සියලු ම හිමිකම් ඇවිරිණි
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බස්නාහිර පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව
மேல் மாகாணக் கல்வித் திணைக்களம்
Department of Education - Western Province

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தரப்) பரீட்சை - 2021
General Certificate of Education (Adv. Level) Examination

ශ්‍රේණිය / தரம் / Grade	13	විෂයය / பாடம் / Subject	භෞතික විද්‍යාව இயற்பியல் Pysics	පත්‍රය / வினாத்தாள் / Paper	I	පැය / மணித்தியாலம் / Hours	2

නම /**Name :…………………………………………………………..**

Answer all the questions.

(01) Which of the following indicates the correct physical quantity dimension of $\frac{impulse}{time}$?

1. MLT^{-3} 2. MLT^{-2} 3. $ML^{-1}T^{-1}$ 4. $ML^{-2}T^{-2}$ 5. $ML^{-1}T^{-2}$

(02) An experiment with a spectrometer to find the minimum angle of deviation.

(a) collimator is adjusted to obtain a parallel light beam.
(b) telescope is adjusted to observe a parallel light beam.
(c) Prism is adjusted where the refracted angle of prism is always kept in the center of the prism table

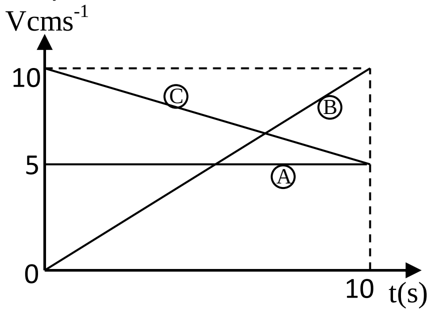
1. a only 2. b only 3. c only 4. a and b 5. a and c

(03) Which of the following statements regarding zero error in measuring instrument is/are correct?

A) Negative zero error occurs in a vernier caliper due to decay of internal jaws.
B) Positive zero error occurs because of rust in between thimble and an anvil of a micro meter screw guage.
C) Reading cannot be obtained by omiting the error due to decay of the tip of a spherometer.

1. A only 2. B only 3. C only 4. A and B 5. B and C

(04) A, B and C are three vehicles travel on parallel tracks. They pass the same place at t=0. what is the correct statement given below on their motion when they reach t=10s?



1. C moves behind A.
2. A and C reach the same location.
3. B moves behind A.
4. A and B reach the same location once again.
5. C moves behind B.

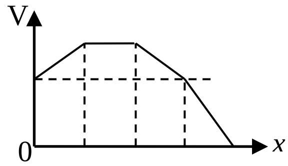
(05) What is the minimum speed that should be given to molecule 'M' Mass to reach $R/_4$ height from the earth surface. The radius of the earth is R and the gravitational acceleration of the surface is g.

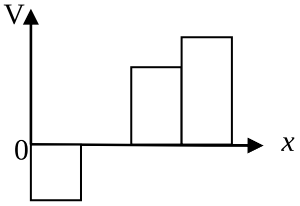
1. $\sqrt{\frac{gr}{2}}$ 2. $\sqrt{gr}$ 3. $\sqrt{\frac{gr}{4}}$ 4. $\sqrt{\frac{gr}{5}}$ 5. $\sqrt{\frac{2gr}{5}}$

(06) Convex lens of focal length of 16cm forms an image, twice of size of it's object. What is the object distance?

1. 8 cm 2. 16 cm 3. 20 cm 4. 24 cm 5. 32 cm

(07) The diagram shows differenciation of an electric potentiality of a certain area of a space towards ox direction. Which graph best shows the Intensity of electric field?



1.


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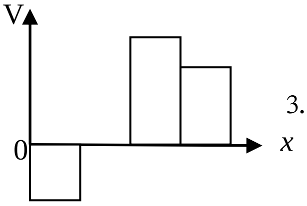

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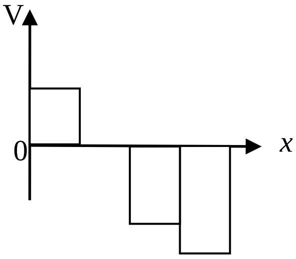

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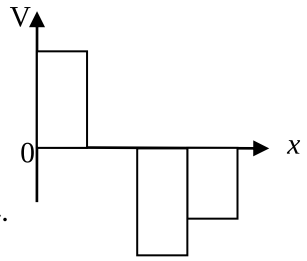

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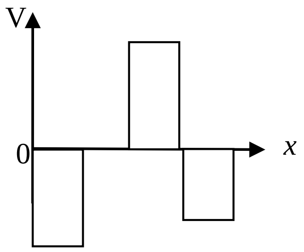
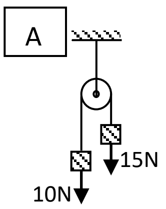
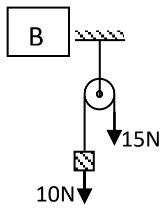


(08) Given below are two smooth pulley systems.

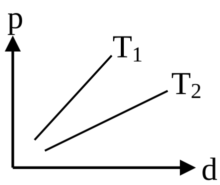




When acting forces, the mass 10 N in A and B

1. Motion at A and B takes place at the same acceleration.
2. A doesn't show an acceleration but B shows an acceleration.
3. Acceleration at B is greater than A.
4. Acceleration at B is not greater than A.
5. Cannot predict the acceleration at A and B.

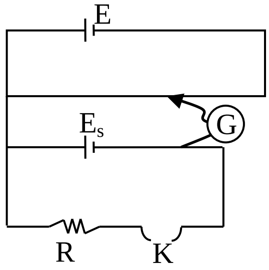
(09) Given below is a graph against density (d) and pressure (p) of two temperature T_1 and T_2 of an ideal gas. Which one is correct?



1. $T_1 > T_2$ 2. $T_1 = T_2$ 3. $T_1 < T_2$

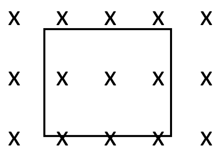
4. Above three answers are correct. 5. Above all answers are correct.

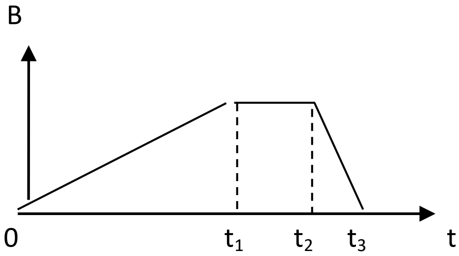
(10) The given circuit has a R fixed resistance whether the 'K' key opens or off it's balancing direction doesn't change. The reason for this is,



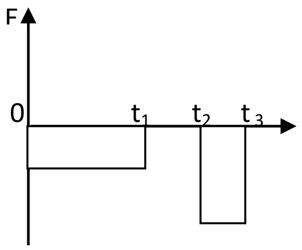
1. $E_s > E$
2. $E_s < E$
3. Doesn't connect the two terminalsof the cells correctly.
4. Internal resistance of E_s is zero.
5. Internal resistance of E_s is zero.

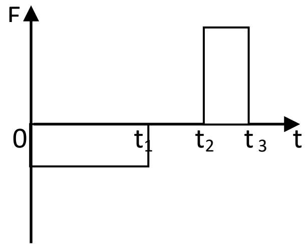
(11) First figure shows a metal wire loop of square shape is placed perpendicularly in an uniform magnetic field. The Second figure shows change of density of magnetic flux (B) with time.

