மொறட்டுவைப் பல்கலைக்கழக பொறியியற்பீட தமிழ் மாணவர்கள் நடாத்தும்
கல்விப் பொதுத் தராதர உயர்தர (கணித, விஞ்ஞான) மாணவர்களுக்கான 6 ஆவது
முன்னோடிப் பரீட்சை -2015

கல்விப் பொதுத் தராதரப் பத்திர(உயர் தர) முன்னோடிப் பரீட்சை - 2015
General Certificate of Education (Adv. Level) Pilot Examination - 2015

Physics-I பௌதிகவியல்-I	01	T	I	Two hours இரண்டு மணித்தியாலங்கள்

Important:

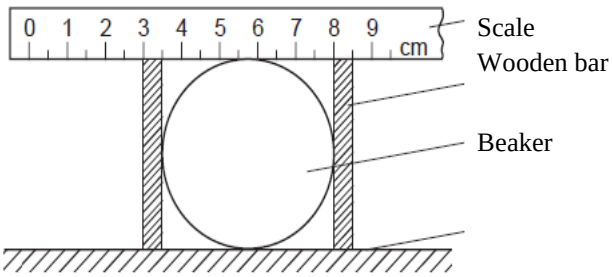
- This paper consists of **50** questions in **12** pages.
- Answer all questions.
- **Write your index number** in the space provided on the answer sheet.
- choose **the correct or most appropriate answer from the amswers numbered** (1) , (2) , (3) , (4) , (5) for each question from 1 to 50 and put a cross (X) according to the instructions given in the answer sheet

Use of calculator is prohibited
($g = 10\ N\ kg^{-1}$)

01. Which of the following i**s not** equivalent to the unit of surface tension?

(1) $N\ m^{-1}$ (2) $J\ m^{-2}$ (3) $kg\ m^{-2}$ (4) $kg\ s^{-2}$ (5) $W\ m^{-2}\ s$

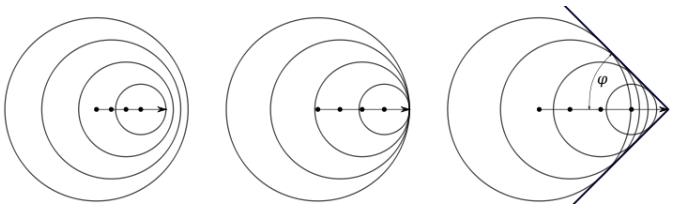
02.



An experimental set up used by a student to measure the diameter of a beaker is shown above. The diameter derived from the measurement is

(1) 3.5 cm (2) 4 cm (3) 4.5 cm (4) 5cm (5) 8 cm

03.



The above figure shows the wave fronts of the sound waves produced by an aero plane in three different instances during a horizontal fly. The Mach number and the directions of the movement in these three instances respectively are

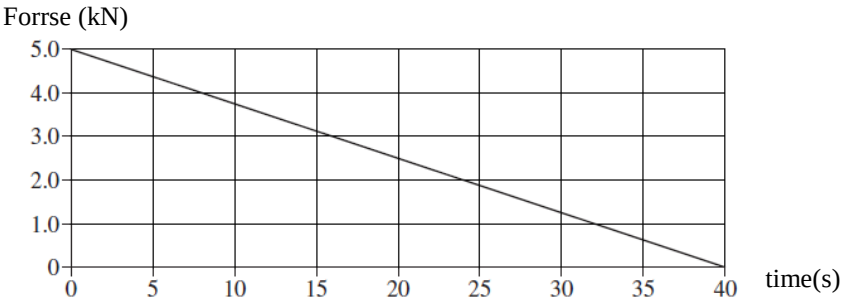
(1) Equal to one, lesser than one, greater than one, right hand side in three instances
(2) Greater than one, equal to one, lesser than one, right hand side in three instances
(3) Greater than one, equal to one, lesser than one, left hand side in three instances
(4) Lesser than one, equal to one, greater than one, right hand side in three instances
(5) Lesser than one, equal to one, greater than one, left hand side in three instances

04. In which of the following instance/ process, photo electric effect does not not happen?

(1) Light Dependent Resistor (LDR) (2) Light Emitting Diode (LED)

(3) Photosynthesis (4) Solar cell (5) Function of retina

05.



The above figure shows the variation of force acting on a glider of mass 2000kg when launching it on a horizontal level track.Its velocity at the end of 40 seconds is

(1) 2.5 ms^{-1} (2) 10 ms^{-1} (3) 50 ms^{-1} (4) 100 ms^{-1} (5) 500 ms^{-1}

06. An electronic instrument of resistance 5Ω and power 5W is made to function by getting power from a 230 V primary source. The ratio between the current through the primary coil and secondary coil is

(1) 46 (2) 23 (3) 10/23 (4) 1/23 (5) 1/46

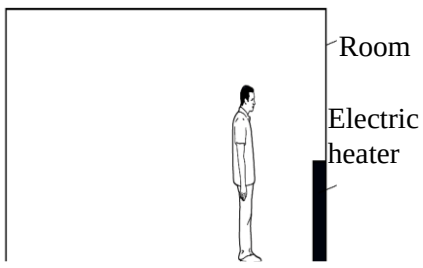
07. Velocity of light in air is $3x10^{8}ms^{-1}$.What is the minimum time needed to a light ray to penetrate a diamond block of thickness 5cm and refractive index 2.4 ?

(1) 1×10^{-8}s (2) 2×10^{-8}s (3) 4×10^{-6}s (4) 4×10^{-8}s (5) 4×10^{-10}s

08. Two wires A,B of equal length which are made up of same material are having the radii of r,2r respectively. One end from each of them is connected together and the composite wire is tied to a Sonometer under tension T. The joint point O is in the middle of the bridges .When a stationary wave is formed at the wire point **O** is a node. The ratio between the number of loops in A and B is

(1) 2:3 (2) 1:2 (3) 2:1 (4) 3:2 (5) 5:4

09. The figure shows a man entering a cool room and standing infront of an electric heater after switched on it. The **main** ways of heat transformation to the man is



(1) By conduction

(2) By radiation

(3) By convection

(4) Both conduction and convection

(5) By all three Conduction, convection and radiation

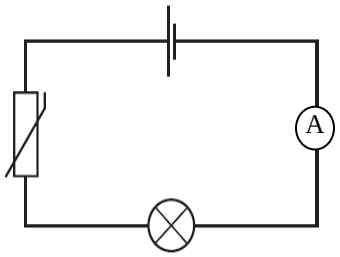
10. In two cylindrical rods A and B, length of A is thrice that of B ,the radius of A is twice that of B and the young's modulus of B is thrice that of A,. When a tensile force F is applied for both rods, the extension made in rod A is Δl. The extension made in the rod B is,

(1) $\frac{\Delta l}{6}$ (2) $\frac{4\Delta l}{9}$ (3) Δl (4) $\frac{9\Delta l}{4}$ (5) $6\Delta l$

11. The supply voltage needed to produce X-rays of maximum photon energy 100keV is

(1) 100 V (2)200 V (3) 10^5 V (4) 1.6 x 10^{-17} V (5) 1.6 x 10^{-14} V

12. A filament bulb, a thermistor and an ammeter are connected in series with a battery of constant emf as shown in the figure. The resistance of thermistor will decrease with temperature. From the time of activation of the electric circuit, the reading of the ammeter increases. Which of the following statements is/are correct?



