cell of 3V which doesn't have internal resistance, calculate the current flowing through the Voltmeter.

.....

.....

(ii) The Analog Voltmeter is directed to 0-1V range and connect to measure the Potential difference between A and B.



(a) Should the Voltmeter be connected as Parallel or Series.

.....

.....

(b) What is the actual potential difference across 20kΩ before connecting the Analog Voltmeter.

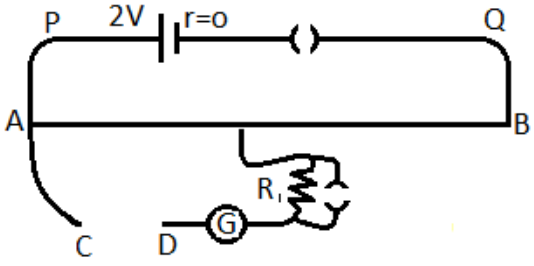
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.

(c) What is the voltage across 20kΩ showing in the above voltmeter after connecting the analog voltmeter.

.....

(b) Figure shows a diagram of potentiometer circuit. The length of the potentiometer wire is 200 cm.



(i) Give a reason for using a plug key instead of a tap key in the above.

.....

(ii) What is the reason for making the rest of the circuit, except the potentiometer wire, using Cu.

.....

(iii) What is the reason for using a Manganin (Mn) wire for the potentiometer wire?

.....

(iv) Explain what can happen if a large voltage source is used for the potentiometer cell instead of using a 2V.

.....

(v) Mention a suitable value for R_1 for the above potentiometer.

.....

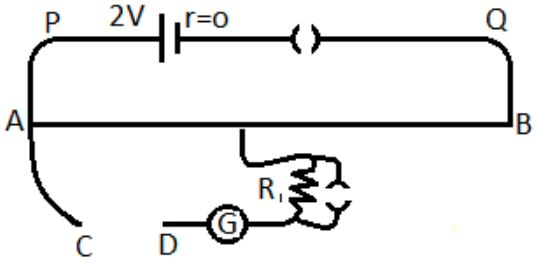
(vi) Find the potential gradient of the above potentiometer.

.....

(vii) If the electromotive force of a cell is measured using this potentiometer, the balanced length is obtained as 112.5 cm.

(a) Draw how to connect the cell.

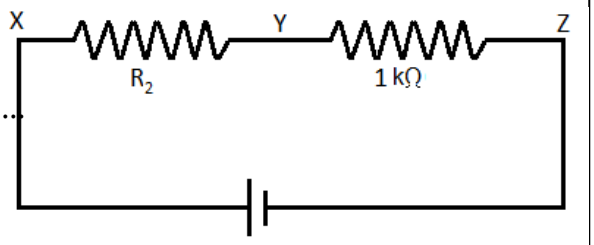
(b) Calculate the electromotive force of the cell.



.....

.....

(viii) When measuring the potential difference across XY using this potentiometer, the balance length obtained is 120cm and the balanced length when measuring XZ potential difference is 160cm. Calculate the value of R_2.



.....

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.....

.....

(ix) What is the sensitivity or the least count for the potentiometer used above.

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Royal College - Colombo 07

Grade 13

Second Term Test – August 2023

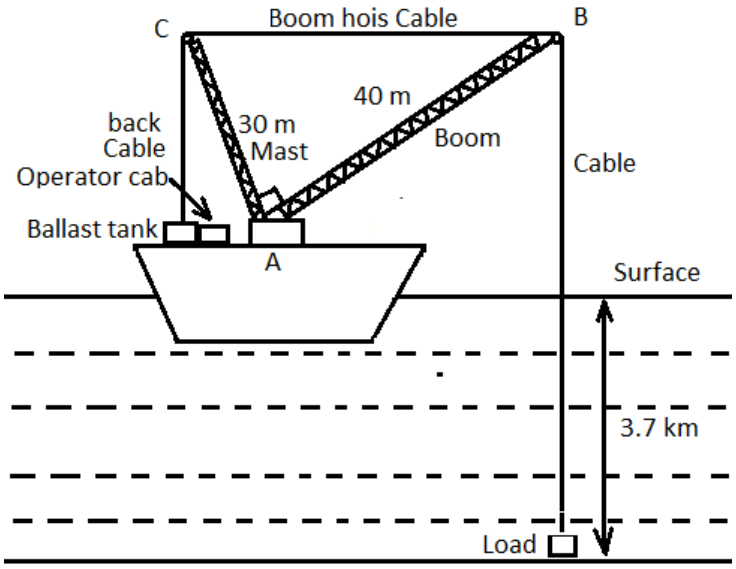
Physics II

01 E II

Part B – Essay

Answer 4 questions only

5. A floating crane is a ship with a crane specialized in lifting heavy loads, typically exceeding 1500 tons for modern ships. The largest crane vessels are used for offshore construction.



(a) (i) Write down the Archimedes principle.

(ii) Consider a cylindrical object of volume V fully immersed with its axis vertical in a fluid of density ρ. Verify Archimedes principle theoretically by considering the forces acting on it.

(b) This floating crane is used to lift a load of mass 7500 tons which is on the bed of the ocean at an average depth of 3.7 km. The volume of this load is 500 m^3. Assume the average density of the ocean water is 1000 kgm^{-3} and the atmospheric pressure as 1 x 10^5 Pa. (1 ton = 10^3 kg)

(i) The above mentioned load is lifted 0.7 km from the ocean bed, calculate the total pressure acting on the upper surface of the load.

(ii) What is the upthrust force acting on the load relevant to the above (b) (i) instance?

(iii) By considering the equilibrium of the load relevant to the above (b) (i) instance, calculate the tension of the cable.

(c) AB and AC are uniform steel arms of masses 2000 kg and 1000 kg respectively and their dimensions are shown in the figure. They pivot at point A. To keep the steel arms and its attachments at equilibrium position, a ballast tank is fixed at point D. Ballast tank is a compartment filled with water (BC=50m and it is horizontal).

(i) Calculate the total weight of the ballast tank by taking moments about point A.
[Hint :- 224023/18 = 12450]

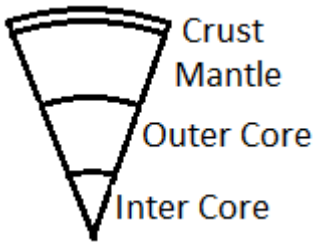
(ii) The weight of the empty ballast tank is 450 x 10^4 N. If this ballast tank is filled with water of density 1000kgm^{-3}, calculate the volume of water which can be filled in this tank.

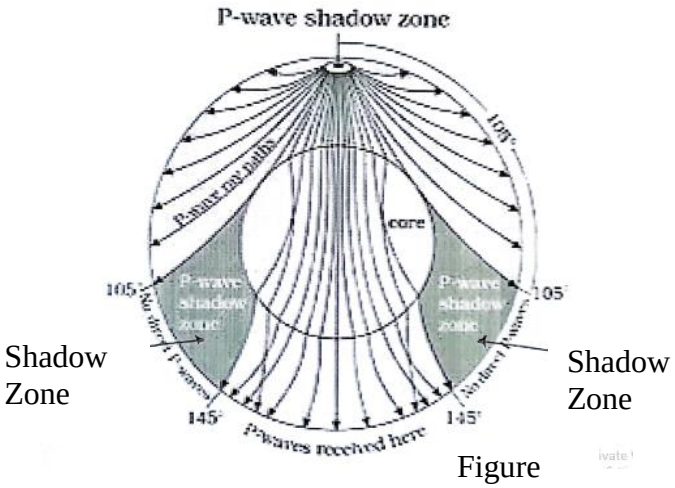
(d) (i) Calculate the needed work done to raise the load from (b) (i) instance to just below the surface of the ocean (neglect the height of the load).

(ii) If the time taken for the above work done in (d) (i) is 1 hour and 40 minutes, calculate the power needed.

(iii) Calculate the power needed to lift the load from the surface with above (d) (ii) velocity.

6. When heat is given to the bottom of an air, a liquid or a viscous fluid, then both heat and matter are transferred due to convection. The heated matter at the bottom expands and decreases its density and moves upwards. The matter which has moved upwards supplies heat to the neighboring particles and cools again. Due to this cooling, its density is increased and therefore if moves downward. This matter moving upward and downward with the heat is a cyclic process and this process can be observed inside the mantle of the earth. The inside of the earth may be considered to have four major concentric parts namely internal core, external core, mantle and crust.

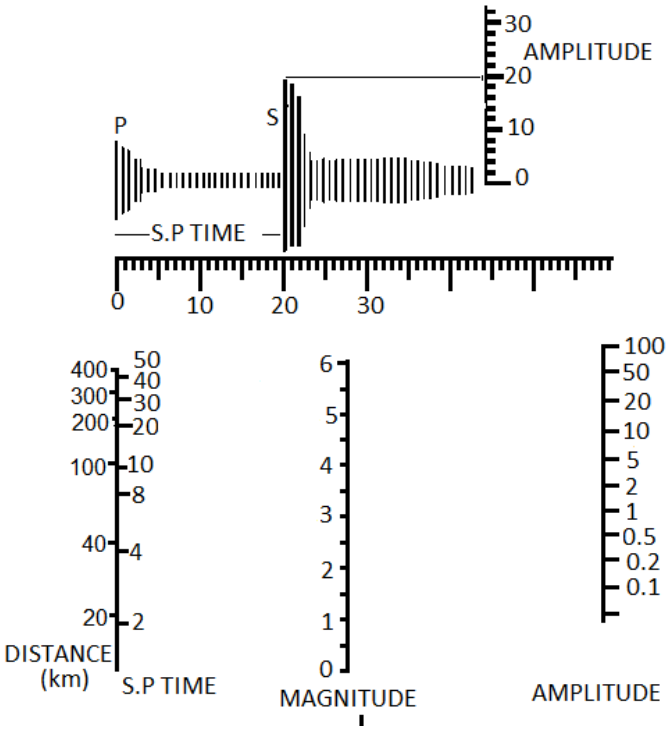




Figure

The extreme temperature of the internal core is about 6000°C and the extreme heat spreads to the crust. The temperature of the lower boundary of the mantle is at 4000°C due to this heat. Due to this extreme heat, convection current are created inside the mantle and collides with the crust at the upper boundary of the mantle. The composition of the mantle are Si, Mg, Al materials and they remain as semi viscous fluid. Due to these collisions the boundary of the crust is broken and again fall into the mantle. These broken places are known as the boundaries of the tectonic plates. These tectonic plates are floating on the earth. A collision or a slip between these two plates are known as an earthquake. From this, vast amount of energy is created and the point which the earthquake starts is known as the focus. There are 7 major tectonic plates and 8 small tectonic plates.

The body waves created due to an earthquake is divided into two types as primary (P) and secondary (S) and the secondary waves can't be observed at the opposite side of the earth from where the vibration takes place. Therefore it is considered that the inside the earth takes a liquid form. When the inside the earth is observed, figure (b) shows the travelling of seismic waves. Waves cannot be observed in the shadow areas of it.