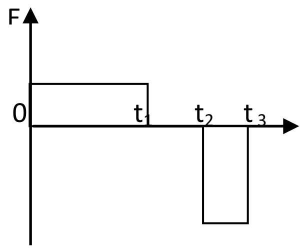


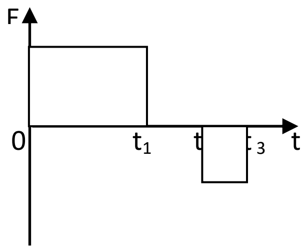


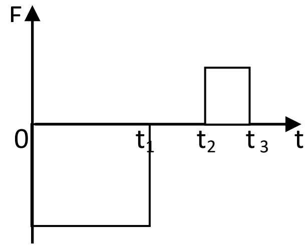
Which graph shows correctly the induced electric flux over the loop with time?

1. 

2. 

3. 

4. 

5. 

(12) A boat moving with a regular velocity of $10ms^{-}1$. Then the resistance force against the motion of boat is 400N. What is the power of engine of this boat?

1. 40W 2. 400W 3. 2000W 4. 3000W 5. 4000W

(13) A liquid flows through two capillary tubes which are not connected with same pressure variation. The ratio of internal diameter between these two tubes is 2:1. The ratio of the length of these tubes is 1:2. What is the ratio of rate of liquid flow through these tubes?

1. 32 : 1 2. 16 : 1 3. 8 : 1 4. 4 : 1 5. 2 : 1

(14) A man wears the spectacles with -2.5 D power lenses. What is his eye disease and the distance to the far sightedness when he does't wear lenses?

1. Far sightedness, 40 cm away.
2. Short sightedness, 40 cm away.
3. Short sightedness, 250 cm away.
4. Far sightedness, 250 cm away.
5. Astigmatism (metrophia), 40 cm away.

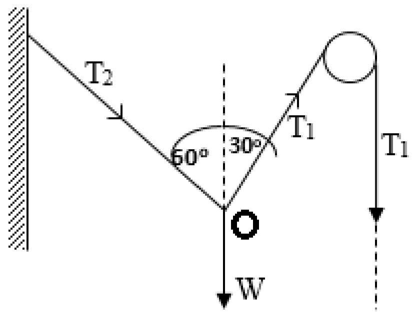
(15) There are two spheres with equal masses and external volumes. But one sphere is a hollow one and the other is a solid one. When both spheres dropped through glycerine in same time, in a certain moment.

1. The velocity of hollow sphere is more than the velocity of solid sphere.
2. The acceleration of the hollow sphere is more than the acceleration of the solid sphere.
3. The velocities of two spheres are same but acceleration aren't equal.
4. The acceleration of two spheres are same but velocities aren't same.
5. In both the spheres velocity and acceleration are same.

(16) A and B are two planets. The radius of B is three times bigger than that of A. The density of A is twice more than B. What is the ratio between gravitational acceleration of A and B surfaces?

1. 1 : 3 2. 2 : 3 3. 3 : 2 4. 3 : 4 5. 4 : 3

(17) According to the diagram given, to keep the point 'o' in equilibrium.



1. $T_1 = T_2 = \frac{\sqrt{3}W}{2}$
2. $T_1 = \frac{\sqrt{3}W}{2}$ and $T_2 = \frac{W}{2}$
3. $T_1 = \frac{W}{2}$ and $T_2 = \frac{\sqrt{3}W}{2}$
4. $T_1 = T_2 = \frac{W}{2}$
5. $\sqrt{3}\, T_2 + T_1 = 2W$ and $T_1 = \sqrt{3}\, T_2$

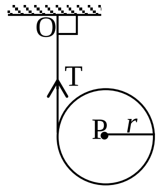
(18) A metallic cylinder which is trapped air connected to a piston. To trapped the air piston is instantly moved and keep in the same position. What is the pressure inside the cylinder after sometime?

1. It increases 2. It decreases 3. It remains constant
4. Rise or fall of pressure depends on the nature of the air. 5. None of the above.

(19) A rod is made of a material with youngs module y, lenear expansivity coefficient x, length l and cross area A. This rod has kept between two fixed supporters which is not allowed for expansion. When the temperature increases in a θ value, what is the force exerted by two supporters?

1. $Ayl\alpha\theta$ 2. $Ay^2\alpha\theta$ 3. $Ay\alpha\theta$ 4. $Al^2y\alpha\theta$ 5. $\frac{Ay\alpha\theta}{l}$

(20) A non elastic string is tightened at o and its free end is wrapped to the circumference of the pulley and released. The string has a tention force of T and its mass is m. What is the incorrect statement out of the following?



1. Torque which is needed for rotational motion is supplied by the tension.
2. The pulley pulls downwards with a constant acceleration.
3. Weight (mg) produces the Torque needed for pulley to rotate.
4. When considering the motion of P it moves vertically downwards with a constant acceleration.
5. Torque affected to the rotational motion of pulley acting along the string.

(21) Light non – extensible string length of *l* is attached with a smooth ring to a one end and mass of m into another end. When this system going through the ring is rotational around vertical axis in a horizontal circular path of radius *2l* with a constent angular velocity. (Extensible constent is λ) What is the frequency of the motion in (Hz)?

1. $\frac{1}{2\pi}\sqrt{\frac{\lambda}{m}}$ 2. $\frac{1}{2\pi}\sqrt{\frac{\lambda}{2m}}$ 3. $\frac{1}{2\pi}\sqrt{\frac{2m}{\lambda}}$ 4. $\frac{1}{2\pi}\sqrt{\frac{m}{\lambda}}$ 5. $\sqrt{\frac{\lambda}{2m}}$

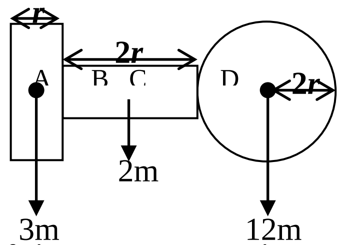
(22) Internal additional pressure of one soap bubble is three times that of another same type bubble. The ratio of the volume between the first and the second soap bubble is.

1. 1 : 3 2. 1 : 9 3. 1 : 27 4. 27 : 1 5. 9 : 1

(23) Sound intensity of a point source is I. There are 99 other such sources at the same place where the point source is kept. What is the variation of the sound intensity level at a given point?

1. 1 dB 2. 10 dB 3. 20 dB 4. 40 dB 5. 100 dB

(24) Which one of the following shows the correct location of the centre of gravity in the complex object given below.

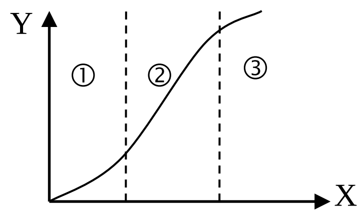


1. In between AB
2. In between BC
3. In between CD
4. In between DE
5. At D

(25) A Certain liquid gets cool from 70^0 C to 60^0C within 5 mins. If the environmental temperature exists constant as 30^0C. Find the time taken to cool the liquid from 60^0C to 50^0 C.