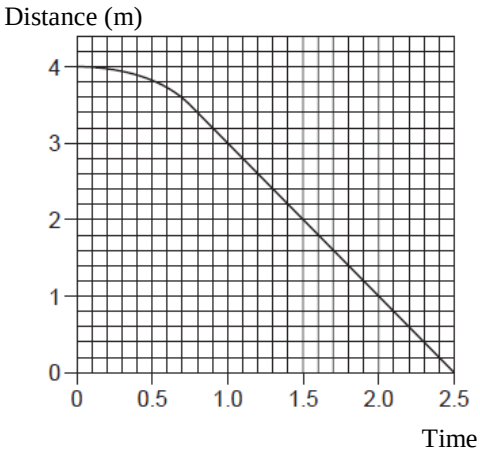
(A) The change in the resistance of the bulb is less than the change in the resistance of thermistor

(B) Power produced by the cell increases

(C) Power dissipated in bulb increases

(1) (A) only (2) (B) only (3) (C) only (4) (A), (B) only (5) All (A), (B), (C)

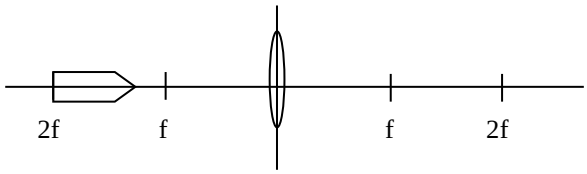
13. The variation of height from the land, of a particle falling under gravity, with time is shown in the nearby graph. The terminal velocity of that particle is



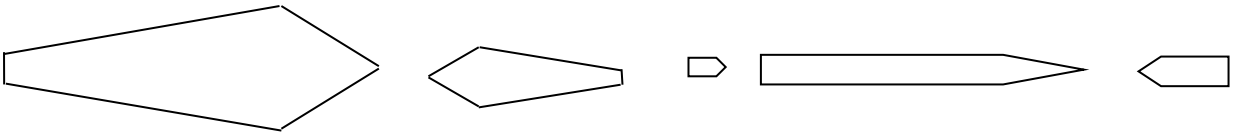
(1) 0 (2) 1 ms^{-1} (3) 1.3 ms^{-1}

(4) 1.6 ms^{-1} (5) 2 ms^{-1}

14.

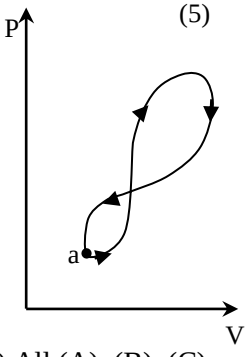


A pencil is kept on the principle axis of a convex lens of focal length f as shown in the figure. Which of the following is the image formed by the lens



(1) (2) (3) (4) (5)

15. An ideal gas undergoes pressure (P) volume (V) process from a to a .If the area of the large loop ia A_1 and the area of small loop is A_2 which of the following statement/statements is/are correct?



(A) The work done by the gas in this process is A_1-A_2

(B) Temperature of the gas at start is equal to the temperature at the end

(C) During the process a -a temperature first increases and then descreases

(1) (A) only (2) (B) only (3) (C) only (4) (A), (B) only (5) All (A), (B), (C)

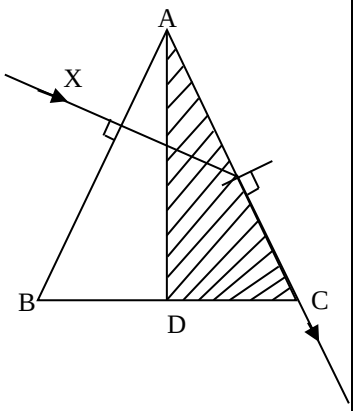
16. Space shuttle of mass m is in midpoint between a planet with mass M_1 and its satellite of mass M_2.If the distance from the shuttle to the centre of the planet is d,the resultant force acting on the shuttle is

(1) $\frac{Gm(M_1 - M_2)}{d}$ (2) $\frac{Gm(M_1 + M_2)}{d^2}$ (3) $\frac{Gm(M_1 - M_2)}{d^2}$ (4) $\frac{Gm(M_1 + M_2)}{d}$ (5) $\frac{Gm(M_1 + M_2)}{2d}$

17. The sound intensity level at 3m away from a sound source is 120dB.If the sound intensity level at distance d from the source is 100dB.then the value of d is

(1) 6m (2) 10m (3) 20m (4) 30m (5) 40m

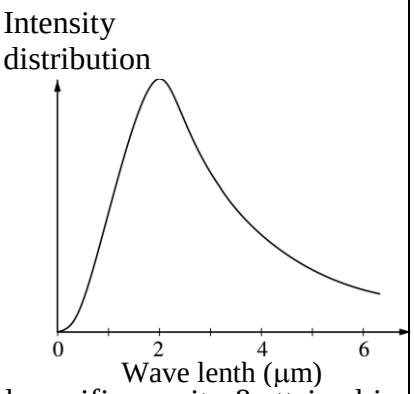
18. The light ray X entering perpendiculor to the face AB of a isosceles prism of prism angle A emerges the face AC by grazing along it .If the shaded region shown in the figure is removed symmetrically so that face AD remains smooth, the sine value of the emergent angle is



(1) $\frac{Sin(\frac{A}{2})}{SinA}$ (2) $\frac{Sin(\frac{A}{2})}{CosA}$ (3) $\frac{SinA}{Sin(\frac{A}{2})}$

(4) $Sin(\frac{A}{2})$ (5) $\cos(\frac{A}{2})$

19. The nearby figure shows the variation of intensity distribution of a black body at a certain temperature. If the value of Wien's constant is 2.9 $X10^{-3}$mK. The approximate temperature of the black body is



(1) 10 K (2) 50 K (3) 250 K

(4) 1500 K (5) 6250 K

20. If the terminal velocity of a spherical solid sphere of radius a and specific gravity 8 attained in the water is V,. Which of the following statement is incorrect?