The magnitude of an earthquake is measured using the Richter scale. By using the figure (c) which is given from an earthquake, the magnitude of it can be measured. The value of the earthquake can be obtained by connecting the value of the maximum amplitude and the value of the S - P time difference. Intensity of an earth quake is given by $M = \log (I/ I_0)$, $I_0 = 1Wm^{-2}$. If the energy of an earthquake is E. $\log E = 4.4 + 1.5 M$

(a) (i) What is the layer of the earth that has the activity which is the major cause of earthquakes?
(ii) Explain this activity.
(iii) What is an earthquake?
(iv) Explain briefly the focus.
(v) Explain briefly the 'epi centre'
(vi) How many number of tectonic plates are there on the surface of the earth?

(b) (i) What is the reason that the seismic waves are described as mechanical waves?
(ii) Write down another two mechanical waves.
(iii) Seismic waves are divided into two major types according to the areas of the earth which they travel. Write down these two types.
(iv) What is the type of wave which reaches seismic wave observation centre first?
(v) By using arrow heads, draw the direction of particle vibration and the propagation of the wave mentioned in above (iv)
(vi) Name the two types of surface waves.
(vii) Out of seismic waves, name the type of wave which cause the most damage.

(c) (i) Write down the relevant Richter scale value by using the given seismic wave figure (figure c) (No need to draw the figure).

(ii) When the Richter scale value (M) is 8.2, what is its intensity? (No need to simplify).

(iii) What is the energy released in Joules, relevant to the above (ii).

(iv) What is the scale, that is designed based on the above mentioned released energy, which is used to measure the magnitude of seismic waves?

(v) By using the properties of waves, explain the reason for creating shadow areas inside the earth.

(vi) What is the conclusion that can be reached, due to secondary waves not being observed at the opposite side of the earth from the place of the earthquake?

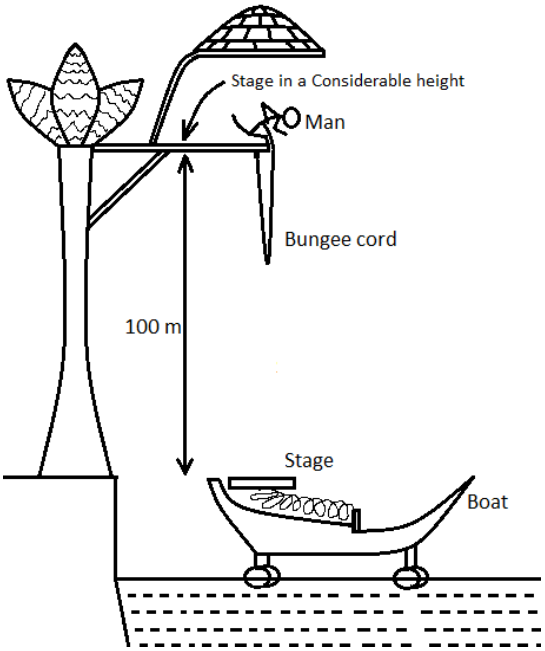
(vii) Write down the reason for that.

7. (a) (i) Name separately "stress'' and "strain''.

(ii) Write down Hooks law as an expression and identify all the terms in it.

(iii) Write down the dimensions of Young's Modulus.

(b) Some people are doing ''Bungee Jumping'' activity as entertainment. In this one end of the Bungee cord is connected to a fixed support and the other end is connected safely to the person who is doing the Bungee jumping. Then he or she jumps down from a stage which is at a considerable height. This Bungee cord is made of artificial or natural rubber.



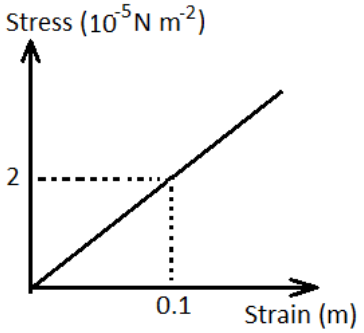
As shown in the figure, a man of 60kg mass hopes to do Bungee jumping from 100m height towards vertical downward direction. For this he uses a Bungee cord of length 45m with uniform cross section. Graph (1) represents the stress-strain graph relevant to the bungee cord. The man has jumped gently to the vertical downward from the stage. Neglect the mass of the bungee cord.

(i) What is the time taken by the man to move in vertical downward direction under the gravity?

(ii) Calculate the velocity obtained by the man at the end of this time.

(iii) Find the Young's modulus of the material that is used to make the bungee cord.

(iv) When extension of the bungee cord is 20m, the man has passed the equilibrium point of man and bungee cord. Then what is its cross sectional area?



(v) Due to a sudden damage to the bungee cord, it is suddenly break at the 20m extension point. Then the man falls freely under gravity and sometime later falls safely on to a stage which is in a boat at rest and reaches to rest instantly inside the boat. The mass of the boat is 140kg and it is in the equilibrium on 4 identical hollow spheres as shown in the figure. After the man falls in to the boat, the 4 spheres slightly submerge and float on water of density $1000 kgm^{-3}$. Neglect the masses of 4 spheres. 20% of kinetic energy of the man contributes to move the boat with the man forward (Take $\pi = 3$).

(I) Draw the velocity-time graph for the whole motion of the man from the start to the moment he lands on the stage in the boat.

(II) What is the radius needed by each sphere in order to maintain the vertical equilibrium of the boat with the man as described above?

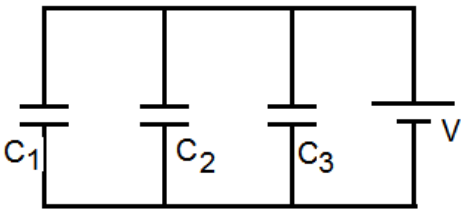
(III) Calculate the starting velocity of the boat with man to move forward.

(IV) What is the total viscosity force acting on the spheres by water when starting the motion? (Coefficient of viscosity of water is $8 \times 10^{-4} Nm^{-2}$).

(V) Calculate the initial acceleration of the boat at this time.

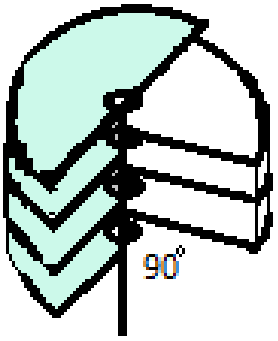
(VI) Draw the velocity time graph for the whole motion of the boat.

8. Capacitors are used to store charges and are made of conducting plates. Insulating materials such as air, oil or paper are inserted between these conducting plates



(a) (i) Write done an expression for the capacitance (C) of a charged capacitor if the charge of each plate is Q and the potential difference between the plates is V.

(ii) Construct an expression for the equivalent capacitance (C) of above three parallel capacitors C_1, C_2 and C_3.



(iii) Above figure shows the how the plates are positioned in a variable capacitor. If the common surface area between a couple of plates in A, the distance between the plates is d, the distance between the plates is filled with air of permittivity ε_0 and the number of plates are n, write down an expression for the capacitance of the capacitor.

(iv) In a variable capacitor, initially the common surface area between couple of plates is 10 mm^2 (and continuity plates are placed at 90^o) and the distance between two continuity plates is 2. Total number of plates is 7. Air is filled between plates and connected to a 12V battery. Calculate the equivalent capacitance of this variable capacitor in pF (Permittivity of air is $9 \times 10^{-12} C^2 N^{-1} m^{-2}$).

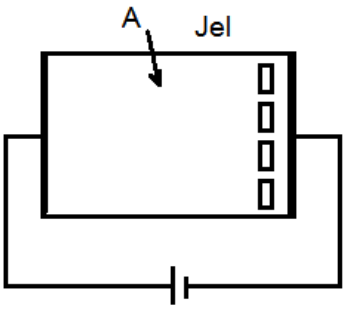
(v) Calculate the amount of charges stored in an internal plate.

(vi) Calculate the electric energy stored in a capacitor made of two continuity plates.

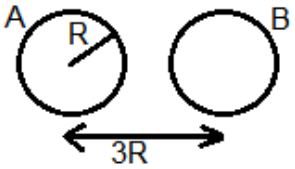
(vii) If the plate B of above variable capacitor is rotated to the clockwise direction with $\pi/6$ rad^{s-1} constant angular velocity, calculate the new capacitance of the capacitor mentioned in above part (iv) after 2seconds.

(viii) Write down 2 instances that variable capacitors are used.

(b) DNA electrophoresis is scientific method for separating the parts of DNA chain by moving the parts of DNA in an electric field. By this the criminals and their victims can be identified clearly. Here, the parts of DNA chain are gathered into compartments in the electrolytes and a potential difference is supplied to the plates. Then, negatively charged the parts of DNA chain starts to move across the jelly medium.

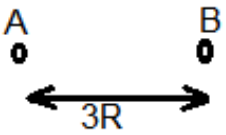


(i) By assuming the parts of DNA chain are approximately spherical and when an instance the external potential difference is not supplied, the radius of DNA part is 3×10^{-2} mm, electric field intensity of the surface of DNA is 1×10^{3} NC^{-1}. What is the amount of charges in the part of DNA chain A? ($1/4\pi\varepsilon_0 = 9 \times 10^{9}$ Nm^2 C^{-1}).



(ii) Calculate the force exerted by the spherical DNA chain on another spherical DNA chain B of - 9.0 pC charge, which is away from its circumference at a distance of twice its radius.

(iii) If the above two charges are as shown in the figure, draw the spreading of electric field lines near the two charges by using arrow heads. (Consider DNA as negatively charged small conducting spheres).



(iv) Calculate the electric field intensity if the potential difference between the two plates is 100V and the distance between them is 25cm.

(v) Calculate the force acting on B if it is in the electric field mentioned in above (iv). If the mass of it is 48×10^{-8} kg, what is the acceleration of it?

(c) If the velocity of the spherical DNA chain increases, the resistive forces acting on the particle by jelly increase with it.

(i) Calculate the terminal velocity of part of the DNA chain which is in the above electric field, and which is acting as a sphere of radius 3×10^{-2} mm having a charge of 0.9 pC, when coefficient of viscosity of the jelly medium is 1×10^{-1} Pas. (π=3).

(ii) Draw the variation of horizontal component of velocity of the particle with time.

9. The electricity generated in electric power stations using electric generators is converted to a high voltage and transmitted to rural areas through cables. This generated voltage is converted to a high voltage by using transformers and transmitted. The peak voltage generated in the electric generator in an electric power station is 330 V and it is converted to a high voltage of 66000 V by using a transformer.



(a) (i) What is the type of transformer used to convert the electricity generated in the power station to a high voltage ? Write down an another instance in which this type of transformer is used.

(ii) Explain the reason for converting to a high voltage.

(iii) In the above power station, what is the ratio between the number of turns in the primary coil and the number of turns in the secondary coil?

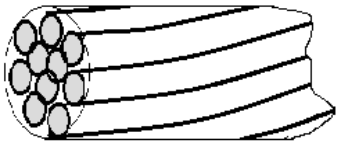
(iv) If the efficiency of the transformer is 80 %, calculate the ratio of the current in the primary coil to the current in the secondary coil.