1. 2 min 2. 5 min 3. 7 min 3. 6 min 5. 3 min

(26) The graph given below shows the input and output current of a transistor which is in general emission status.



(a) The gradiant of zone ② is $\frac{I_C}{I_B}$

(b) A transisitor can be used as a switch at zone ① and ③

(C) At zone ③ Voltage of collector and Emitter (V_{CE}) reaches nearly to zero.

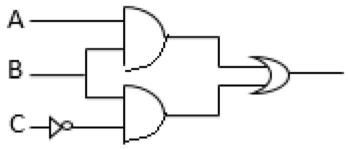
1. Only a correct 2. Only b correct 3. Only c correct

4. a and c are correct 5. all correct

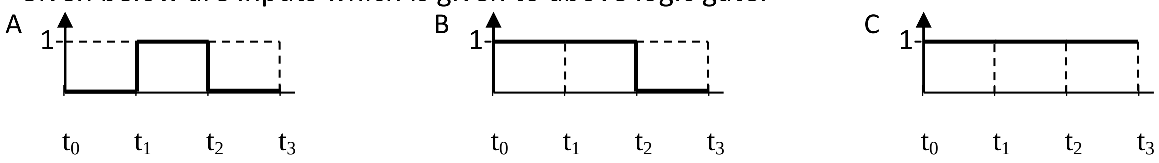
(27) When observing the moon using a astronomical telescope, its diameter is 20 times greater the moon which we see in our naked eye. If the focal length of objective piece?

1. 1cm 2. 2cm 3. 5cm 4. 20cm 5. 50cm

(28)



Given below are inputs which is given to above logic gate.



What is the time range when output logic gate at 1?

1. t_1 to t_2 2. t_0 to t_1 3. t_0 to t_3 4. t_2 to t_3 5. t_1 to t_3

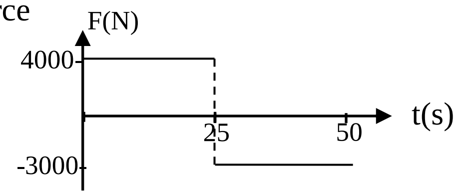
(29) There is a small mountain peak near a lake. A boat travels with a speed of 18 $kmh^{-1\ t}$ towards the mountain peak by horning with the sound frequency of 335Hz. If the frequency of sound in air is 340 kmh^{-1}, What is the frequency of the sound heard by a child who is at the peak of the mountain.

1. 345 Hz 2. 340 Hz 3. 335 Hz 4. 330 Hz 5. 325 Hz

(30) The current flows through a circular loop which contains one string. If this same loop folds into a circular loop again and allows to flow the same current through it. What is the factor that changes density of magnetic flux at the centre of the loop?

1. $\frac{1}{4}$ 2. $\frac{1}{2}$ 3. 2 4. 4 5. 8

(31) According to the graph given below, that changes time with a force excerted on a vehicle of 100kg which is resting on smooth verticle rails.



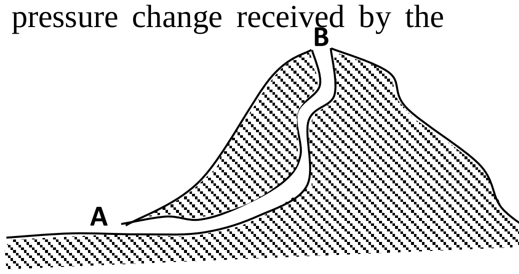
What is the momentum after 50 seconds and its speed?

1. 25×10^3 Ns, $50ms^{-1}$ 2. 25×10^3 Ns, $25ms^{-1}$

3. 175×10^3 Ns, $175ms^{-1}$ 4. 175×10^3 Ns, $75ms^{-1}$

5. 25×10^3 Ns, $15ms^{-1s}$

(32) Shown below is an earth cave done by an animal to protect itself. According to the A and B positions,an air current flows through A with a velocity of $2ms^{-1}$ and through B it flows with a velocity of $8ms^{-1}$. When compared locations B is 1.2 kgm^{-3}.The pressure change received by the animal in the cave is

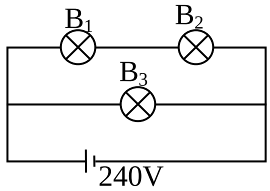


1. 8.4 *P*a 2. 84 *P*a 3. 48 *P*a 4. 36
*P*a 5. 4.8 *P*a

(33) A thin tube which has internal radius r is inserted vertically in a liquid with surface tension T and density d. What is the rise of the height, if the internal radius of the liquid meniscus is ‘R’

1. $\frac{2T}{Rdg}$ 2. $\frac{2T}{rdg}$ 3. $\frac{2Td}{rg}$ 4. $\frac{Tg}{rd}$ 5. $\frac{Tg}{Rd}$

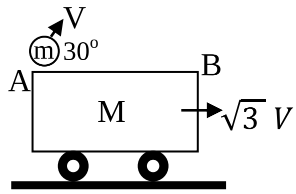
(34) B_1, B_2 and B_3 are three bulbs with equal voltages. B_1 =100W, B_2, and B_3 are two 60 W bulbs. They are connected to 240 V electric source. If, B_1, B_2 and B_3 bulbs has output power of W_1, W_2 and W_3.



1. $W_1 > W_2 = W_3$ 2. $W_1 > W_2 > W_3$ 3. $W_1 < W_2 = W_3$

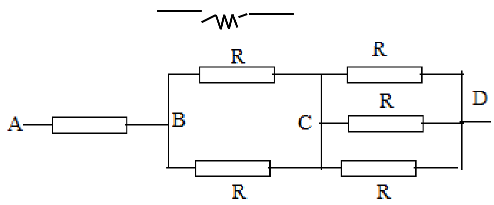
4. $W_1 < W_2 < W_3$ 5. $W_1 = W_2 =$

(35) Which of the following is the correct statement regarding a trolley with a length of AB = l and a mass of M. According to the given diagram at the position A mass M ($m \ll\ll M$). Trolley moves with a constant velocity of $\sqrt{3}\ V$, It releases inclined with a velocity of V.



1. At the edge of A mass ‘m’ takes place its horizontal location.
2. If $l > \frac{\sqrt{3}V^2}{20}$ mass m in between A and B reaches same horizontal location.
3. If $l < \frac{\sqrt{3}V^2}{20}$ mass m in between A and B reaches same horizontal location.
4. If $l = \frac{\sqrt{3}V^2}{20}$ mass in at the right side of B reaches same horizontal location.
5. For any l value mass m position in between A and B to get the same horizontal location

(36) The diagram shows 6 identical resistance works according to ohms law. If V_{AC} = 9 V,



1. $V_{AB} = 3 \text{ x } V_{CD}$
2. V_{BC} = 4cV
3. $V_{BC} < V_{CD}$
4. potential energy is even in all resistance.
5. $V_{AB} = V_{BC}$

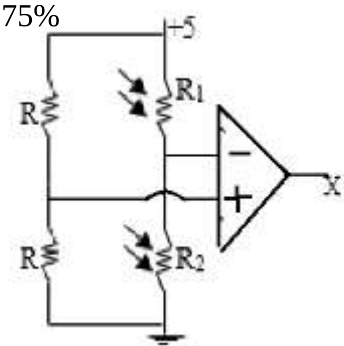
(37) When a tuning fork and acoustic wire vibrates length of the wire is 95cm and 100 cm, Beats can be heard with the frequency of 4 Hz. What is the frequency of the tuning fork?