(1) When the sphere moves in terminal velocity resultant force acting on it is zero

(2) When allowing a hollow sphere, made up of same material and same radius, to move downwards into the water, terminal velocity is less than v

(3) If the solid sphere is allowed to move into a coconut oil its terminal velocity is less than V

(4) When the solid sphere is allowed to fall into a liquid of relative density 2 and coefficient of viscosity twice that of water, its terminal velocity is Vv

(5) When allowing a solid sphere made up of same material and radius 2a to fall ,its terminal velocity is 4v

21. A heating element of 100W power is placed into a vessel containing 1 litre water. Eventhough the heater worked for long time, the water did not get boiled. If the heater is removed at this stage, the approximate time taken to the water to cool down by 1C is (specific heat capacity of water is 4.2KJkg-1^0C^{-1})

(1) 21s (2) 41s (3) 43s (4) 86s (5) 172s

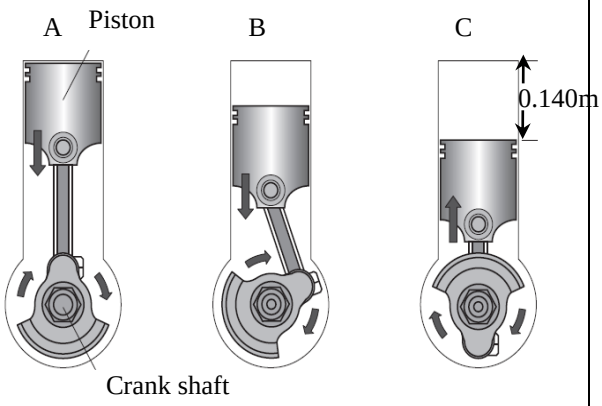
22. Some metal balls are placed in to a cylindrical vessel and remaining volume is filled with water. The coefficient of linear expansivity of vessel is α_a, coefficient of linear expansivity of metal balls is α_b and coefficient of volume expansivity is γ .If the level of water at beaker is not decreasing or overflowing for any temperature change which of the following relations among α_a, α_b, γ are correct?

(1) $\alpha_a = \alpha_b + \gamma$ (2) $\alpha_a > \alpha_b + \gamma$ (3) $3\alpha_a = 3\alpha_b + \gamma$ (4) $3\alpha_a < 3\alpha_b + \gamma$ (5) $3\alpha_a > 3\alpha_b + \gamma$

23. If the element ${}^{A}_{Z}X$ deforms as an element ${}^{A-4}_{Z-1}Y$ through two steps by natural radio activity, which of the following is suitable for those steps?

	First step	Second step
(1)	β- emmision	neutron- emmision
(2)	β- emmision	α- emmision
(3)	β- emmision	γ- emmision
(4)	Deutron- emmision	two neutron- emmision
(5)	α- emmision	γ- emmision

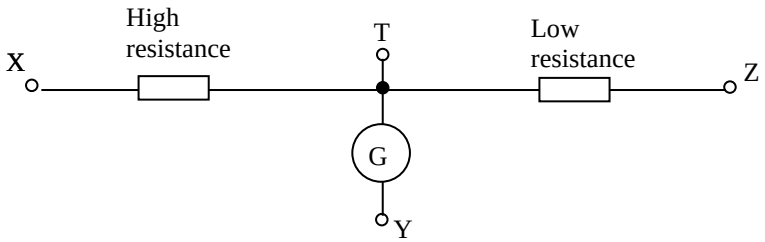
24. The figure shows three instances of motion of piston of a car engine. The motion of the piston could be considered as a simple harmonic motion.If the crank shaft connected with piston is rotating at the angular speed of 1500 rpm,maximum velocity of the piston is



(1) 11 ms^{-1} (2) 22 ms^{-1} (3) 105 ms^{-1}

(4) 110 ms^{-1} (5) 230 ms^{-1}

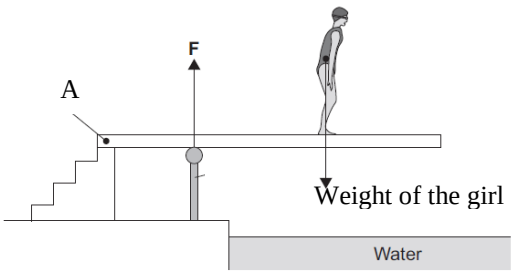
25.

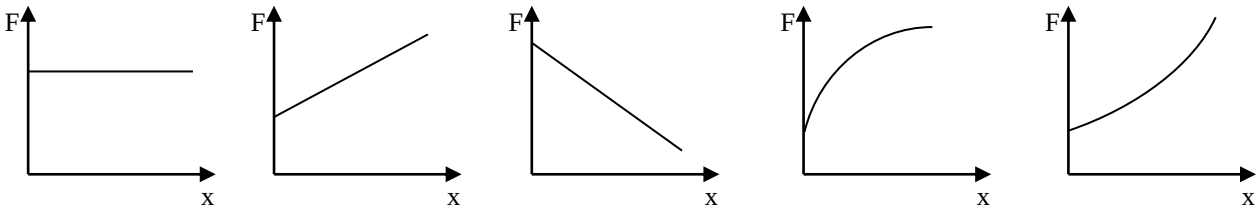


The above figure shows the set up used to change a galvanometer to an ammeter and a voltmeter To change this galvanometer as an ammeter of measuring high electric currents which connection is to be made? What are the terminals of ammeter?

	Connections	terminals of ammeter
(1)	Z,T	Y,X
(2)	X,Y	Y,T
(3)	Connection not needed	Y,T
(4)	Connection not needed	Y,X
(5)	Z,Y	Y,T

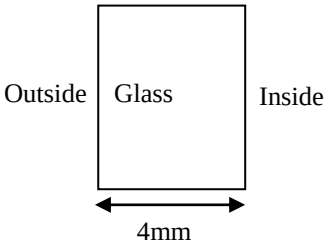
26. A girl is moving on a diving board from A towards the other end of the board .Which of the follwing graph shows the variation of reaction F given by the support to the board.(The board is able to rotate freely about A)



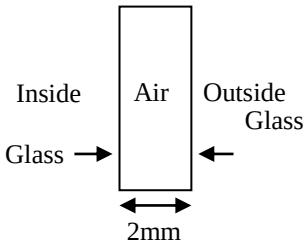


(1) (2) (3) (4) (5)

27.



Window A



Window B

A room consists of two windows A and B with equal cross sectional area.Window A consist a glass of thickness 4cm.Window B consists two very thin glass layers at 2mm gap and the gap is filled with air.Thermal conductivity of glass and air is $0.8Wm^{-1}{}^{0}C^{-1}$,$0.025Wm^{-1}{}^{0}C^{-1}$respectively

$$\text{The ratio} \frac{\text{The rate of heat flow through the window A}}{\text{The rate of heat flow through the window B}}$$

(1) 2 (2) 4 (3) 8 (4) 16 (5) 32

28. A parallel laser beam coming from He,Ne laser has 1mm diameter.This beam is sent through a convex lens of focal length 1.5cm inorder to get a parallel beam of diameter 10 mm, the focal lenth of second lens to be used and the distance from the first lens is

	Focal lenth	lenth
(1)	4.5cm	6.0cm
(2)	10cm	10.0cm
(3)	10cm	11.5cm
(4)	15cm	15.0cm
(5)	15cm	16.5cm

29. From two points at separation of 50m in a horizontal ground, two balls A, B are thrown towards each other. Ball A is thrown with speed 20ms^{-1}at an inclination of 30 ^{0}upwards and another ball B is thrown with speed 20 ms^{-1} at an inclination of 60^{0} in the same plane. Which of the following statements is/are correct about the motion of the balls until they reach the ground?