(v) Write down the two methods that the energy lost from a transformer.

(a) Mention the precaution which can be taken to minimize the first method.

(b) Mention the precaution which can be taken to minimize the second method.

(b) The length of a cable which is used to transmit electricity generated in the electric power station to the consumer is 30 km. Two of these cables are used to transmit electricity. The cross sectional area of one of the thin cables used to make the above cables is 2 mm^2 and the resistivity of the material is 2 x 10^{-8} Ωm.



(i) What is the reason for using more thin wires instead of one wire when preparing the electric cables?

(ii) What is the resistance of one cable of length 30 km?

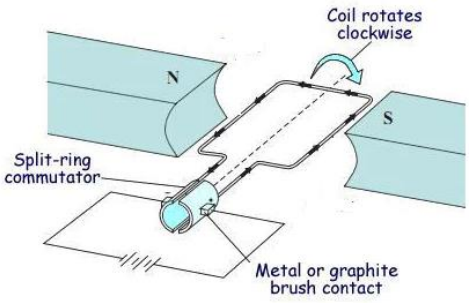
(iii) If the current flowing through a cable at 30 ^{0}C, is 1/3 A, what is the potential difference of the two ends of the cable?

(iv) Calculate the power loss of one cable.

(v) If the $\frac{2}{7}$ A current flowing through the cable at 40 ^{0}C, and the potential difference equals to the above calculated value, calculate the new resistance.

(vi) Calculate the temperature coefficient of resistivity by using the above resistance values.

(c) Figure shows a model of a direct current motor which can be worked with a direct current voltage of 12 V



(i) If the internal resistance of the direct current power supply is 2 Ω and the resistance of the armature is 118 Ω. What is the initial current of the motor?

(ii) At the instance of the armature is rotating freely the current of it is equals to the 80 % of initial value. Write down the reason for it.

(iii) Calculate the value of the main factor which affects for the above reason.

(iv) The magnetic field value applied to the above motor is 0.1 T and the armature has 100 number of turns. If the area of the plane of the coil is 8 cm^2. Find the angular velocity when it rotates freely. (Consider the magnetic field is radial and the frictional forces can be neglected.)

10. There are many ways that hot bodies cool down to room temperature. When a hot body is exposed to air or it's water is evaporated, its heat will be removed and it will get cold.

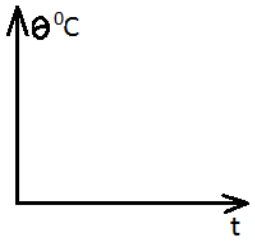
(a) (i) Write down two factors affecting evaporation.

(ii) Define the specific latent heat of vaporisation.

(iii) Write down a factor that affects the temperature at which vaporisation occur.

(b) (i) Write down the Newton's cooling law using symbols. Name the symbols you used.

(ii) A student places solid wax in a calorimeter and supplies heat uniformly until the wax is near to vaporisation. Draw the expected graph if it's free to release heat to the environment.



(iii) The student put wax into a calorimeter having negligible heat capacity and supplies heat uniformly using a source that has constant power. The room temperature is 30^0C. Draw a graph of temperature versus time and obtain the information given below.

The temperature of wax increases and remains constant at 96^0C. Afterwards it is allowed to cool by removing the heat supply. The gradient of the tangent which is drawn on the graph at the moment before liquid wax starts to solidify is 3.6^0C min^{-1}. The constant temperature obtained by the wax is 62^0C and the time duration that the wax is at constant temperature is 20 minutes. The gradient of the tangent drawn on the graph after the moment that the wax totally solidify is 4.8^0C min^{-1}. Specific heat capacity of wax is 1800 J kg^{-1} K^{-1}.

1) Draw the graph relevance to the cooling of wax and mark the value 62^0C.
2) What is the melting point of wax?
3) Calculate the specific heat capacity of solid wax.
4) Calculate the specific latent heat of fusion of wax.
5) If the heat is supplied further to the liquid wax in the above practical, after one instance it is observed that wax remains as liquid wax and the temperature does not increase. Explain the reason.

(c) Steam is needed to be produced at home in day to day activities. A student uses a boiler to produce steam at 100^oC to sterilise the culture media in mushroom cultivation. Except the

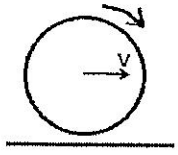
bottom of the boiler, the other parts are covered with the thermal insulators. To maintain produced steam at atmospheric pressure, a small hole is placed at the top of the boiler.

The thermal conductivity of the bottom of the boiler is $400 Wm^{-1}K^{-1}$, the thickness is 2cm. And the surface area of one side of the bottom is $500 cm^2$. A heating coil of 20kW supplies heat to the bottom of the boiler. Take the specific latent heat of vaporisation of water as $2.0 \times 10^6 Jkg^{-1}$.

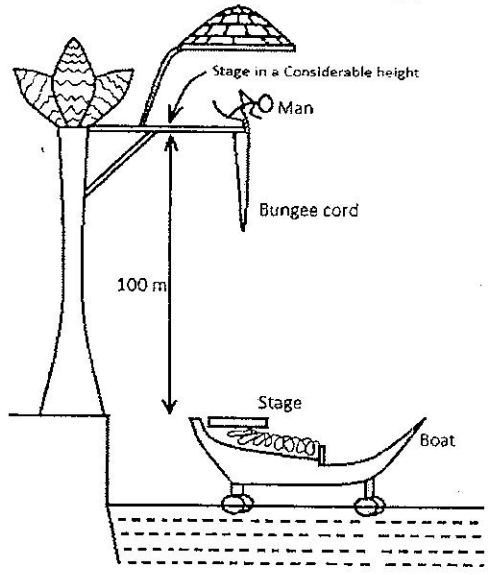
1) What is the rate of steam produced by the boiler in kgs^{-1}?
2) What is the external temperature of the bottom of the boiler?
3) Due to the usage of brackish water for a long time, a layer of thickness of 0.1cm is formed at the inside of the bottom. The thermal conductivity of the material of the layer is $10 Wm^{-1}K^{-1}$. What is the rate of steam generated now?
4) What is the external temperature of the bottom of the boiler after forming this 0.1cm layer?
5) If the hole in the upper part of the boiler is closed while the heating coil is working,
   (i) What happens to the temperature of the steam?
   (ii) What happens to the pressure of the steam produced?

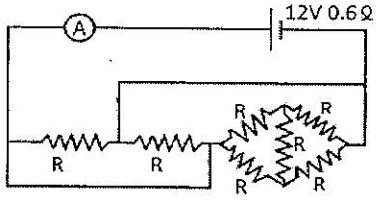
Marking Scheme - Physics

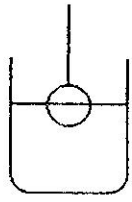
Grade 13, Second term test- 2023 August

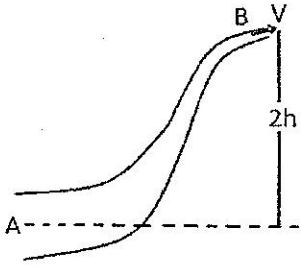


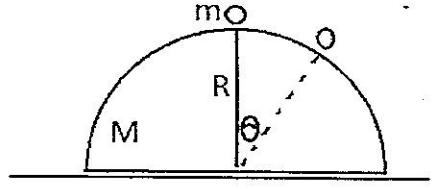


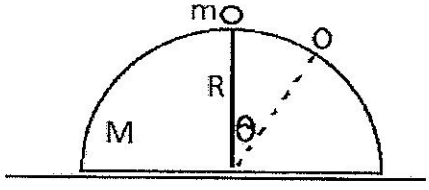


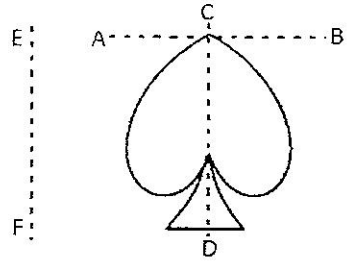


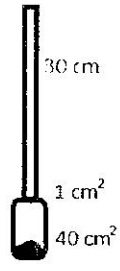


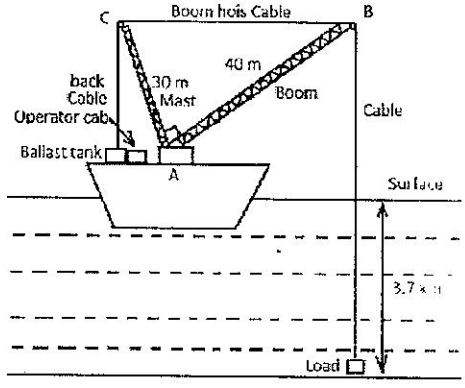




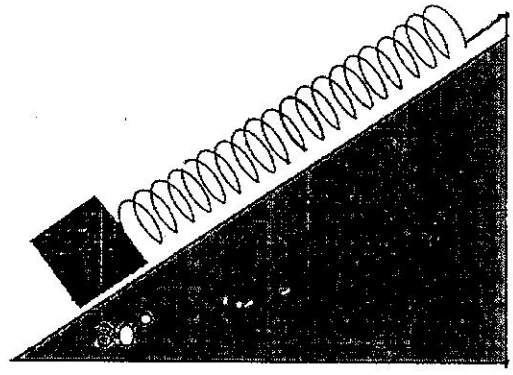








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Grade 13, Second term test- 2023 August

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2- 3	12-5	22-2	32-5	42-5
3- 2	13-5	23-5	33-2	43-3
4- 4	14-3	24-4	34-4	44-2
5- 4	15-3	25-2	35-4	45-3
6- 4	16-1	26-3	36-2	46-5
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8- 4	18-4	28-1	38-5	48-2
9- 1	19-3	29-2	39-2	49-1
10-3	20-3	30-4	40-5	50-2

- 1 පත්‍රයට එක් ප්‍රශ්නයකට එක ලකුණ බැගින් ලකුණු 50
- 2 පත්‍රයට ලැබෙන මුළු ලකුණ හතරෙන් බෙදන්න.

  1 පත්‍රයේ ලකුණු වලට 2 පත්‍රයේ ලකුණු හතරෙන් බෙදූවිට ලැබුණු අගය එකතු කරන්න. එවිට මුළු ලකුණ ලැබේ.

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13 ශ්‍රේණිය

දෙවන වාර පරීක්ෂණය - 2023 අගෝස්තු

භෞතික විද්‍යාව II

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කාලය : පැය තුනයි

කියවීම් කාලය අමතර විනාඩි 10

නම :-..... පන්තිය : -..... විභාග අංකය :-.....

වැදගත්

- මෙම ප්‍රශ්න පත්‍රය පිටු 18කින් යුක්ත වේ.
- මෙම ප්‍රශ්න පත්‍රය A හා B යන කොටස් **දෙකකින්** යුක්ත වේ. කොටස් දෙකට ම නියමිත කාලය **පැය 3 කි.**
- ගණක යන්ත්‍ර භාවිතයට ඉඩ දෙනු නොලැබේ.