1. 144 Hz 2. 148 Hz 3. 150 Hz 4. 152 Hz 5. 156 Hz

(38) ent x turns to a stable element Y. The halfA nuclear elem-life of the element is 8 days. At the end of 24 days, what is the percentage of element x that turns into Y.

1. 25% 2. 50% 3. 75% 4. 87.5% 5. 93.75%

(39) In the circuit given below, there are two LDR R_1 and R_2 which depend on identical light. In complete darkness one LDR has 50 MΩ resistance. Op-amp has saturated voltage of ±5 and open loop voltage output is $10^{5.}$



A) When reduces resistance upto 200Ω , in each LDR, in natural light condition Vx > 0

B) In above A when receives light to R_2 to get 50Ω resistance Vx = + 5V

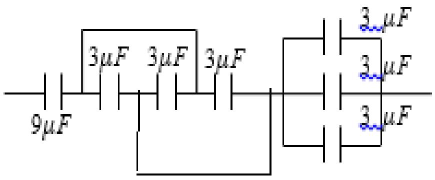
C) It is better to use fixed resistance instead of R_2, LDR to identify any light difference when the circuit is in any light condition.

1. A is correct 2. A and B are correct 3. B is correct
4. C is correct 5. A, B, C all correct

(40) A stone satalin with a surface area of $3600cm^2$ and thickness of 10cm expose to 100^oC steam at lower surface. If 0^oC ice layer is kept an hour over the higher surface of the satalin. Within an hour, if ice 4.8g dissolves find the heat conductivity. Latent heat of fusion of ice is = 3.36×10^5 Jkg^{-1}

1. 1.21×10^{-2} $Wm^{-1}C^{o-1}$ 2. 2.34×10^{-3} $Wm^{-1}C^{o-1}$ 3. 1.03×10^{-2} $Wm^{-1}C^{o-1}$
4. 1.24×10^{-3} $Wm^{-1}C^{o-1}$ 5. None of the above.

(41) What is the equivalent capacity of capacity system given below.



1. $9\ \mu F$ 2. $\frac{9}{11}\ \mu F$
3. $3\ \mu F$ 4. $\frac{18}{11}\ \mu F$ 5. $\frac{3}{11}\ \mu F$

(42) A lead bullet penetrates into a solid object and it is melted. 50% of kinetic energy of the bullet converts to heat to melt the lead bullet. What is the initial speed of the bullet?

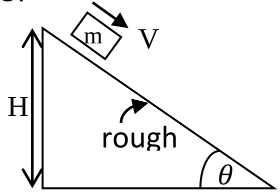
Initial temperature of the bullet is 27^0C and its melting point is $327\ ^0C$.

Latent heat of Fusion of lead is = 2.5×10^4 Jkg^{-1} k^{-1}

Specific heat capacity of lead = 125 Jkg^{-1} k^{-1}

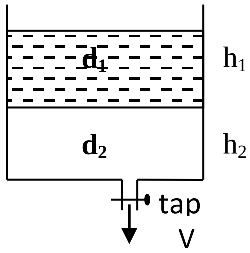
1. $353.5\ ms^{-1}$ 2. $248\ ms^{-1}$ 3. $456\ ms^{-1}$ 4. $302\ ms^{-1}$ 5. $500\ ms^{-1}$

(43) An object of mass m and 'H' height from the earth slips downwards along an inclined plane with a constant velocity. When it reaches the lower edge, what is the kinetic energy and frictional force between the plane and the object shown correctly.



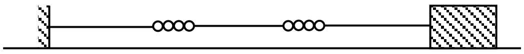
1. $\frac{1}{2}mv^2$, $\frac{mg}{Sin\theta}$ 2. $\frac{1}{2}mv^2$, mg Cos θ 3. mgH, mg Sin θ
4. $\frac{1}{2}mv^2$, mg Sin θ 5. mgH, mg Cos θs

(44) Shown below is a large tank with a large diameter. It is filled with non mixed two liquids with unequal densities d_1 and d_2 to a height of h_1 and h_2. There is a tap to get the liquid out, at the bottom of the tank. What is the correct statement for the initial velocity V that flows liquid through the tap if we do not consider viscous characteristics and surface tension?



1. V = $\sqrt{2gh_2}$ 2. V = $\sqrt{2g(h_1 + h_2)}$
3. V = $\sqrt{2gh_2(\frac{d_1}{d_2})}$ 4. V = $\left[2g\ \frac{(2h_2d_2 + h_1d_1)}{d_2}\right]^{\frac{1}{2}}$
5. V = $\left[2g\ \frac{(h_1d_2 + h_2d_1)}{d_2}\right]^{\frac{1}{2}}$

(45)

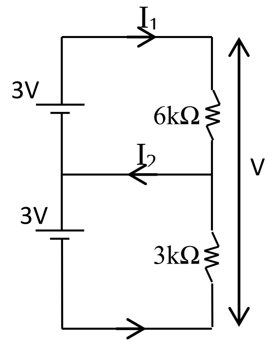


Two identical springs having k constant force are connected as shown in the picture. The cube which has m mass is in simple harmonic motion. What is the periodicity of the motion.

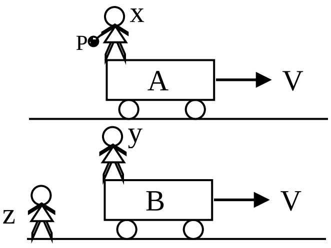
1. $2\pi\sqrt{\frac{2m}{k}}$ 2. $2\pi\sqrt{\frac{4m}{k}}$ 3. $2\pi\sqrt{\frac{m}{k}}$ 4. $2\pi\sqrt{\frac{m}{2k}}$ 5. $2\pi\sqrt{\frac{m}{4k}}$

(46) The diagram shows two 3V dry cells and two 6kΩ resistor combination. In which response shows the total voltage (v) through I_1, I_2 and two resistors.

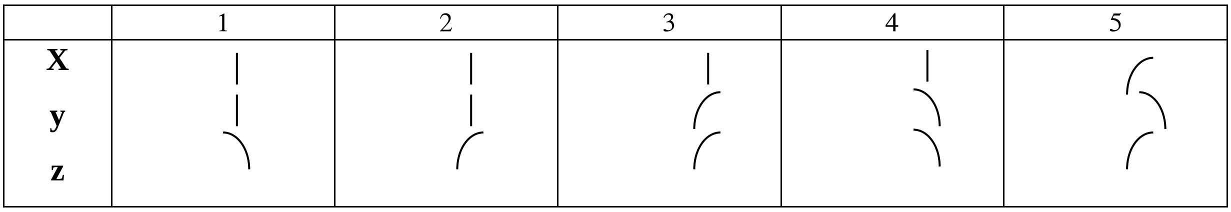
	I_1 / mA	I_2 / mA	V / volt
1	0.5	0.5	6
2	0.5	0.5	0
S3	0.5	1.5	0
4	0.5	1.5	6
5	0	0	0



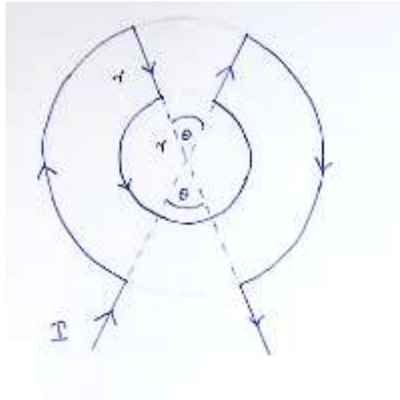
(47)



X and Y are two observers who are on two trolleys A and B. As in the diagram two trolleys move with constant speed of in two straight horizontal rails. Z is an observer who stays on the earth. When x releases an object in his hand, and if considered that there isn't any resistance, Select the paths of the object observed by x, y and z observers.