(1) Velocity of B relative to A increases with time

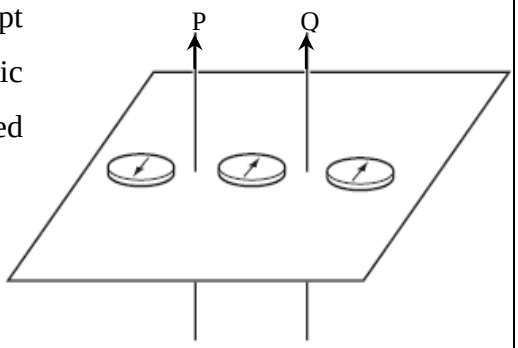
(2) Velocity of B relative to A increases with time

(3) Two balls will collide with each other during the motion

(4) When the both balls are at same vertical line ball A will be above ball B

(5) When the both balls are at same vertical line ball B will be above ball A

30. Two current carrying parallel conductors P, Q are kept perpendicularly to the plane of sheet where three magnetic pins A, B, C are kept. If the current through Q is reversed what will happen to the directions of magnetic pins?



(1) directions of A,B,C will change

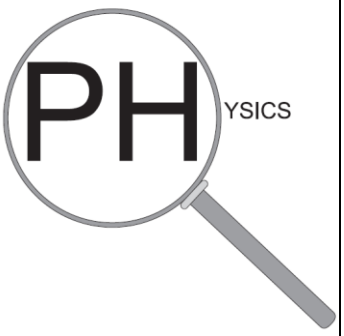
(2) directions of A,B,C will not change

(3) direction of C will change

(4) directions of A,B will not change

(5) directionsof B,C may change

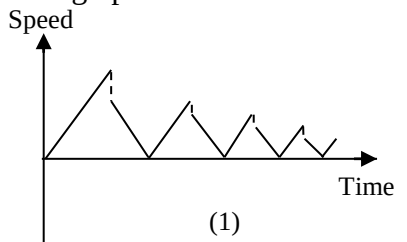
31. The word physics on the sheet is 14mm height. It is observed through a convex lens of focal length 16 cm and it is seems like in the nearby figure. If the height of the image formed by the lens is 56mm,the distance between the lens and the sheet is



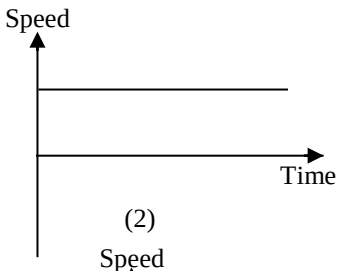
(1) 12 cm (2) 16cm (3) 20cm

(4) 22cm (5) 40cm

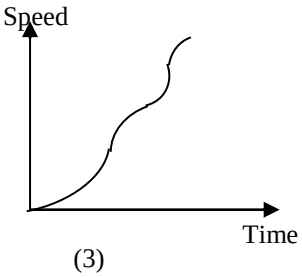
32. A ball releasing from a point above the horizontal floor , collide on the floor, bounces and rises again and again.Which of the following graph correctly shows the variation of its speed with time graph?



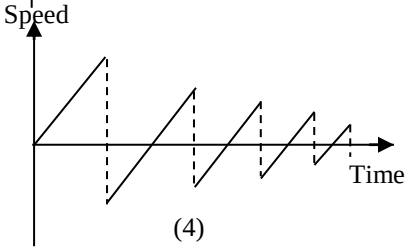
(1)



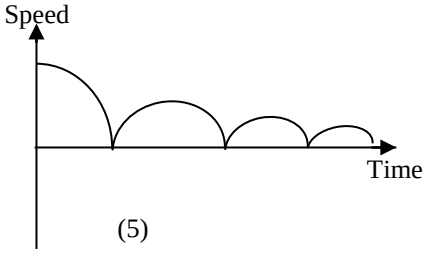
(2)



(3)

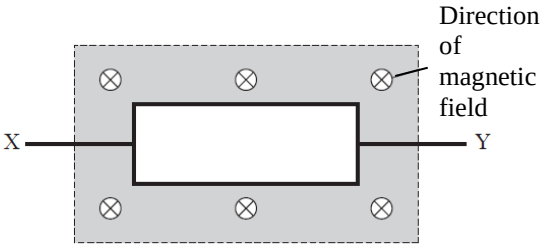


(4)



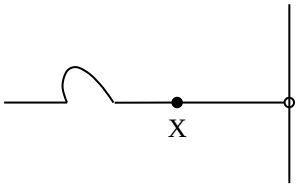
(5)

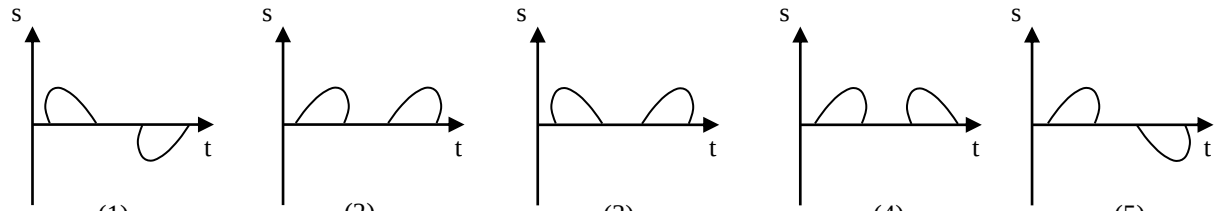
33. A rectangular coil of A cross sectional area and N number of turns is kept inside a uniform magnetic field. When the coil is rotated about the axis XY with a constant angular frequency. The maximum electro motive force induced in the coil is E_0.The magnetic field intensity is of that magnetic field is



(1) $\frac{E_o}{2\pi NAf}$ (2) $\frac{E_o}{\pi NAf}$ (3) $\frac{E_o}{2\pi f}$ (4) $\frac{E_o}{\pi f}$ (5) $2\pi f E_o$

34. One end of a string is connected at a post and able to move.The figure shows an instance of a pulse moving right handside along the string.Which of the following graph correctly shows the vertical displacement (s) with time?