A කොටස - වනුහගත රචනා
(පිටු 09 කි)

සියලුම ප්‍රශ්නවලට පිළිතුරු මෙම පත්‍රයේම සපයන්න. ඔබේ පිළිතුරු ප්‍රශ්න පත්‍රයේ ඉඩ සලසා ඇති තැන්වල ලිවිය යුතුය. මේ ඉඩ ප්‍රමාණය පිළිතුරු ලිවීමට ප්‍රමාණවත් බවද දීර්ඝ පිළිතුරු බලාපොරොත්තු නොවන බවද සලකන්න.

B කොටස - රචනා
(පිටු 09 කි)

මෙම කොටස ප්‍රශ්න හයකින් සමන්විත වේ. සම්පූර්ණ ප්‍රශ්න පත්‍රයට නියමිත කාලය අවසන් වූ පසු "A" සහ "B" කොටස් එක් පිළිතුරු පත්‍රයක් වන සේ "A" කොටස උඩින් තිබෙන පරිදි අමුණා, විභාග ශාලාධිපතිට භාර දෙන්න. ප්‍රශ්න පත්‍රයේ B කොටස **පමණක්** විභාග ශාලාවෙන් පිටතට ගෙන යාමට ඔබට අවසර ඇත.

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

භෞතික විද්‍යාව II සඳහා		
කොටස	ප්‍රශ්න අංකය	ලකුණු
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
	8	
	9	
	10	
එකතුව		

අවසාන ලකුණු

ඉලක්කමින්	
අකුරෙන්	

සියලුම ප්‍රශ්නවලට පිළිතුරු සපයන්න.

1. වස්තුවක ඝනත්වය යනු ඒකක පරිමාවක ස්කන්ධයයි. එදිනෙදා කටයුතුවලදී ඝනත්වය සෙවීමට විවිධ උපක්‍රම භාවිතා කරයි. තරාදියක් හා හිස් බෝතලයක් භාවිතා කර නිවසේ දී ද්‍රවයක ඝනත්වය සෙවීමට ශිෂ්‍යයෙක් කටයුතු කරයි.

(a) හිස් බෝතලයේ ස්කන්ධය m_1 ද, බෝතලය සම්පූර්ණයෙන් ජලයෙන් පිර වූ විට ස්කන්ධය m_2 ද, ජලය ඉවත් කර තෙල් වර්ගයකින් සම්පූර්ණයෙන් පිර වූ විට ස්කන්ධය m_3 ද හිස් බෝතලයේ ධාරිතාව V ද නම්,

(i) ජලයේ ඝනත්වය ρ_w සඳහා ප්‍රකාශනයක් ලියන්න.

$\rho_w = \frac{m_2 - m_1}{V}$ ——— (1)

(ii) තෙල්වල ඝනත්වය ρ_l සඳහා ප්‍රකාශනයක් ලියන්න.

$\rho_l = \frac{m_3 - m_1}{V}$ ——— (1)

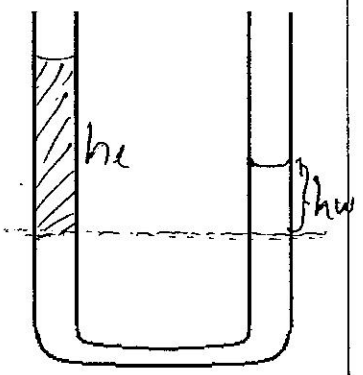
(iii) තෙල්වල සාපේක්ෂ ඝනත්වය සඳහා m_1 , m_2 , m_3 ඇසුරෙන් ප්‍රකාශනයක් ලියන්න.

$\frac{\rho_l}{\rho_w} = \frac{m_3 - m_1}{m_2 - m_1}$ ——— (1)

(iv) $m_1 = 12$ g ද, $m_2 = 32$ g ද, $m_3 = 30$ g ද නම් තෙල්වල ඝනත්වය kg m^{-3} වලින් සොයන්න.

$\frac{\rho_l}{\rho_w} = \frac{30-12}{32-12} = \frac{18}{20}$ $\rho_l = 900$ ——— (1) ලා

(b) අරය 0.2 cm අඩු කේෂික නල විවිධ කටයුතු සඳහා විද්‍යාගාරයේ භාවිතා කරයි. 0.5 mm අරයන් ඇති වීදුරු නලයකින් සකස් කරන ලද U නළයක් රූපයේ දක්වෙයි. එය භාවිතයෙන් එක්තරා තෙල් වර්ගයක ඝනත්වය සෙවීමේ පරීක්ෂණයක් සිදු කිරීමට ශිෂ්‍යයෙක් කටයුතු කරයි.



(i) මෙම U නලය සාදා ඇති නලය, කේශික නළයක් වන්නේ ද? නොවන්නේ ද? යන වග එහි අරය ඇසුරු කර ගනිමින් පහදන්න.

0.2 cm ක් අඩු නිසා

කේශික නලයකි. ——— (1)

(ii) සිරින්ජරයක් මාර්ගයෙන් U නළයට ජලය සහ තෙල් වර්ගය ඇතුළු කරනු ලැබේ. තෙල්වල ඝනත්වය ජලයේ ඝනත්වයට වඩා අඩු යැයි සලකමින් වම්පස බාහුවේ තෙල් පවතින පරිදි ජලය සහ තෙල් පවතින අයුරු රූපයේ ලකුණු කරන්න. තෙල් කඳ දකුණට නිවැරදි ——— (1)

ද්‍රව වෙන් කරන අතුරු මුහුණතේ සිට දකුණු පස බාහුවේ ඇති ජල කඳේ උස h_w ද, වම්පස බාහුවේ ඇති තෙල් කඳේ උස h_l ද ලෙස සලකුණු කරන්න.

රූපයේ h_l ට ——— (1)

රූපයේ h_w ට ——— (1)

(iii) ජලයේ පෘෂ්ඨීක ආතති සංගුණකය T_w සහ තෙල්වල පෘෂ්ඨීක ආතති සංගුණකය T_l වේ. වීදුරු කේශික නළයේ අභ්‍යන්තර අරය r ලෙස ගනිමින් අතුරු මුහුණතේ මට්ටම්වල වම් පස පීඩනය P_A හා දකුණු පස පීඩනය P_B සඳහා ප්‍රකාශන ලියන්න.
ද්‍රව දෙකම වීදුරු සමඟ ස්පර්ශ කෝණය ශූන්‍ය බව සලකන්න.

P_A $\pi - \frac{2T_l}{r} + h_l \rho g$ (1)

P_B $\pi - \frac{2T_w}{r} + h_w \rho g$ (1)

(iv) P_A හා P_B අතර සම්බන්ධතාවය කුමක් ද?

$P_A = P_B$ (1)

(v) කේශික U නළයට තෙල් එකතු කරමින් තෙල් කඳේ h_l උස සහ එවිට ලැබෙන ජල කඳේ උස h_w මැන ප්‍රස්තාරයක් ඇඳීමට ශිෂ්‍යයා අදහස් කරයි.

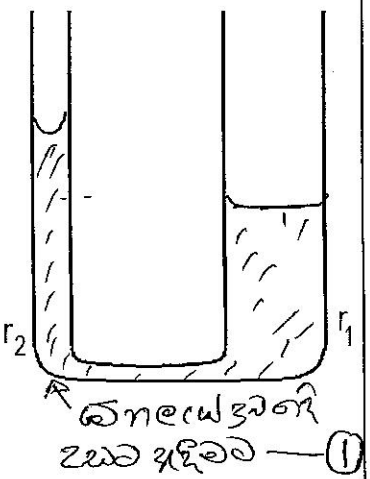
ස්වායත්ත විචල්‍ය කුමක් h_l (1)

පරායත්ත විචල්‍යය කුමක් ද? h_w (1)

(vi) ඉහත ප්‍රස්තාරය ඇඳීම සඳහා විචල්‍යයන් $y = mx + C$ ආකාරයට නැවත සකස් කරන්න.

$h_w = \frac{\rho_l}{\rho_w} h_l + \frac{2T_w}{\rho_w g r} - \frac{2T_l}{\rho_w g r}$ (1)

(c) තවත් ශිෂ්‍යයෙක් වෙනත් ක්‍රමයක් යෝජනා කරයි.
ඔහු තෝරාගනුයේ අරය r_1 හා අරය r_2 වන බාහු ඇති U නලයකි. මෙහි ρ_l ඝනත්වය සොයන ද්‍රවය පමණක් යොදා ගනිමින් ඝනත්වය සෙවිය හැකි බව ඔහු ප්‍රකාශ කරයි. r_1 විශාල වන අතර එය කේශික නළයක් නොවේ. r_2 කුඩා වන අතර එය කේශික නලයකි.



(i) මෙම U නළයට අර්ධයක් පමණ ද්‍රවය දැමූවිට ද්‍රවය පිහිටන ආකාරය අඳින්න.

නළයේ දිගෙන් උඩට ඇදීමක් (1)

(ii) කේශික නලය හා ද්‍රවය අතර ස්පර්ශ කෝණය ශූන්‍ය ලෙස ගෙන ඝනත්වය ρ_l සෙවීම සඳහා අවශ්‍ය සමීකරණය ගොඩනගන්න. ද්‍රව කඳන්වල උසේ වෙනස h ලෙස ගන්න.

$\pi - \frac{2T}{r} + h\rho g = \pi$

$\rho_l = \frac{2T_l}{hrg}$ (1)

(iii) පෘෂ්ඨීක ආතතිය $T_l = 4.2 \times 10^{-3}\ Nm^{-1}$ ද, $h = 5\ mm$ ද, $r_2 = 0.2\ mm$ නම් P_l හි අගය $kg\ m^{-3}$ වලින් සොයන්න.

$\rho_l = \frac{2 \times 4.2 \times 10^{-3}}{5 \times 10^{-3} \times 0.2 \times 10^{-3} \times 10}$ ආදේශය (1)

$\rho_l = 840$ (1)

(iv) මෙහි C හි ක්‍රමයට වඩා b හි සඳහන් ප්‍රස්තාරික ක්‍රමය P_l සෙවීම සඳහා වඩාත් සුදුසු බව y ශිෂ්‍යයා පවසයි. y ශිෂ්‍යයාගේ අදහස නිවැරදි දැයි පහදන්න.

වැරදියි.

ප්‍රස්තාරයේ අන්තඃඛණ්ඩය (ඡේදය) ද්‍රෝණ අගය නම් (1)

(v) y ශිෂ්‍යයාගේ අදහස සලකමින් බාහු අසමාන U නළයට ජලය දමා සිහින් බාහුවෙන් තෙල් දමනු ලැබුවේ නම් P_l සඳහා ප්‍රකාශනයක් ඉදිරිපත් කරන්න. පොදු අතුරු මුහුණතේ සිට ජලය සහ තෙල් කඳන්වල උස h_w හා h_l වේ.