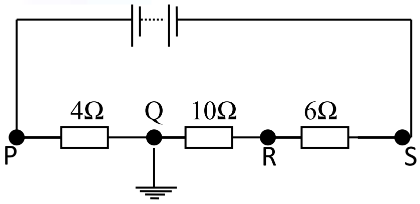
(48) A wire is folded as in the picture and send I current through it. What is the density of magnetic flux at oint '0' (rad) ?

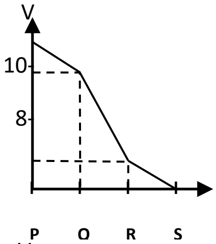


1. $\frac{2(\pi-\theta)}{4r}\mu I$ 2. $\frac{\mu I}{2r}$ 3. $\frac{\mu I}{4r}$

4. $\frac{\mu I}{2\pi r}$ 5. $\frac{\mu I\theta}{2r}$

(49) 10 V constant voltage is supplied to 3 resistors of 4Ω, 10Ω and 6Ω . Point Q is earthed. In which graph shows the voltage difference against resistance.



1.


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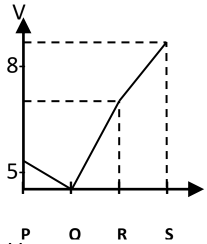

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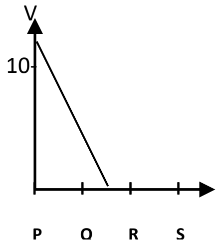

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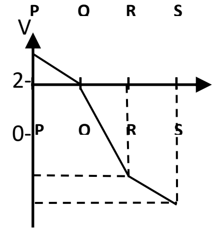
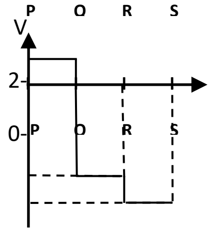
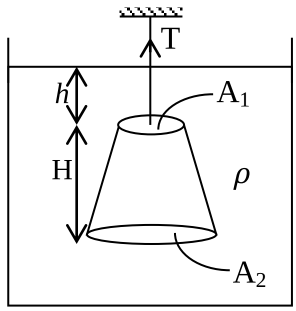


5.


(50) A solid object of weight W has cut from a solid cone. It is immersed in liquid of density ρ by hanging it, as in the picture. Tension of the string is T and surface area of the wide surface of solid is A_1, and A_2. What is the magnitude of thye combined force in inclined surfaces?



1. $-W - T + (A_2 - A_1)\,h\rho g + A_2 H\rho g$
2. $-W + T + (A_2 - A_1)\,h\rho g + A_2 H\rho g$
3. $W + T + (A_2 - A_1)\,h\rho g + A_2 H\rho g$
4. $W - T + (A_2 - A_1)\,h\rho g + A_2 H\rho g$
5. $W - T - (A_2 - A_1)\,h\rho g + A_2 H\rho g$

සියලු ම හිමිකම් ඇවිරිණි
முழுப் பதிப்புரிமையுடையது
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බස්නාහිර පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව
மேல் மாகாணக் கல்வித் திணைக்களம்
Department of Education - Western Province

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தரப்) பரீட்சை - 2021
General Certificate of Education (Adv. Level) Examination

ශ්‍රේණිය / தரம் / Grade: 13	විෂයය / பாடம் / Subject: භෞතික විද්‍යාව இயற்பியல் Pysics	පත්‍රය / வினாத்தாள் / Paper: II	පැය / மணித்தியாலம் / Hours: 3

නම /Name :..

PART A
Structured Essay

Answer all four questions.

($g = 10\ ms^{-2}$)

(01) For using any type of measuring instrument, it is difficult to obtain 100% accurate measurements when measuring a very tiny parts this error becomes large. Therefore it is resulted largely in final reading. This erropr can be shown as a partial error or as a percentage of error.

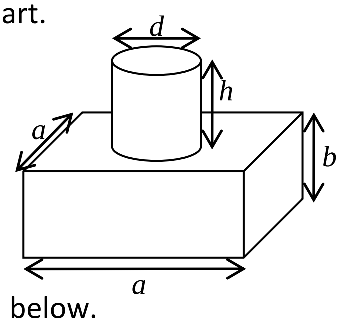
(a) If an instrument is incorrectly calibrated or if it is decaying there can be errors. Such errors are called random errors. Write two steps that can be taken to avoid above mentioned errors.
....
....

(b) What is meant by partial error?
....
....

(c) What is the maximum partial error that can be obtained when measuring 10 cm from a meter ruler?
....

(d) The minimum measurement of certain vernier caliper is 0.1 mm. What is the minimum length that can be obtained to measure with 1% of percentage error, from that vernier caliper?
....
....

(e) Given below is a paper rider. It is made of solid cylindriacal part and a cubical shaped part. A student is asked to measure the metallic volume of cylindrical part.



The student has obtained approximately accurate reading given below.

Measurement	The minimum measurement of the instrument	Reading	
		(i)	(ii)
d	0.02 mm	19.72 mm	22.28 mm
h	0.1 mm	34.9 mm	35.1 mm

(i) What are the most appropriate values that the student should used to obtain d and h?

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

(ii) Write an expression using d and h to obtain the volume of solid cylindrical part

....
....

(iii) Calculate the volume of the cylindrical part using the values in (i) above $(\pi = \frac{22}{7})$

....
....

(iv) Partial error of volume of the solid cylindrical part is given below.

$$\frac{\triangle V}{V} = 2\frac{\triangle d}{d} + \frac{\triangle h}{h}$$

Calculate the percentage error of the solid cylindrical part using the above values.

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

(02). An experiment should be done to find the latent heat of friction of ice using the method of mixing. Given below are few items which are needed for the experiment.

(1). Copper calorie meter

(2). 45 ^{0}C hot water beaker

(3). Ice cubes

(a). What are the other items which are needed for the above experiments?

……

……

……

(b). What are the steps you are taken to minimize absorption of heat from the environment during the experiment?

……

……

……

……

(c) If the room temperature is $30\ ^0$C and atmosphere dew point is $25\ ^0$C,

(1) What is the temperature you select as initial temperature of water?

……

(2). What is the minimum temperature of water? Write the reason for your choice.

……

……

……

……

(d). Mention experimental measurements you should obtain, before ice is added and write suitable symbols for them.

……

……

……

……

(e). What should be considered when ice is added to calorie meter with water?

……

……

……

(f). Mention experimental measurements you obtained after the experiment and write suitable symbols for this.

....

....

....

(g). What should be done to prevent ice floating on water during the experiment? Write the reason for this.

....

....