35. Directions of the motion of sound source (S) and the observer (O) at different instances are given below.

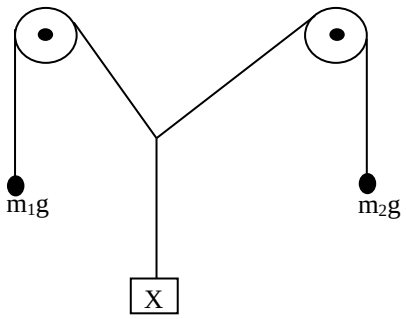
	sound source (S)	observer (O)
a	→	→
b	←	←
c	→	←
d	←	→

Connect the above instances with the below predictions

f-frequency felt by observer ,f_o-frequency of the source

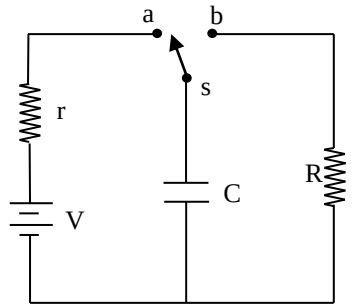
	$f>f_o$	$f<f_o$	Can't predict
(1)	c and d	a	b
(2)	a and b	c	d
(3)	d	c	a and b
(4)	c	d	a and b
(5)	c	a	b and d

36. The following set up is used to verify force parallelogram law.the length of the diagonal of the parallegram gain in the paper is 4cm .The relative density of X is 8.If X is totally immersed under the water and the experiment is done again then value of L is



(1) 2.4cm (2) 2.8cm (3) 3.2cm (4) 3.5cm (5) 3.8cm

37.



figure(1)

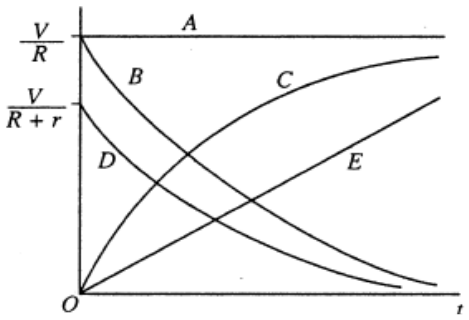
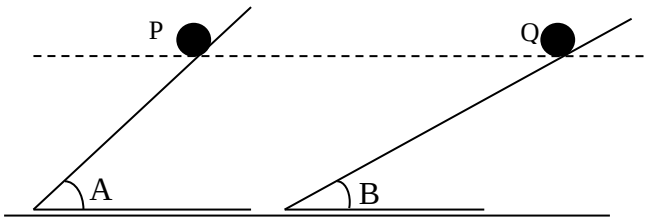


figure (2)

The capacitor shown in thefigure(1) is fully charged by touching the switch S at a. At t=0if the switch is made to touch at b,which of the following graph will correctly shows the variation of current passing through the resistance?

(1) A (2) B (3) C (4) D (5) E

38.

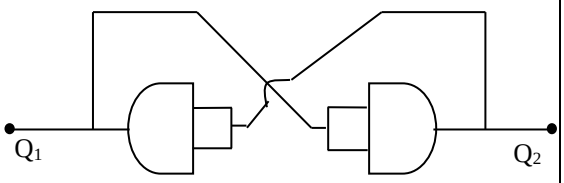


Two identical masses P,Q are kept at same horizontal level on two smooth inclined planes inclined at angles A,B which are kept at same horizontal floor and let to move at same time. The ratio between the times to attain same horizontal displacements T_P/T_Q is?

(1) $\sqrt{\frac{\sin(A)\cos(A)}{\sin(B)\cos(B)}}$ (2) $\sqrt{\frac{\sin(B)\cos(B)}{\sin(A)\cos(A)}}$ (3) $\frac{\sin A}{\sin B}$ (4) $\frac{\sin B}{\sin A}$ (5) $\frac{\sin(B)\cos(B)}{\sin(A)\cos(A)}$

39. Two AND gates are connected as shown in the figure.consider the following combinatios for logical levels for the inputs Q_1,Q_2

	Logical level of Q_1	logical level of Q_2
(A)	0	0
(B)	0	1
(C)	1	0
(D)	1	1



Which of the above combinations will give stable logical levels for the inputs Q1,Q2?

(1) (A) only (2) (D) only (3) (A),(B) only (4) (A),(D) only (5) (B),(C) only

40. When we put a copper below in to the water it was sunk. And when we put copper scrapings, they were float.Which of the following statement/statements is/ are correct?

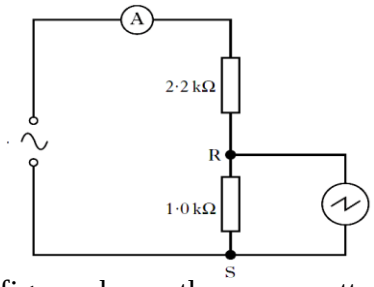
(A) The weight of the displaced water is less than the weight of copper block

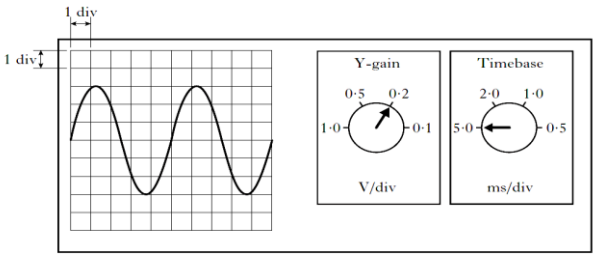
(B) The weight of displaced water is equal to the weight of the copper block

(C) When change copper block into scrapings, its volume increases

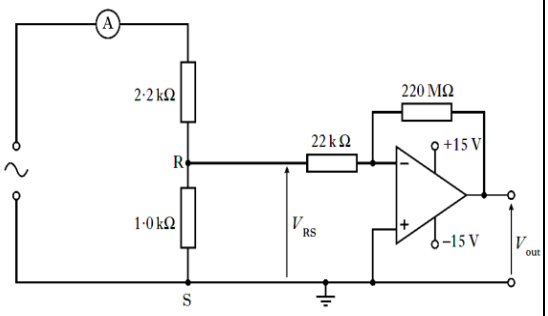
(1) (A) only (2) (A), (B) only (3) (A),(C) only (4) (B),(C) only (5) All (A),(B),(C)

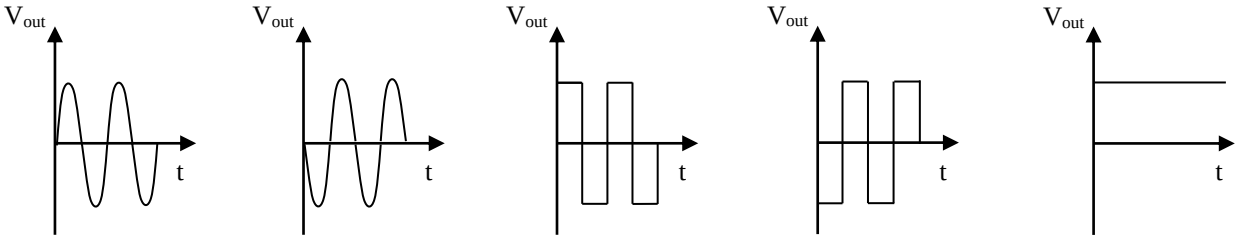
41.