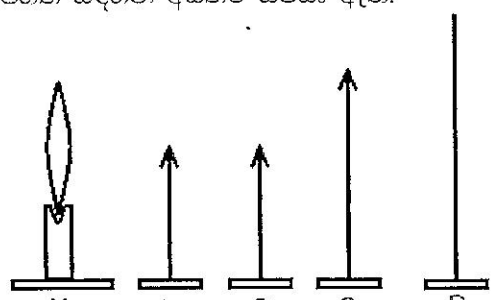
$\pi - \frac{2T}{r_2} + h_w \rho_l g = \pi + h_w \rho_w g$

$P_1 = \frac{\rho_w h_w}{h_1} + \frac{2T}{r h_1 g}$ —— (1)

(20)

2. පාසල් විද්‍යාගාරයේ දී උත්තල කාචයක නාභිදූර සෙවීම සඳහා පහත සඳහන් අයිතම සපයා ඇත.

A , B , C :- නිවේෂණ කුරු
D :- තිරය
X :- ආධාරකය මත තැබූ උත්තල කාචය



(a) (i) පරීක්ෂණය ආරම්භ කිරීමට ප්‍රථමයෙන් ඔබ විසින් දළ වශයෙන් ලබාගත යුතු මිනුම කුමක් ද?

දළ නාභි දුර සෙවීම (1)

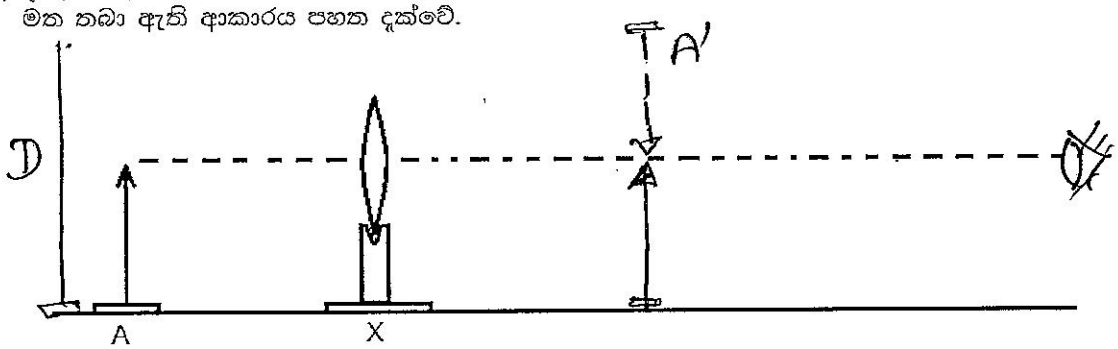
(ii) එම මිනුම ලබා ගැනීමේදී අනුගමනය කළ යුතු පරීක්ෂණාත්මක ක්‍රියා පිළිවෙල ලියන්න.

දීප්ති වස්තුවකින් යොමුකර පාහාදිලි (තියුණු) ප්‍රතිබිම්බයක් තිරයමත ලබාගෙන, කාචය හා තිරය අතර දුර මැනීම (1)

(iii) ඉහත (a) (ii) හි මිනුම ගැනීමේ වාසිය කුමක් ද?

වස්තුව කාචයේ ප්‍රධාන අක්ෂයේ වඩාබ අවශෝෂණය කරගැනීමට (1)

(b) දී ඇති අයිතමයන්ගෙන් A නිවේෂණ කුර සහ කාචය තාත්වික ප්‍රතිබිම්බයක් ලැබෙන පරිදි මේසය මත තබා ඇති ආකාරය පහත දැක්වේ.



(i) ප්‍රතිබිම්බ දුර සොයා ගැනීම සඳහා සුදුසු නිවේෂණ කුර නම් කර එය තැබිය යුතු අයුරු ඉහත රූපයේ ඇඳ දක්වන්න. කඩ තුඩ මිටමට ඇදීමට —— (1)

(ii) D තිරය ද ඉහත සටහනේ අඳින්න. වම් පස ශාලවර් ඇදීමට —— (1)

(iii) ප්‍රතිබිම්බය නිරීක්ෂණය කිරීම ඇස තැබිය යුතු ස්ථානය ඉහත සටහනේ ලකුණු කොට එය E ලෙස නම් කරන්න. වම් පස කඩ තුර මඩාඩ ඇස තිබීමට --- (1)

(iv) A හි ප්‍රතිබිම්බය නිරීක්ෂණය කිරීමේ දී A හි ප්‍රතිබිම්බය සුදුසු නිවේෂණ කුර හා සමපාත වන විට පෙනෙන ආකාරය ඉහත රූපයේ ඇඳ පෙන්වන්න. A' ලෙස සහිත ප්‍රතිබිම්බය අඳිනවා —— (1)

(v) A හි ප්‍රතිබිම්බය නිරීක්ෂණය කිරීමේ දී එම ප්‍රතිබිම්බය තරමක් අපහැදිලි ලෙස පෙනුණි. මෙයට හේතුව කුමක් ද?

ප්‍රතිබිම්බය, වස්තුවේ ප්‍රධාන අක්ෂය තුරට වඩා ළඟින් සෑදීම (1)

(vi) A හි පිහිටුම් පෙනස් නොකර එය නිවැරදි කර ගන්නේ කෙසේද? (අඩු) විදුරුවට ගෙනයාමෙන් (1)

ඇස විවුහයට හොයාව (1)

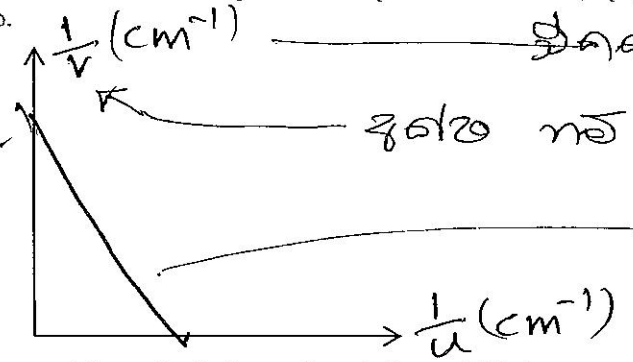
(vii) ඉහත සූදු නිමේෂණ කුට ප්‍රතිබිම්බය සැදෙන ස්ථානයේ සිට ඇස දෙසට තල්ලු වී ඇත. මෙය ඔබ හඳුනා ගන්නේ කෙසේද?

ඇස ඇසයට ඵලය ළඟා වීම, ඇස ඵලය ඔහා දිශාවට විතැන්වීම දිශාවට නිමේෂණ කුට ඵලය සීමා (1)

(c) (i) තාත්ත්වික ප්‍රතිබිම්බ සඳහා ලකුණු සම්මුතිය යෙදූ කාච සූත්‍රය ලියා දක්වන්න. සුපුරුදු සංකේත භාවිතා කරන්න.

$\frac{1}{-v} - \frac{1}{+u} = \frac{1}{-f}$ හෝ $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ (1)

(ii) වස්තු දුරෙහි පරස්පරය ස්වායත්ත විචල්‍ය ලෙස තෝරාගත් විට ලකුණු සම්මුතිය යෙදූ කාච සූත්‍රය අනුව ලැබේ යැයි සිතන ප්‍රස්තාරයේ දල හැඩය පහත ඇඳ දක්වන්න. ඒකකය සමග අක්ෂ නම් කරන්න.

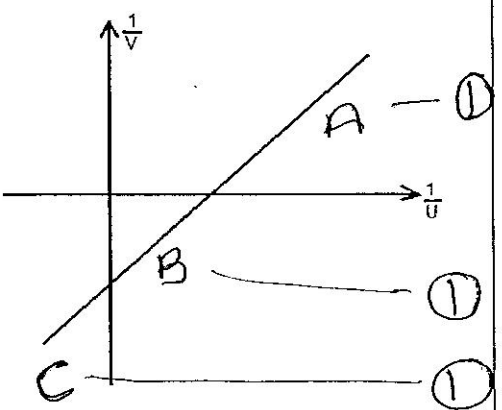


ඒකකයට (1)
අක්ෂ නම් කිරීම (1)
(1)

(d) ලකුණ සහිතව දුර මැන වගුවක් සකස් කර, සිසුවා විසින් පහත සඳහන් අවස්ථා සඳහා පාඨාංක ලබාගත්තේ යැයි සිතමු.

(A) තාත්ත්වික වස්තු සහ අතාත්ත්වික ප්‍රතිබිම්බ
(B) තාත්ත්වික වස්තු සහ තාත්ත්වික ප්‍රතිබිම්බ
(C) අතාත්ත්වික වස්තු සහ තාත්ත්වික ප්‍රතිබිම්බ

එම පාඨාංක සඳහා 1/V සහ 1/U අතර අඳිනු ලැබූ ප්‍රස්තාරයේ හැඩය පහත පරිදි විය.



(1)
(1)
(1)

අදාළ දත්ත ලක්ෂ්‍ය පවතින ප්‍රදේශ ඉහත ප්‍රස්තාරයේ A , B , C ලෙස යොදා පෙන්වන්න.

(e) (i) ඉහත (d) හි ප්‍රස්තාරයේ අන්තඃඛන්ඩයේ විශාලත්වය $0.1\ cm^{-1}$ නම් නාභි දුර සොයන්න.

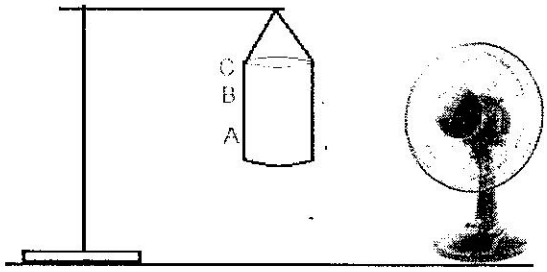
$f = 10$ cm (1)

(ii) ඉහත කාචයෙන් තාත්ත්වික ප්‍රතිබිම්බයක් ලබා ගැනීමට $(u + v)$ අගය කොපමණ අගයකට වඩා වැඩි විය යුතුද

40 cm ට වඩා වැඩි විය යුතුයි. (1)

20

3. (a) විවිධ ප්‍රමාණයේ කැලරිමීටර කිහිපයක් පමණක් ඇති පාසල් විද්‍යාගාරයේ දී නිව්ටන්ගේ සිසිලන නියමය භාවිතා කොට පොල්තෙල්වල විශිෂ්ට තාප ධාරිතාවය සෙවීමේ පරීක්ෂණයක් සඳහා භාවිතා කළ අසම්පූර්ණ රූප සටහනක් පහත දක්වේ.



(i) නිව්ටන්ගේ සිසිලන නියමය ලියා දක්වන්න.

වස්තුවක තාපය විමෝචන සීඝ්‍රතාව, වස්තුවේ උෂ්ණත්වය පරිසරයේ තාපාංක උෂ්ණත්වය සමානුපාතික වේ. (1)

(ii) එය වලංගු වීමට අවශ්‍ය තත්ත්වයන් මොනවාද?

වැඩා උෂ්ණත්වය පරාසය සඳහා ස්වභාවික සංවහනය සිදුවන උෂ්ණත්වය පරාසය සඳහා බල සංවහනය නියතයි (1)

(iii) මෙහිදී ඔප දැමූ කැලරිමීටරයක් භාවිතා කරන්නේ ඇයි ?