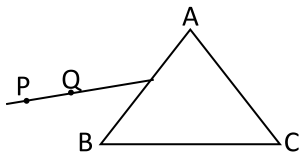
(h). Write the formula using the symbols mentioned in above (d) and (f) questions to find latent heat of fusion (L) ice. The specific heat capacity of water is $4200\ J\ kg^{-1}\ K^{-1}$. Specific capacity of copper is $400\ J\ kg^{-1}\ K^{-1}$.

....

....

....

(03) Given below is a diagram drawn by a student to find the refractive index of a glass prism. P and Q are two optic pins used by the student to indicate incident ray.



(a). The optic pins are kept wrong by the student. How should it be changed?

1. ....
....
2. ....
....

(b). (i) Explain the way you obtain emergent ray.

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

(ii) In b(i) why do you use two pins instead of one?

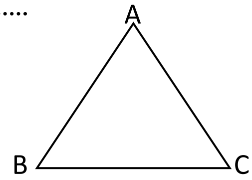
....
....

(c). Calculate the refractive index if the incident angel of AB surface $i = 10^{o}$ and refractive angle $r_1 = 6^{o}$

....
....

(d). (i) What is the change that should be done to find refractive index using critical angle without using P and Q pins?

....
....



(ii) Draw the locatins of pins to obtain emergent ray in the diagram.

(iii) Explain the steps you are taken to obtain emergent ray.

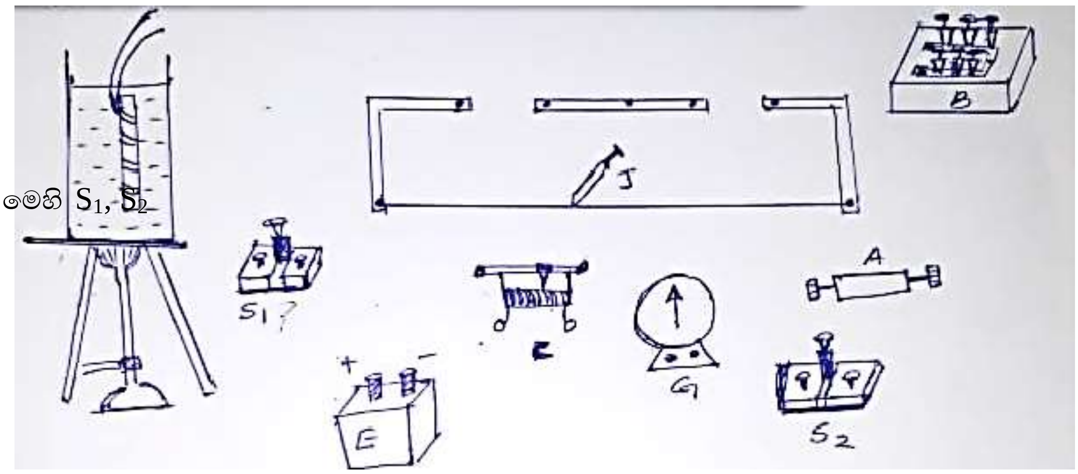
....
....
....

(iv) Create and draw critical angle to air glass surface using a reflective ray from the AC surface.

(v) Write the realationship between x and c if critical angle c and reflective index n.

....
....

(04) (a) Given below are instruments used to find co-efficient of friction of heat (α) of a coil using a meter bridge. All equipment used in an experiment, a coil immersed in a water bath, meter bridge are given as in the picture.



E, a plug switch, Lead acid accumilater a, centre zero Galvanometer, J, (Jockey) sliding key. A is a large resistance. B and C are resistence box and variable resistor respectively.

(a) Draw and name other instruments needed to do the experiment.

(b) Draw a suitable circuit diagram to find α connecting instruments given in the picture.

(c) What is the importance of usin A and S_2 in this experiment?

....

....

(d) How do you find the accuracy of the circuit when it is completed?

....

....

(e) What is the adjustment you should do if the circuit is accurate?

....

....

(f) What are the readings you should take in this experiment?

....

....

(g) If the resistance of B is $R_{B,}$ resistance of the coil at $\theta^{o}C$ is $R_{\theta,}$ length of balance l, write the relationship among R_B, R_θ and length of balance l.

....

....

(h) Define (α) coefficient of friction of heat.

....

....

.

(i) Write physical characteristics of the material of resistance coil in above resistance box B.

....

....

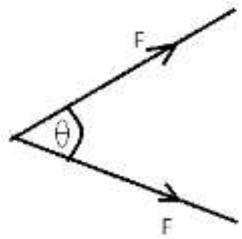
PART B

ESSAY

Choose four questions and answer

($g= 10\ ms^{-2}$)

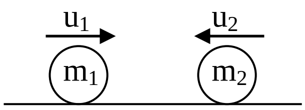
(05) (A) Figure shows two forces of magnitude F and an angle between the forces is θ. Find the angle of θ for each situation,



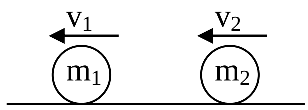
(i) Where the vector addition of two forces equal to F?

(ii) Vector substraction of two forces equal to F.

(B) Below figure shows the linear motion of two masses of m_1 and m wth the respective speeds of u_1 and u_2, before and after the collision.



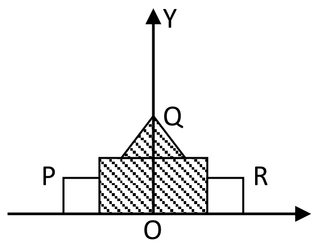
Before the collision



After the collision

After the collision of $m_1$and m_2, mooves with a velocity of v_1 and v_2 in the same direction. Show that the linear momentum is conserved, considering the collision of the system. (Consider that the surface is smooth)

(C) Figure shows a model of rocket placed on a smooth table. P,R are cubes of 2kg and the mass of Q kept in middle is 6kg. O is the middle point of it and the bottom surface is touching the axis of OX.



In a sudden simple collision, it is possible to move parts P and R away from the part Q, along -$\overrightarrow{OX}$ and $+\overrightarrow{OX}$ directions respectively.

1. Cube P is ejected along the $\overrightarrow{-OX}$ axis with a velocity of $3ms^{-1}$ with respect to Q at t=0.
2. Cube R is ejected along $+\overrightarrow{OX}$ direction with a velocity of $3ms^{-1}$ respect to Q t=0.8s.

(i) Find the velocity of P and the rest of the system with respect to earth at t=0.

(ii) Find the distance that travelled by the bottom surface of the rocket (o) at t=0.8s.

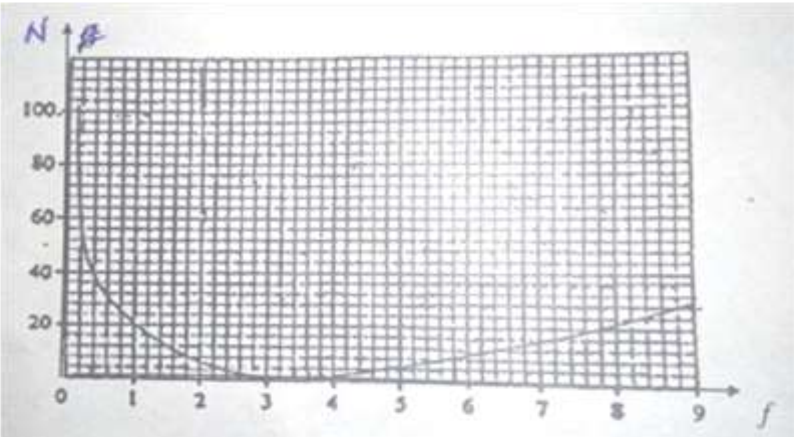
(iii) Find the velocity of Q with respect to earth at time t=2.8s.