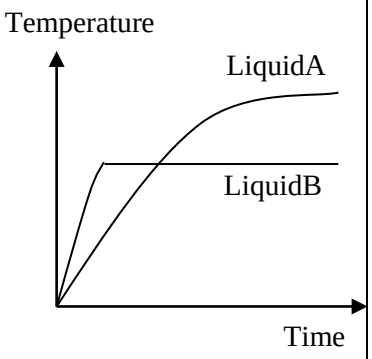
the figure shows the wave pattern of a cathode ray oscilloscope which is connected across the points R,S in the electric circuit drawn in the above figure.If the circuit is changed as shown in the nearby figure below,the correct graph shows the variation of output (Vout) with time is





(1) (2) (3) (4) (5)

42. The variation of temperature of two liquid samples of equal volume which are taken in two identical vessels at same environment and heated by identical heaters is shown in the nearby graph.The conclusions you may attain from this graph is



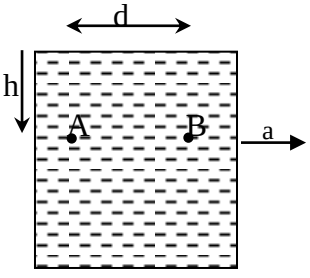
(A) Specific heat capacity of A is greater than the specific heat capacity of B

(B) Liquid B attained the boiling point

(C) Liquid A attained the boiling point

(1) (A) only (2) (B) only (3) (C) only (4) (B),(C) only (5) All (A),(B),(C)

43. A closed cylindrical vessel filled with water is pulled with an acceleration a. the figure shows the longitudinal section of the vessel. If the pressure at the points A, B which are at the separation d is P_A,P_B. Which of the following statrement/statements is/are true?



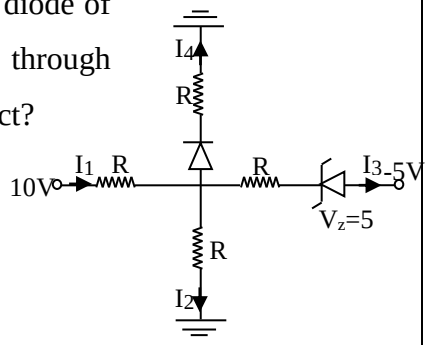
(A) when the depth from the upper level increases the pressure differences between the points A,B will increase

(B) the resultant force by the liquid exerted on the base of the vessel is at the center of the base

(C) resultant force exterted on the wall of the vessel goes through the center of the vessel

(1) (A) only (2) (B) only (3) (C) only (4) (B),(C) only (5) Non of the obove

44. The following circuit is made up of a silicon diode and a Zenor diode of breaking voltage 5V and some resistors. if the electric currents through the branches are I_1, I_2, I_3, I_4, which of the following relation is correct?



(1) $I_1 > I_3 > I_2 > I_4 \neq 0$

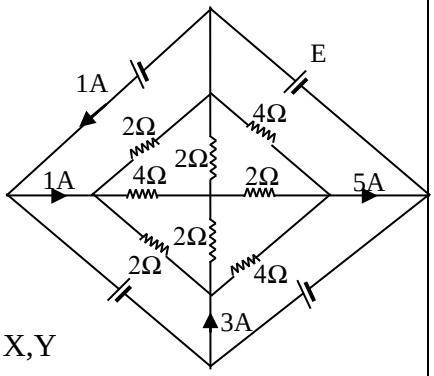
(2) $I_1 > I_3 > I_2 > I_4 = 0$

(3) $I_1 > I_2 = I_3 = I_4 \neq 0$

(4) $I_1 > I_2 = I_3 > I_4 \neq 0$

(5) $I_1 > I_2 = I_3 > I_4 = 0$

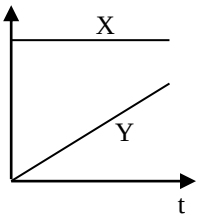
45. A circuit is made by some resistances and batteries as shown in the figure .Current through the battery of electro motive force E is



(1) 1A (2) 2A (3) 3A

(4) 4A (5) 5A

46. The following graph shows the variation of two quantities X,Y related with a moving particle with time t .which of the following may suitable for X and Y



(A) X may be the mechanical energy of an object moving downwards in a smooth inclined plane and Y may be the linear kinetic energy of the particle

(B) X may be the kinetic energy of a particle slipping downwards in a inclined plane and Y may be the work done on the object by the resistive forces

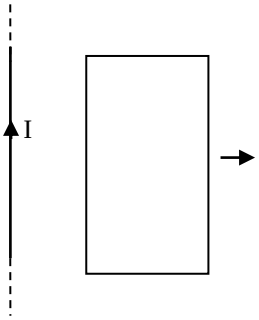
(C) X may be the resultant force acting on the object and Y may be the velocity of the particle

Which of the above is /are correct?

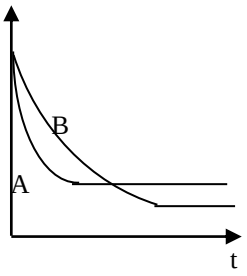
(1) (A) only (2) (A), (B) only (3) (A),(C) only (4) (B),(C) only (5) All (A),(B),(C)

47. A rectangular loop shown in the figure is kept coplanar with a long wire carrying current I. The loop is pulled in the right hand side direction. Which of the following answers correctly gives the direction of induced current and the directions of the forces acting on the left, right hand sides of the loop?

	Induced current	force acting on left hand side	force acting on left hand side
(1)	Anticlockwise	towards left	towards right
(2)	Anticlockwise	towards left	towards left
(3)	Anticlockwise	towards right	towards left
(4)	Clockwise	towards right	towards left
(5)	Clockwise	towards left	towards right



48. Two identical vessels having equal volume of water are kept upon two identical electronic balances and kept inside two closed rooms of equal volume at temperature 30^0C and 40^0C respectively. When observed from outside the readings of the electronic balances are varied as shown in the figure. Which of the following statement/statements is/are correct?



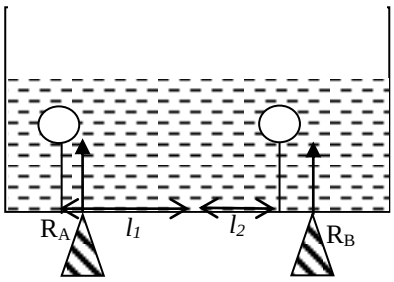
(A) At initial the absolute humidity of A is less than that of B

(B) Room A is finally saturated with water vapour

(C) If rooms A and B are connected with a window, water vapour will transfer from A to B

(1) (A) only (2) (A), (B) only (3) (A), (C) only (4) (B),(C) only (5) All (A),(B),(C)

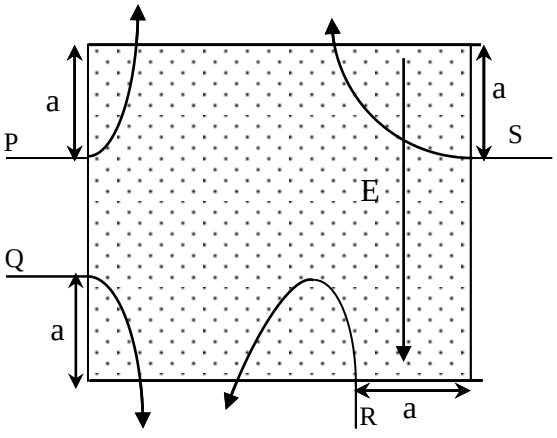
49.