විකිරණ මගින් තාප හානිය අවම කිරීමට (1)

(iv) ඉහත රූප සටහනෙහි දක්විය යුතු අත්‍යාවශ්‍ය දෑ ඇඳ රූප සටහන සම්පූර්ණ කරන්න.

මාර්කියට, උෂ්ණත්වමානයට, තියනට

(v) මෙම පරීක්ෂණය සඳහා අවශ්‍ය අනෙකුත් විද්‍යාගාර උපකරණ මොනවාද?

කැලරිමීටර්, (1)

විරාම සවිකාරක් (1)

(vi) මෙහිදී මුලින් ම කැලරිමීටරයට ජලය එකතු කිරීමට අදහස් කෙරේ. මේ සඳහා සුදුසු ජල මට්ටම A , B , C මට්ටම් තුන අතරින් තෝරාගන්න. ජල මට්ටම සඳහන් කරන්න. ඉතිරි මට්ටම් දෙක නොසලකා හැරීමට හේතු වෙන වෙනම සඳහන් කරන්න.

සුදුසු මට්ටම — B (1)

A — මට්ටමට දැමූ විට පෘෂ්ඨීය පුරා එකාකාර උෂ්ණත්වයක් නැත. (1)

C මට්ටමට දැමූ විට මාර්ගීය ධේදී ඵලය අඩු වේ. (1)

(b) (i) ජලය් සඳහා පරීක්ෂණය සිදු කිරීමෙන් අනතුරුව පොල්තෙල් සඳහා පරීක්ෂණය සිදුකරයි. මේ සඳහා කලින් භාවිතා කළ කැලරිමීටරයම භාවිතා කළ යුතු ද? පහදන්න.

ඔව්. (1)

පෘෂ්ඨීය ස්වභාවය සමාන වන හෙයින් කැලරිමීටරයේ නැවී නිසා (1)

(ii) පොල්තෙල් සඳහා අවශ්‍ය දව මට්ටම ඉහත A , B , C අතුරින් කුමක් ද?

B මට්ටම (1)

(iii) කැලරිමීටරය තුලකින් එල්වා තැබීම වෙනුවට හෙපාර මත තැබූ තාප පරිවාරක සෘජුලෝප තහඩුවක් මත තබා පරීක්ෂණය කළ හැකිද? පහදන්න.

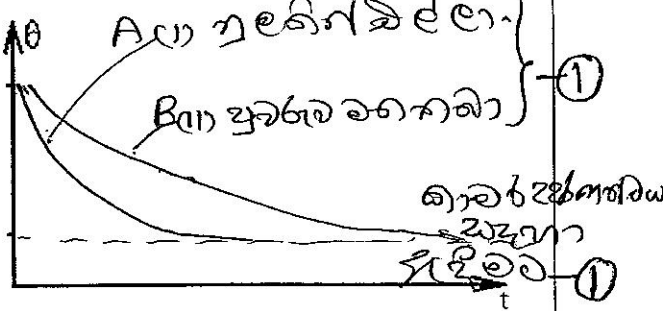
ගත්තුබ සන්නා විවිධරව
ඒක හොඳයි. (1)

පතුල හරහා සිදුවෙන තාප හානිය වැඩිවෙලා වැඩිපුර විමතිකියා හෝ අවම නිරවද්‍ය නොවේ.

(iv) එසේ (b) (iii) පරිදි පරීක්ෂණය සිදු කළහොත් දකිය හැකි නිරීක්ෂණයක් සඳහන් කරන්න.

සිසිල් වීම සිදුවීම/ (1)
(උෂ්ණත්වය හාල වැඩිවීම සිදුවීම)

(v) ඉහත පරීක්ෂණය සිදු කිරීමේ දී පොල්තෙල් සඳහා (i) නුලකින් එල්ලා සිදු කිරීමේ දී (A) හා (ii) පරිවාරක පුවරුවක් මත තබා කිරීමෙන් ලැබෙන සිසිලන වක්‍ර (B) දී ඇති බණ්ඩාංක තලයේ අඳින්න. ඒවා නම් කරන්න.



A යා නුලකින් එල්ලා (1)
B යා පුවරුව මතතබා

කාමර උෂ්ණත්වය සඳහා සිසිල් වීම (1)

(vi) පරීක්ෂණය සිදුකරන අතරතුර ඔබ සිදුකළ යුතු අත්‍යාවශය කාර්යය කුමක් ද? එසේ කිරීමට හේතුව කුමක් ද?

මන්ථනය කිරීම, (1)
එකතර උෂ්ණත්වයක් /දුවයේ හා වදුන් උෂ්ණත්වය
වගේ වා හැකිවීම (1)

(c) (i) පොල්තෙල්වල විශිෂ්ට තාප ධාරිතාවය සෙවීමේ පරීක්ෂණයේදී ඔබ ලබාගන්නා පාඨාංක මොනවාද?

ආරම්භක කාමර උෂ්ණත්වය / මිනිත්තු දෙකක් ගැනම
උෂ්ණත්වය (1)

(ii) මීට අමතරව ගණනය කිරීම සඳහා අවශ්‍ය අනෙකුත් දත්ත මොනවාද?

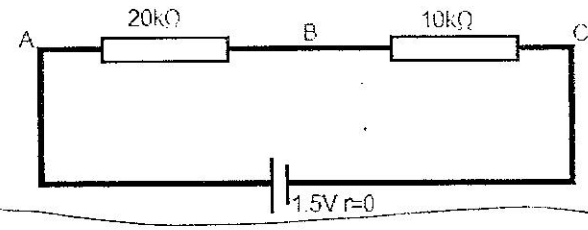
ජලයේ වි. තාප ධාරිතාව, කැලරිමීටරයේ වි. තාපධාරිතාව
ජලයේ ස්කන්ධය, පොල්තෙල් ස්කන්ධය,
(හිස) කැලරිමීටරයේ ස්කන්ධය
දෙකෙළ ලෙඳ 1 බැගින් විවිධ උෂ්ණත්ව සඳහා ලෙඳ (2)

4. ධාරාවක් ගලා යන පරිපථයක වුවත් කුඩා විභව අන්තර මැනීමට විද්‍යාගාරයේ භාවිතා වන උපකරණයකි විභවමානය, පරාස වෙන්කර හැකි සාමාන්‍ය ප්‍රතිසම වෝල්ට් මීටරයක අභ්‍යන්තර ප්‍රතිරෝධය 20 kΩ/V වන අතර විභවමානයක අභ්‍යන්තර ප්‍රතිරෝධය අනන්තයක් වේ. 20

(a) (i) ඉහත ප්‍රතිසම වෝල්ට්මීටරයක පරාසය 0 - 5 V ට යොමුකර අභ්‍යන්තර ප්‍රතිරෝධයක් නැති 3 V කෝෂයක විභව අන්තරය මනින විට ප්‍රතිසම වෝල්ට්මීටරය තුළින් ගලන ධාරාව කොපමණදැයි ගණනය කරන්න.

$E = \varepsilon i r$ → $I = 3 \times 10^{-5}$ A / (1)
$3 = I(20 \times 5 \times 10^3)$ 30 μA (1)

(ii) ප්‍රතිසම වෝල්ට්මීටරය 0 - 1 V පරාසයට යොමුකර A හා B අතර විභව අන්තරය මැනීමට සම්බන්ධ කරයි.



(a) වෝල්ට්මීටරය සම්බන්ධ කළ යුත්තේ ශ්‍රේණිගතව ද? සමාන්තරගතව ද?

සමාන්තර ගතව ..... (1)

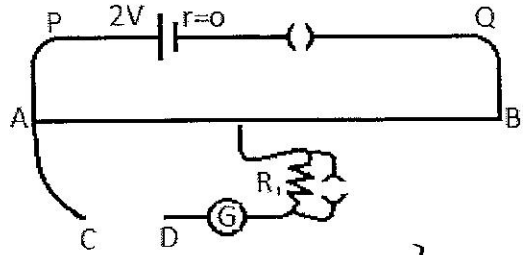
(b) ප්‍රතිසම වෝල්ට්මීටරය සවිකිරීමට පෙර 20 kΩ හරහා සත්‍ය විභව අන්තරය කොපමණද?

$\frac{1.5}{20+10} \times 20 = 1\ V$ ..... (1) (1)

(c) ප්‍රතිසම වෝල්ට්මීටරය සවිකිරීමෙන් පසු 20 kΩ හරහා පෙන්වන වෝල්ටීයතාව කොපමණද?

$\frac{1.5}{\frac{20}{2}+10} \times 10 = 0.75\ V$ ..... (2)

(b) රූපයේ දැක්වෙන්නේ විභවමාන පරිපථයකි. එහි AB විභවමාන කම්බියේ දිග 200 cm වේ.



(i) විභවමාන පරිපථය සඳහා ටකන යතුරක් වෙනුවට පේනු යතුරක් භාවිතා කිරීමට හේතුවක් ඉදිරිපත් කරන්න.

නියත ධාරාවක්/ක්ෂීණ හරහා නියත ක්ෂුද්‍රදර්ශනයක් පවත්වා ගැනීමට ..... (1)

(ii) විභවමාන කම්බිය තැර ඉතිරි කොටසේ තඹ ලෝහයෙන් තනා ඇත්තේ ඇයි ?

ප්‍රතිරෝධය අඩුවන/ශූන්‍ය වන ගැනීමට ..... (1)

(iii) විභවමාන කම්බිය සඳහා මැංගනීන් (Mn) ලෝහයක් භාවිතා කරන්නේ ඇයි ?

ප්‍රතිරෝධය වැඩි ගැනීමට/ධාරාව අඩුවන ගැනීමට ..... (1)

(iv) විභවමාන කෝෂය සඳහා 2 V වෙනුවට විශාල වෝල්ටීයතා භාවිතා කළහොත් සිදුවිය හැකි දෙයක් විස්තර කරන්න.

කම්බිය රත්වේ/අධික ධාරා නිසා කම්බියට හානි වේ ..... (1)

(v) ඉහත විභවමානය R_1 සඳහා සුදුසු ප්‍රතිරෝධ අගයන් සඳහන් කරන්න.

1 kΩ සිට 5 kΩ දක්වා ඕනෑම අගයන්ගෙන් ..... (1)

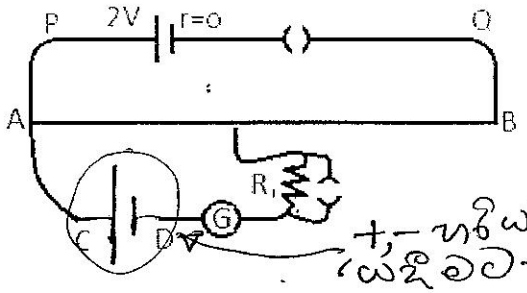
(vi) ඉහත විභවමානයේ විභව අනුක්‍රමණය සොයන්න.

$0.01\ V\ cm^{-1}$ / $0.001\ V\ mm^{-1}$ ..... (2)

(vii) මෙම විභවමානයෙන් කෝෂයක විද්‍යුත් ගාමක බලය මැන්න විට සංතුලන දිග 112.5 cm දිගක් ලැබුණි.