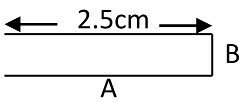
(iv) Find the distance to the centre of the bottom surface of the rocket from the origin of o at t=2.8s.

(06) $I_0 = 10^{-12}\ Wm^{-2}$ is the sound vibration occur in air. The frequency relevant to this is known as threshold of audibility. Vibrations of $I = 1\ Wm^{-2}$ affected to give a pain in the ear, so it is known as threshold of painful audibility. Threshold of audibility does not have a constant value that it depends on the frequency of sound heard by the ear. Below graph shows the change of threshold of audibility in the range of frequency 150 Hz – 9 kHz. Horizontal axis shows the frequency (f) in kHz and vertical axis shows the relative intensity level (N) relevant to the values of threshold of audibility in decibel.

$$N = 10\ \log_{10} \frac{I}{I_0}$$

Although the structure of the ear and the process of hearing is complex, ear is divided to three parts as outer ear, middle ear and inner ear for the purpose of study. The main usefulness of the outer ear is to increase the sensitivity for special frequencies to our ear. This is done by emerging stationery waves in an auditory canal filled with air. This resonance always occur where a displacement anti-node happen at the starting position of the inner ear. Phenomenon that occurs inside the ear can be represented as close tube. (Starting position of the inner ear is Cranial surface.)





A - auditory canal
B - cranial surface

The distance to cranial surface (B) from auditory canal is 2.5 cm. Sound velocity in air is 340 ms^{-1} at 27 ^0C

(i) (a) What is the range of wavelengths of sound waves that can be heard by man in 27 ^0C ?

(b).Calculate the sound velocity in air at 57^0 C.

(ii). (a).What is the unit of value of N obtain from the equation in the paragraph ?

(b). Calculate the values for N relevant to threshold of audibility and threshold of painful audibility.

(iii). Calculate below, using the graph.

(a) What is the approximate value of frequency that gives the value of N equals to zero.

(b). How much is the threshold of audibility for a sound of frequency 1 kHz?

(c). Determine with reasons whether a person can hear or not waves in each situation where the intensity of $1 \times 10^{-11}\ Wm^{-2}$ and $1 \times 10^{-4}\ Wm^{-2}$ with a frequency of 1 kHz.

(iv) (a). Calculate the fundamental frequency of auditory canal according to the simple apparatus shown in the figure 2 (Temperature is 27 ^0C).

(b). Minimum frequency that sensitive to a human ear is equal to the value you obtain in above. Give reasons comparing the value you obtain and the value in (iii) (a).

(07) (A) (i) Write down the poisal formula for viscous fluid along a tube, and define the notations.

(ii) Indicate three conditions where the poisal formula valid.

(B) An oil of viscocity of 0.9 $kgm^{-1}s^{-1}$ and density of 9.0×10^{2} kgm^{-3} is flowing with a normal speed of $1.0\ ms^{-1}$, through a straight horizontal metal pipe of internal radius 20 cm, length of 1km to carry the oil from an oil cleaning centre to a factory.

(i) Calculate the pressure difference that should maintain across the tube.

(ii) How much is the minimum power that should be given to produce oil with given rate. (Take= π = 3.0)

(iii) In which radius distances are having minimum and maximum velocities for oil flowing in the tube? What is the minimum value of speed?

(C) Internal radius is reduced by 10% due to sticking waste inside the tube. Of what percentage the pressure should change to distribute the oil across the tube with the same rate. Given in above (B)?

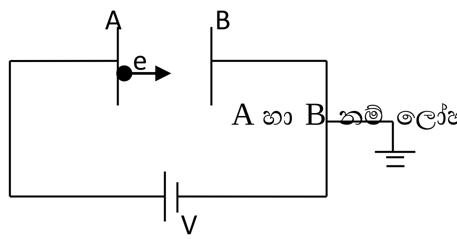
(D) Oil is supplied to another two factories instead of above mentioned factory, connecting two small pipes of having same length and radius to the end of the metal pipe mention in above (B). Find the radius of small pipe, if the length of a each small pipe is 1km and pressure difference is same across all tubes.

(08) (A) Write an expression for electric field intensity E between plates using the 'Gauss principle following data are given. Q charge is stored in a parallel plate capasitor placed in air, area of the plate is A, permittivity in free space is ε_o.

(B) Write a relationship for V, voltage difference between plates using E and distance between plates d.

As in the figure A and B plates are kept in a vaccum

Parallel. V voltage source is connected to A and B plates.



Mass m positively charge particle which has a charge equal to the charge of election accelerates towards B plate from rest at plate A. T his occurs as a result of potential difference V between two plates. (Consider magnitude of charge is e)

(i) Write an expression for the lost of static electric potential when electric charge reaches to plate B.

(ii) Derive and expression for V_1 of the electric charge arrive towards plate B.

(iii) Obtain an expression for the acceleration of the charge in between plates.

(iv) If the distance 'd' between plates, obtain an expression for time 't' to reach from A to B.

(C). When above mentioned charge partical is moving from A to B, It is collided with an equal light charge particle equal to a charge electron is moving as one object from a distance of 'X' to plate A.

(i) What is the velocity of the particle just before the collision?

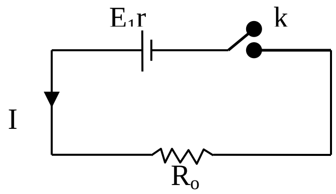
(ii) Explain the motion of the unit particle after the collision, and write down a statement for velocity of the particle that reaches towards 'B'.

(iii) If the time T taken for the complete motion show that,

$$T = \sqrt{\frac{2mdx}{eV}} + (d-x)\sqrt{\frac{md}{2Vex}}$$

(09). Answer either part (A) or part (B)

(A).(a) The circuit given below shows R_o external resistor with r internal resistor and a cell of E electromotive force connected.



(i). Show $P = \frac{E^2 Ro}{(Ro+r)^2}$ out put power P in the circuit.

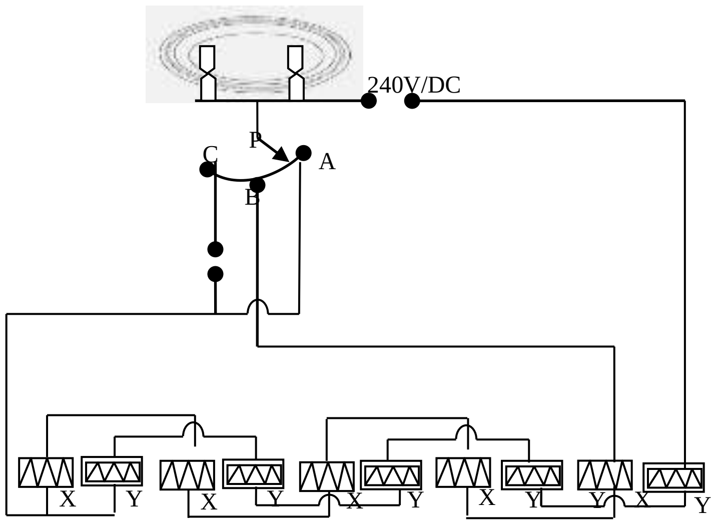
(ii). What is the value for R_o to get maximum output power.