The figure shows two spherical spheres immersed inside a symmetric vessel filled with water. The pegs are located at equal distances from the edges. The figure shows the longitudinal section along the diameter consist the pegs and the spherical particles. The spherical spheres of equal volume and densities d_1,d_2 are tied and let to float at the distances of l_1,l_2 from the centre.If the reactions given by the pegs are equal, the ratio of l_1/l_2(the density of water is dw)

(1) $\frac{d_1}{d_2}$ (2) $\frac{d_2}{d_1}$ (3) $\frac{d_w - d_1}{d_w - d_2}$ (4) $\frac{d_w - d_2}{d_w - d_1}$ (5) $\frac{d_1 - d_w}{d_2 - d_w}$

50.



A rectangular region consist of outward uniform magnetic field in the direction perpendicular to the sheet and downward electric field E along the sheet .The path of four particles P,Q,R and with equal magnitude of charge entering into the region from equal distances from the vertices. If the kinetic energies of those particles when exit from this region are E_p ,E_q,E_r ,E_s the correct relations among them is

(1) $E_p = E_q = E_r = E_s$ (2) $E_p = E_q = E_s > E_r$ (3) $E_q > E_r > E_p = E_s$ (4) $E_p = E_q > E_r > E_s$ (5) $E_q = E_s > E_r > E_p$

மொறட்டுவைப் பல்கலைக்கழக பொறியியற்பீட தமிழ் மாணவர்கள் நடாத்தும்
கல்விப் பொதுத் தராதர உயர்தர (கணித, விஞ்ஞான) மாணவர்களுக்கான 6 ஆவது
முன்னோடிப் பரீட்சை -2015

கல்விப் பொதுத் தராதரப் பத்திரஉயர் தர) முன்னோடிப் பரீட்சை – 2015
General Certificate of Education (Adv. Level) Pilot Examination - 2015

Physics II பௌதிகவியல் **II**	01	T	II	Three hours

Index No. ☐ ☐☐ ☐☐☐☐

Follow the instructions
Use of calculator is prohibited
$g=10 N kg^{-1}$

***Part A-Structured essay**
-Answer all question on this paper itself
-Answer each question on the allowed space. Consider that the given space is enough for the answer and elaborated answers are not required.

***Part B-Essay**
-Answer four question only
-Use the answer sheets provided for this purpose.
-Annex part B to A placing part A on top and hand it over to the supervisor at the end of given time.
-Only part B of this question paper is allowed to be taken out of the exam hall.

Only for examiner

Part	Question	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
	8	
	9A	
	9B	
	10A	
	10B	

Final Marks

In digits	
In words	

Examiner	
Marks checked by	1.
	2.
Supervised by	

[See page 02

Part - A Structured Essay

Answer all four questions on this paper itself

(g= 10 N kg $^{-1}$)

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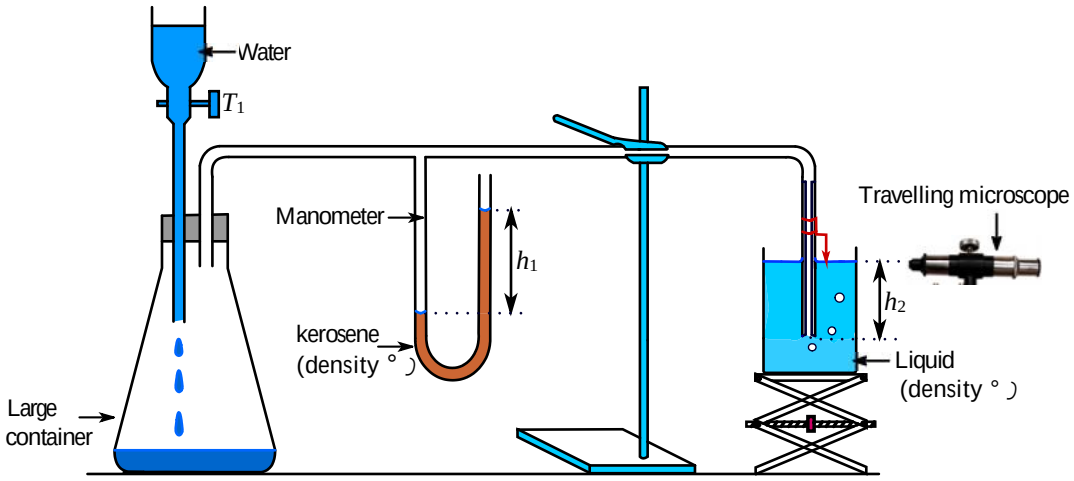
1. The following diagram shows an experimental setup to determine the surface tension of a liquid. The surface tension and density of the liquid are T and ° respectively. The density of kerosene in the manometer is ° , the internal diameter of the capillary tube of the instrument is *d*, the highest height difference of the manometer liquids is h_1, the depth of the bottom of the capillary tube from the liquid level is h_2 and the atmospheric pressure is ® .



(a) An air bubble is formed at the immersed end of the of the capillary tube. State an expression for the pressure (P_1) inside the bubble at its time of release in terms of the above quantities.

.....

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(b) State an expression for the pressure (P_2) of the liquid outside the bubble in terms of the above quantities

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(c) Give an expression for the excess pressure across the bubble in terms of *T* and *d*

.....

(d) (i) What is the relation between *T, d,* P_1 and P_2 ?

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(ii) Derive an expression for T in terms of *d*, h_1, h_2 ° and °

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(e) The following measuring instruments are provided to you:

half meter ruler, vernier caliper and travelling microscope

Which of the above instrument is the most suitable to measure h_1 , h_2 *and d* ?

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[See page 03

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(h) Would the non-uniformity of the capillary tube affect the results of the experiment? Explain.

(g) The pressure inside the capillary tube of diameter 4 X 10^{-4}m was increased and measured using a manometer. An air bubble is formed at the end of the capillary tube as a result of the increment of the pressure. The height difference between the levels of the liquids in the manometer when the bubble tends to break is 9x10^{-2}m. The lower end of the capillary tube was at a depth of 2.5x10^{-2}m below the liquid level. The densities of the liquids in the vessel and manometer are 800 kgm^{-3} and 900 kgm^{-3} respectively. Calculate the surface tension of the liquid in the vessel.