(a) කෝෂය සම්බන්ධ කරන අයුරු ඇඳ දක්වන්න.

(b) කෝෂයේ විද්‍යුත් ගාමක බලය සොයන්න.



+, − හරියට රැහැන් වලට — (1)

$V = kl$

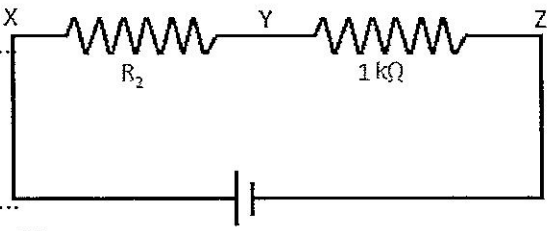
$= 0.01 \times 112.5$

$= 1.125\ V$ — (2)

(viii) ඉහත විභවමානය මගින් X , Y හරහා විභව අන්තරය මැනීමේ දී සංතුලන දිග 120.0 cm ලෙස ද, XZ විභව අන්තරය සඳහා සංතුලන දිග 160.0 cm ලෙස ද ලැබුණි. R_2 ප්‍රතිරෝධයේ අගය ගණනය කරන්න.

$V = IR$

kl



$I R_2 = k(120.0)$

$I (R_2 + 1000) = k(160.0)$

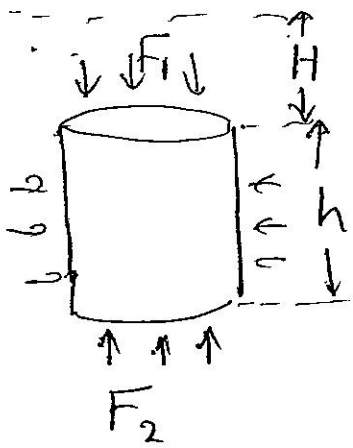
$R_2 = 3000\ \Omega$ හෝ $3\ k\Omega$ — (2)

(ix) ඉහත භාවිතා කළ විභවමානයේ සංවේදීතාව හෙවත් කුඩාම මිනුම කොපමණද?

1mm ට අඟල භාග්‍යය බැගින් $0.001\ V$ — (1)

(20)

(5) (a) වස්තුවක් මත ලබා දිය වගාවෙන් හා සමතුලිතතාව පිළිබඳ ඇතිවිට තරලය මගින් වස්තුව මත ඇති කරන උඩුකුරු තෙරපුම, වස්තුව මගින් විස්ථාපිත තරලයේ බරට සමාන බව. ——— (2)



ඉහළින් ක්‍රියාකරන බලය (ඉහළ පෘෂ්ඨීයය) $= AH\rho g (+\pi)$ — (1)

පාදපෘෂ්ඨීයය $= A(H+h)\rho g (+\pi)$ — (1)

උඩුකුරු තෙරපුම

$A(H+h)\rho g (+\pi) - \{AH\rho g(+\pi)\}$ — (1)

$= Ah\rho g$

$= V\rho g$ ——— (1)

b (i) $P = \pi + h\rho g$

$= 1\times10^5 + 3\times10^3\times1\times10^3\times10$ ——— (1)

$= 3.01\times10^7$ Pa ——— (1)

(ii) $u = V\rho g$

$= 500\times10^3\times10$ ——— (1)

$= 5\times10^6$ N ——— (1)

(iii) $T + u = W$ ——— (1)

$T + 5\times10^6 = 7500000\times10$ ——— (1)

$T = 7\times10^7$ N ——— (1)

10 ප්‍රශ්නය

C (i)

$7.0\times10^7\times40\cos\theta + 20000\times20\cos\theta = 10000\times15\sin\theta + W\times30\times\sin\theta$ (1)

(1) (1) (1)

$7\times32\times10^7 + 2\times16\times10^4 = 9\times10^4 + 18W$ (1)

$18W = 224023\times10^4$ සමීකරණය ලබා ගැනීම (1)

$W = 12450\times10^4\ N$

(ii) බලයේ පරාසය ඇ

$12450\times10^4 - 450\times10^4$ අඩුකිරීමට (1)

$12000\times10^4 N = 1.2\times10^8 N$ නිවැරදි සහිත විසඳුම (1)

$P = \frac{m}{V}$ (1)

$V = \frac{1.2\times10^7}{1000}$ ආකෘතිය කිරීමට (1)

$= 1.2\times10^4 m^3$ නිවැරදි සහිත විසඳුම (1)

d (i) කාර්යය $= F\times x$ සූත්‍රගතකරණය (1)

$= 7\times10^7\times3\times10^3$

$= 2.1\times10^{11} J$ නිවැරදි සහිත විසඳුම (1)

(ii) ක්ෂමතාව $P = \frac{2.1\times10^{11}}{100\times60}$ නිවැරදි කාලයෙන් බෙදීමට (1)

$= 3.5\times10^7 W$ (1)

(iii) ප්‍රවේගය $= \frac{3.0\times10^3}{100\times60}$ හෝ $\frac{3.7\times10^3}{100\times60}$ $(0.5 - 0.61\ ms^{-1})$ (1)

$P = F\times V$ (1)

$= 7.5\times10^7\times(0.5$ හා $0.61)$

$= 3.75\times10^7 W$ සිට $4.65\times10^7 W$ දක්වා නිවැරදි පරාසය ලබා ගැනීම (1)

11 වීදුර

විෂයභාරය 30

⑥ a (i) ආත්මලය ——— (1)

(ii) ආත්මලය වහල අයිති ආගය පෝලඟත් සංඥානය වන ආගය හා වහාර්ථය දුහලට යයිත් කොල්ල වහල මායිත්ත හෝගත් කොල විදීමට ලක්වීම, නිගන්ථයන් විදීමට ලක්වීම නිසා හැකිවලට වන්වීම ——— (2)

(iii) හැකි දෙගේ අතර අතිවන හෝගීවල හා ලිඛිතවල ——— (1)

(iv) හැකෙවහාය හරහත් පාමිව අහාන්තර්ගේ විහිව ඛ්‍රමානය ——— (1)

(v) නාභියට ඉහලින් පාමිව ඛාර්ශ්වයේ ඛ්‍රමානය ——— (1)

(vi) 7 ක් වටී. ——— (1)

b (i) පෘෂ්ඨ කෙවහාය වියෝන් හරහාත්තා නිසා හා ඉතාර්ණයට මාඝාත් අවශ්‍ය නිසා ——— (1)

(ii) ජල කර්ණ, ඝෝෂ කර්ණ ---
නිවැරදි ඔක්කම ඇතුලට ——— (2)

(iii) ඉහාන්තර කර්ණ }
පාර්ශ්වීය කර්ණ } ——— (2)

(iv) P කර්ණ ——— (1)

(v) ←→ කර්ණා දිශාව
←→ අංශු කම්පන දිශාව } ——— (1)

(VI) රළු තරංග සහ මෘදු තරංග ——— (2)

(VII) ශබ්ද තරංග ——— (1)

(C) (i) 5 (4.8 සිට 5.2 දක්වා) ——— (1)

(ii) $M = \log_{10} \frac{I}{I_0}$ ——— (1)

——— (1)

$8.2 = \log \frac{I}{1}$ ——— (1) සූත්‍රය

$I = 10^{8.2}$ W m^{-2} ——— (1) ප්‍රතිඵලය

(iii) $\log E = 4.4 + 1.5\ M$ ——— (1)

——— (1)

$\log E = 4.4 + 1.5 \times 8.2$ ——— (1) සූත්‍රය

$E = 10^{16.7}$ J ——— (1) ප්‍රතිඵලය

(iv) moment magnitude scale ——— (1)

(v) තරංග වර්ගයේ නියා ——— (1)

(vi) පෘථිවි අභ්‍යන්තරය පිළිබඳ වැදගත්කම ගැනීම ——— (1)

(vii) තරළ (සූ) තල තීව්‍රතා තරංග ගමන් කරයි. ——— (1)

ලකුණු 30

13 වැලුව

7. (a) (i) ප්‍රත්‍යාබල වලය – වස්තුව වර්ගඵලයේදී එම F බලය එකක වර්ගඵලයක් ඇසුරින් බෙදා ලබා ගන්නා බලය (1)
විතතිය – වස්තුව දිගෙහි සිදුවන වෙනසයි (1)

(ii) $\frac{F}{A} = Y\frac{e}{l}$ (1)

F බලය
A හරස්කඩ වර්ගඵලය
Y යංමාපාංකය
e – විතතිය
l – ආරම්භක දිග } (2)

(iii) $Y = ML^{-1}T^{-2}$ (1) 6

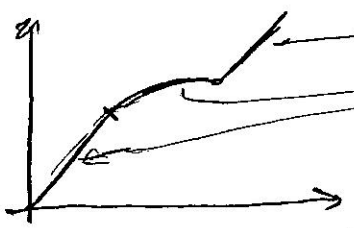
b (i) $s = ut + \frac{1}{2}at^2$ (1)
$45 = 0 + \frac{1}{2}10t^2$
$t = 3\ s$ (1)

(ii) $v = u + at$ (1)
$v = 0 + 10 \times 3$
$v = 30\ ms^{-1}$ (1) 10

(iii) $Y = \frac{2\times10^5}{0.1}$ හෝ $\frac{2\times10^5}{0.1}$ (1)
$Y = 2\times10^6$ හෝ 2×10^{-4} (1)

(iv) $\frac{F}{A} = Y\frac{e}{l}$ (1)
$\frac{600}{A} = 2\times10^6 \times \frac{20}{45}$ හෝ $2\times10^{-4}\times\frac{20}{45}$
$A = 6.75\times10^{-4}\ m^2$ හෝ $6.75\times10^{6}\ m^2$ (1)

(v) (1)



(1)
(1)
(1)

(ii) $V\rho g \times 4 = \text{වම } mg$
$\frac{4}{3}\pi r^3 \times 10^3 \times 10 \times 4 = (140+60)10$ (1)
$r = 0.23\ m$ (1)

(iii) කුඩා බෑනාව සිට හෙළ පෘථිවිය දක්වා ච.ච.නි
$60\times10\times100 = \frac{1}{2}\times600\times20 + E$ (1) 20
$E = 54000\ J$ (1)
∴ ශක්තියට ලබා දා. ශ = $54000\times\frac{20}{100}$ (1)
$\frac{1}{2}\times600\ V^2 = 10800$
$V = 10.4\ ms^{-1}$ (1)

14 වර්ගය

(iv) $F = 6\pi\eta r v \times 4$ ——— ①

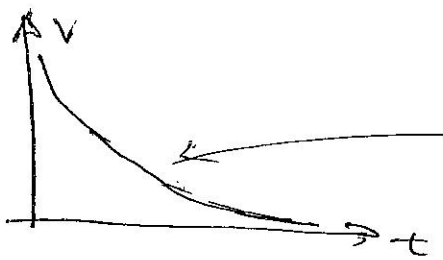
$F = 6 \times 3 \times 8 \times 10^{-4} \times 0.23 \times 10.4 \times 4$ ආදේශය ① ආදේශය ①