(iii).Hence, find the maximum output power value using E and r.

(iv).Draw a graph to show the deviation R_o and power of output (P) in the above circuit.

(c) Given below is a circuit diagram to show the low and high two lower values in an induction cooker. It consists of 4Ω, 5X resistance each and 4Ω 5Y resistances. Power deviation and power disconnection can be done using the key 'p'. Consider 240v direct current is supplied to the cooker.

(d)

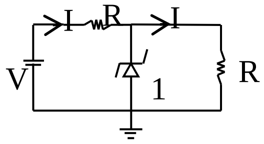


(i) To disconnect the cooker, where to position the key out of the positions A,B and C.
(ii) Find the power of the key in other two positions.
(iii) Water is heated using the cooker. 0.24 kWh is needed to boil water upto the boiling point. If low and high powers are used in two different situatons, calculate the time taken to get the boiling point in both situations.

(iv) What is the power condition which shows economical disadvantages when using it practically.

(B) (i) Draw V-I characteristics of a normal diode and zenar diode in a same axis.

(ii) Explain the function of zenar diode.



(a) 10V zenar diode has placed in the following circuit diagram. R_S and R_L are two resistances of 100Ω and 200Ω respectively. The supply voltage is 50V.

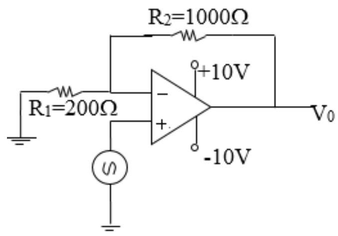
(b) What is the power dissipation of zenar diode then?

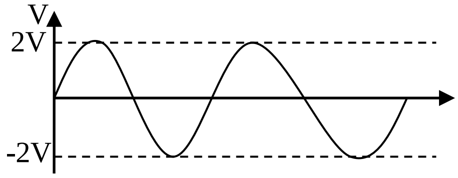
(c) What is the value for R_L to reduce 1.5W energy dissipation from the power of zenar diode?

(iii)

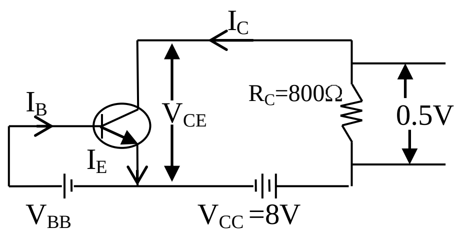
(a) How much is the closed loop voltage gain?

(b) If a signal is given to the circuit by an alternating current source, draw the shape and write the value of output.





(iii) The following transisitor circuit is in a common emitter setup. The supply given to collector is 8V. Through resistancew Rc, 800Ω has 0.5 voltage drop.



(a) Find the collector- emmitor voltage (V_{CE})

(b) Show $\beta = \frac{\propto}{1-\propto}$, if $\propto = \frac{I_C}{I_E}$ ද, $\beta = \frac{I_C}{I_B}$, $I_E = I_C + I_B$

(c) Find base current I_B using above results, $\propto = 0.96$ and data given in the circuit diagram.

(10) Answer either part (A) or (B)

(a) A cylinder is given into two parts by a piston which can easily move along the cylinder without any friction. The cylinder is consisted with two colourful 0.1 mol of ideal gas in each part. This is made for children as a sport equipment. The lengthy of the cylinder is divided into $5 : 4$ using the piston. Each part of the gas cylinder has a temperature of 300 K.

(i) Mark forces exerted over the system and find the pressure exerted by the upper layer of air. (area of the piston A)

(ii) Calculate the pressure exerted by the lower layer of air.

(iii) Calculate the mass of piston using above answers.

(b) It is recorded environmental temperature $0^{o}C$ and relative humidity is 40% in a day in winter season. A heater is placed in the room and therefore the temperature of the air that enters from outside to the room rises upto $20^{o}C$.

At $0^{o}C$ saturated vapor pressure 4.6 Hgmm

At $20^{o}C$ saturated vapor pressure 18 Hgmm

(i) What is the vapor pressure inside the classroom?

(ii) What is the realative humidity inside the classroom at $20^{o}C$?

(B) (a) Explain the reason for emmiting high energy during a nucleic fussion.

(b) Consider the reaction of nucleic fussion given below.

$$ {}^{235}_{92}u + {}^{1}_{0}n \rightarrow {}^{236}_{92}u \rightarrow {}^{141}_{56}Ba + {}^{y}_{x}Kr + 3\,{}^{1}_{0}u + \mathrm{E} $$

(i) Find X and Y values.

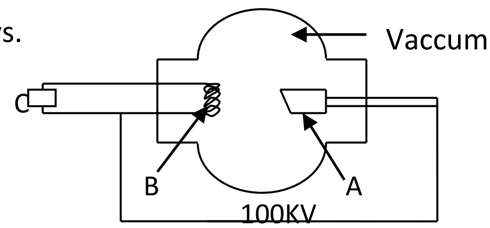
(ii) Find the mass deduction in atomic mass unit in above given nucleic fussion reaction.

(iii) Determine the energy released by the above reaction in Mev.

$${}^{235}_{92}u = 235.04\,u \quad , \quad {}^{141}_{56}Ba = 140.91\,u$$

$${}^{92}_{36}Kr = 91.91\,u \quad , \quad {}^{1}_{0}n = 1.01\,u \quad , \quad 1u = 932\text{ Mev}$$

(c) Given below is a X – ray tube which is used to form X – rays.



(i) Name A and B parts. .

(ii) Name the structure C and explain the use of it.

(iii) Why should a vaccum created inside a X- ray tube?

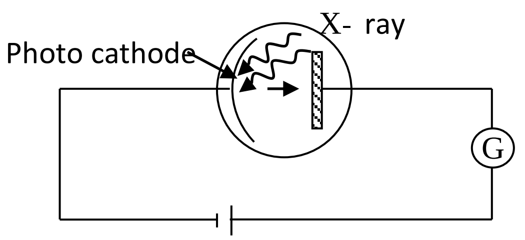
(iv) Explain how does X-rays produce in a X-ray tube.

(v) Clculate the maximum kinetic energy of an electron that reaches to A in Ke.V.

(vi) 25% of kinetic energy in an electron is used to produce X-ray photon. Find the wave length of X-ray.

Charge of electron	=	$1.6 \times 10^{-9}C$
Plank constant	=	$6.63 \times 10^{-34}JC$
Velocity of light in a vaccum	=	$3 \times 10^{8}ms^{-1}$
Mass of electron	=	$9.1 \times 10^{-31}kgs$

(d) To study photo electric effect, x-rays produces in the above are input to photo cell.



(i) It is observed that there cannot be seen any indication of the galvanometer reading, when x-rays are fallen on to cathode of the photo cell. Explain the reason.

(ii) Work function 2.3 ev Na metal is used as the photo cathode. What is the maximum kinetic energy of photo electrons emitted by photo cathode in ev?