$F = 0.14\ N$ ——— ①

(v) $F = ma$

$-0.14 = 200a$

$a = 7 \times 10^{-4}\ ms^{-2}$ ——— ②



හරි හැඩය ——— ②

(7) ප්‍රශ්නය 30

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8 (a) (i) $C = \frac{Q}{V}$ ——— ①

(ii) $Q = Q_1 + Q_2 + Q_3$ ——— ①

$CV = C_1V + C_2V + C_3V$ ——— ①

$C = C_1 + C_2 + C_3$ ——— ①

(iii) $C = \frac{\varepsilon_0 A}{d}(n-1)$ ——— ①

(iv) $C = \frac{9 \times 10^{-12} \times 10 \times 10^{-6}(7-1)}{2.5 \times 10^{-3}}$ ——— ①

$= 2.16 \times 10^{-13}\ F$ ——— ①

$= 2.16 \times 10^{-1}\ PF$ ——— ①

(v) $Q = CV$ ——— ①

$= \frac{2.16 \times 10^{-13} \times 12}{6} \times 2$ ——— ①

$= 8.64 \times 10^{-13}\ C$ ——— ①

(vi) ශක්තිය $= \frac{1}{2}VQ$ හෝ $\frac{1}{2}CV^2$ ——— ①

$= 2.592 \times 10^{-12}\ J$ ——— ①

15 ලකුණු

(vii) $\frac{2.16 \times 10^{-13}}{90} \times 150$ ——— (1)

$3.6 \times 10^{-13} F$ ——— (1)

(viii) ගෝලය ඉහළ යාමට,
ඒකදී පංකාවල කෙළවර ප්‍රතලය
ගුරු කාණාව ඇතුලට ——— (1)

(b) (i) $E = \frac{1}{4\pi\varepsilon_0} \frac{Q}{r^2}$ ——— (1)

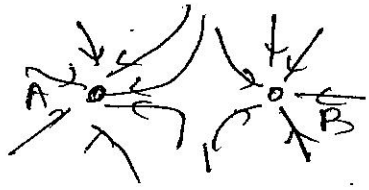
$3 \times 10^3 = 9 \times 10^9 \times \frac{Q}{(3 \times 10^{-2} \times 10^{-3})^2}$ ——— (1)

$Q = 3 \times 10^{-16} C$ ——— (1)

(ii) $F = \frac{1}{4\pi\varepsilon_0} \frac{Q_1 Q_2}{r^2}$ ——— (1)

$F = \frac{9 \times 10^9 \times 3 \times 10^{-16} \times 9 \times 10^{-12}}{(3 \times 10^{-2} \times 10^{-3} \times 3)^2}$ ——— (1)

$F = 3 \times 10^{-9} N$ ——— (1)

(iii) 

——— (1)

(iv) $E = \frac{\Delta V}{d}$ ——— (1)

$= \frac{100}{25 \times 10^{-2}}$

$= 400 \ N \ C^{-1}$ ——— (1)

(v) $F = E Q$

$= 400 \times 9 \times 10^{-12}$

$= 3.6 \times 10^{-9} N$ ——— (1)

$f = ma, \quad 3.6 \times 10^{-9} = 48 \times 10^{-8} a$

$a = 7.5 \times 10^{-3} \ ms^{-2}$ ——— (1)

(vi) $F = 6\pi \eta r V$ ——— (1)

$3.6 \times 10^{-9} = 6 \times 3 \times 1 \times 10^{-1} \times 3 \times 10^{-5} V$

$V = 6 \times 10^{-11} \ ms^{-1}$ ——— (1)

16 පිටුව ——— (1)

30

(9)(a) (i) ඉයිරෝ ජනිත්‍රාවලිය ——— (1)

කොණ්ඩය කිරණාලය, ග්‍රෝත්‍ර ද්‍රාවණය ආදී නියෑම
නිවැරදි ——— (1)

(ii) රාශිය හානිය අවම වන සේ විදුලිය සම්ප්‍රේෂණය ——— (1)

(iii) $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

$\frac{330}{66000}$

$\frac{1}{200}$ හෝ 1 : 200 ——— (1)

(iv) $P_{in} \times \frac{80}{100} = P_{out}$

$V_p I_p \frac{80}{100} = V_s I_s$

$\frac{I_p}{I_s} = \frac{250}{1}$ හෝ 250 : 1 ——— (1)

(v) සුළි කාරවලින් — ආක්‍රමණය වළ නහුව පරීක්ෂා කිරීම (1)

හානිය කිරීම (1)

ශූල නාසය මගින් — ප්‍රතිඛාදය අඩු / සන්නායකතාවය /මහත වැඩි කේබල් භාවිතා කිරීම (1)

(b)(i) නැවත සුළු කල හැකි කිරීම

(ii) $R = \frac{\rho l}{A}$ ——— (1)

$= \frac{2 \times 10^{-8} \times 30 \times 10^{3}}{2 \times 10^{-6} \times 10}$ ——— (1)

$R = 30\,\Omega$ ——— (1)

(iii) $V = IR$ ——— (1)

$V = \frac{1}{3} \times 30 = 10\,V$ ——— (1)

(iv) $P = I^2 R = \left(\frac{1}{3}\right)^2 \times 30 = 3.33\,W$ ——— (1)

(v) $V = IR$

$10 = \frac{2}{7} R$ — $R = 35\,\Omega$ ——— (1)

17 වීමුව

සියලුම විෂයන්ට අදාල ප්‍රශ්න පත්‍ර/පිළිතුරු පත්‍ර/සටහන් ලබා ගැනීමට Past Papers Wiki වෙත පිවිසෙන්න

VI $R_\theta = R_0(1+\alpha\theta)$ ——— (1)

$30 = R_0(1+\alpha\times 30)$ ——— (1)

$35 = R_0(1+\alpha\times 35)$ ——— (1)

$\frac{6}{7} = \frac{1+30\alpha}{1+35\alpha}$ ——— (1)

$\alpha = \frac{1}{240} = 0.0042\ K^{-1}$ ——— (1)

C (i) $I = \frac{E}{R+r}$ ——— (1)

$= \frac{12}{118+2}$

$= 0.1\ A$ ——— (1)

(ii) ඉහතින්ම ගෙන එලෙසම අගිනීම ——— (1)

(iii) $E_1 - E_2 = 0.1\times\frac{80}{100}(118+2)$ ——— (1)

$12 - E_2 = 9.6$ (1)

$E_2 = 2.4V$ (1)

(iv) $E = BNAw$ (1)

$2.4 = 0.1\times 100\times 8\times 10^{-4}\ w$ ——— (1)

$w = 300\ rad\ s^{-1}$ ——— (1)

30

10(a) (i) වායුගෝලීය පීඩනය, ද්‍රවයක, උත්ප්‍රේරණය
--- සඳහා ඔබෙන් ——— (2)

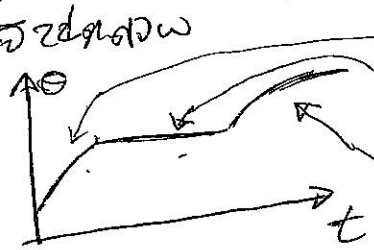
(ii) ඉවසිල්ල වැනි ස්වභාවයන් උත්ප්‍රේරණ නොවන නා තවිව නොවන රෙදි සඳහා භාවිතා වන ඔබෙන් ——— (2)

(iii) වායුගෝලීය පීඩනය ——— (1)

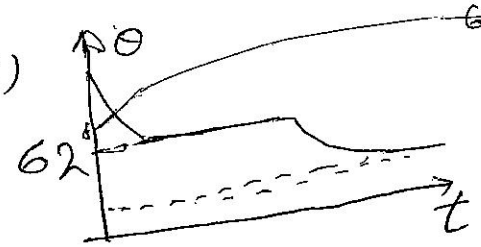
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(b) (i) $\frac{\Delta Q}{\Delta t} = kA(\theta - \theta_R)$ ——— ①

k - සිසිලන නියතය
A - වාතුරස්‍ර වස්තුවේ පෘෂ්ඨීය වර්ගඵලය
$(\theta - \theta_R)$ ← අවට උෂ්ණත්වය / කාමර උෂ්ණත්වය
} සඳහා දෙකක් නම් ඉරහාවා ②

(ii)


ඝාරය යට ①
ඝාරය මත ①
ඝාරය ① ①
62 ලෙස ගිහිල්ල ①

(iii) (I)


කාමර උෂ්ණත්වය දක්වා ඇදිලා ①
අවිර රෙඛාව නව ගිහිල්ලා ①

(II) 62°C ——— ①

(3) $mC_1\left(\frac{\Delta\theta}{\Delta t}\right) = mC_2\left(\frac{\Delta\theta}{\Delta t}\right)_2$

$m \times 1800 \times \frac{3.6}{60} = m C_2 \frac{4.8}{60}$ සඳහා ගිහිල්ලා ①

$C_2 = 1350\ J\ kg^{-1}K^{-1}$ — ①

(4) $m\frac{L}{20\times60} = m\,1800\times\frac{3.6}{60}$

$L = 129600\ J\ kg^{-1}$ — ②

(5) වඳුනා ලැබෙන ආහාර, වියලන ආහාරයට සාපෙක්ෂව වඩා ——— ①

(C) (1) $Q = \frac{mL}{t}$ ——— ①

$20000 = \frac{m}{t} \times 2\times10^6$ ——— ①

$\left(\frac{m}{t}\right) = 0.01\ kg\ s^{-1}$ ——— ①

සියලුම විෂයන්ට අදාල ප්‍රශ්න පත්‍ර/පිළිතුරු පත්‍ර/සටහන් ලබා ගැනීමට Past Papers Wiki වෙත පිවිසෙන්න

(2) $Q = \frac{KA(\theta_1 - \theta_2)}{l}$

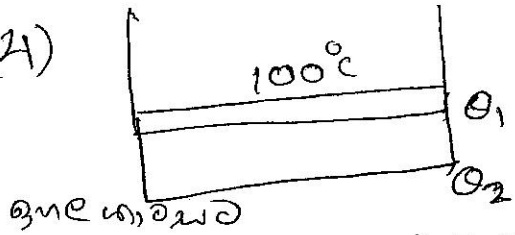
$20000 = \frac{400 \times 500 \times 10^{-4}(\theta - 100)}{2 \times 10^{-2}}$ —— (1)

$\theta = 120^\circ C$ —— (1)

(3) වලින් ප්‍රමාණය ඒ.

$(0.01\ kg\ s^{-1})$ —— (1)

(4)



$20000 = \frac{10 \times 500 \times 10^{-4}(\theta_1 - 100)}{0.1 \times 10^{-2}}$

$\theta_1 = 140^\circ C$ —— (1)

පහළ පාළුව

$20000 = \frac{400 \times 500 \times 10^{-4}(\theta_2 - 140)}{2 \times 10^{-2}}$

$\theta_2 = 160^\circ C$ —— (1)

(5)

(i) දුර්වාගාව වැඩි ය. —— (1)

(ii) ජීවකාල වැඩි ය. —— (1)

10 ලකුණ → 30

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