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(i) What is the basic reason for the phenomenon of surface tension observed in liquids?

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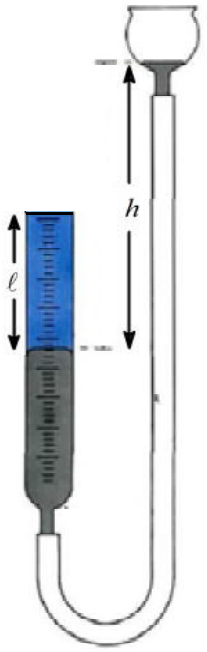
2. An experimental setup to investigate the variation of pressure (p) with volume (V) of dry air at constant temperature is shown in the figure.



(a) What is the disadvantage in using water thread instead of mercury thread to trap the air in the tube?

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(b) If the atmospheric pressure is H cmHg, length of mercury column is h and the length of the air column is l, give the relationship among them.

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(c) Rearrange the above equation to draw a straight line graph taking h as independent variable.

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(d) Sketch a rough graph and name it as A.

[See page 04

Do not write anything in this column

(e) How can you determine H from the graph?

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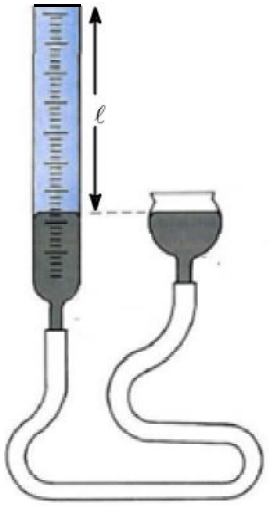
(f) If this experiment was carried out at high temperature, draw the graph for it on the above axis and name it as B.

(g) If ℓ = 6cm in the state shown in the figure and ℓ=8cm when h = 19cm, calculate H.



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(h) Atmospheric pressure is 10^5 Pa. Calculate the height of liquid column which is equal to this pressure.
(Density of water =1000kgm^{-3})

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(i) How does the depth of the well affect the process of drawing water from the well using water pump?

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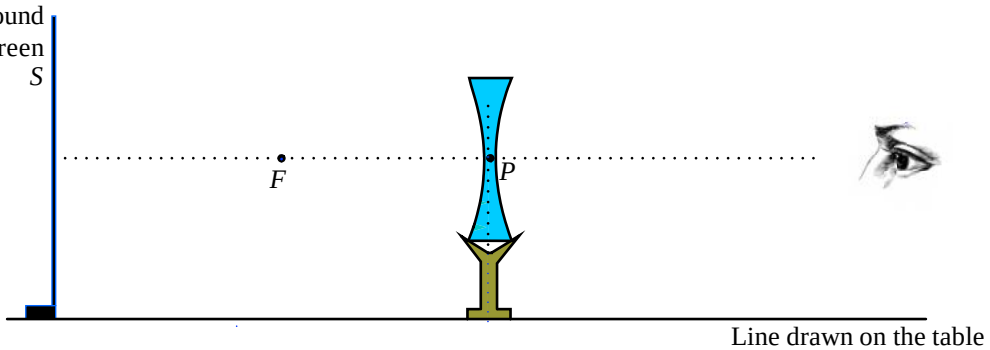
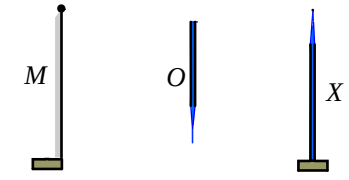
3.



An experimental setup to determine the focal length of a concave lens is shown in the figure above. First a straight line is drawn on the table using a chalk. Lens fixed to a stand is placed on the mid point of the line such that the plane of the lens is perpendicular to the line. Then a screen is placed as shown in the figure. The following materials are given to find the virtual image of a real object.



(a) Complete the experimental setup using the provided objects.

(b) Indicate the places where the images are formed in the above setup.

(c) Write down the experimental procedures in the correct order.

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[See page 05

(d) How would you confirm the position of the image by means of correct adjustments?

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(e) State two properties of the image formed by the lenses.

.....

(f) State an equation to find the focal length by using a straight line graph, in terms of object distance *(u)*, image distance *(v)* and focal length *(f)*. Mention the dependent and independent variable.

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(g) Draw a rough sketch of the expected graph.

(h) The intercept of the graph is 10 in SI units. Find the object distance if the magnification of the image on the concave lens is $\frac{1}{5}$.

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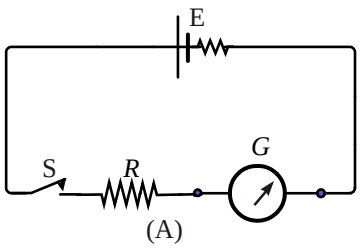
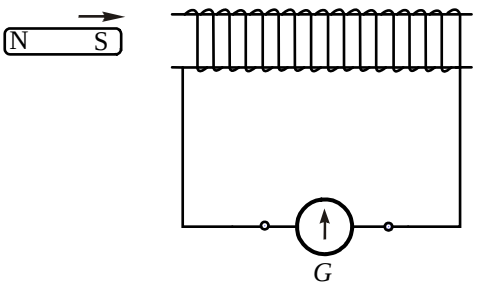
4. The galvanometer shows a deflection in clock wise direction as shown in the figure (A) when switch S is closed. Now the galvanometer is connected to a coil as shown in figure (B).



(A)



(B)

[See page 06

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(a) Now the south pole of the bar magnet is moved quickly towards the coil. What will be the direction of deflection of the galvanometer?

.....

(b) State the law that is used to find the direction of deflection of the galvanometer.

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(c) Give three steps that can be followed to increase the deflection of the galvanometer.

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(d) A simple structure of a transformer is shown in the figure.

(i) Underline which of the following is the most suitable material to be used as the core.

A - solid soft iron core
B - insulated copper plates
C - insulated soft iron core

(ii) State the reason why the other materials are not suitable.

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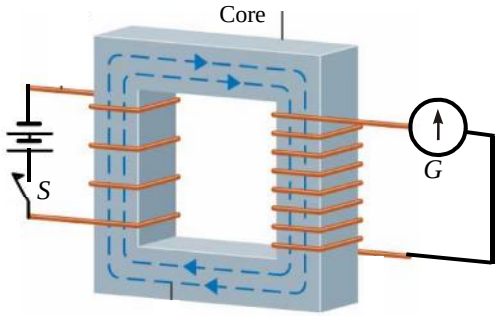
The following figure shows a setup where primary coil is connected to a direct current supply and the secondary coil is connested to a galvanometer (G)



(e) What will be the expected type or direction of deflection of the galvanometer when the switch S is closed?

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[See page 07

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(f) For the variation of voltage difference in the primary coil with time as shown in figure (I) draw the graph for the corresponding voltage difference of secondary coil with time in figure (II), when the switch S is opened and closed at equal interval of time.

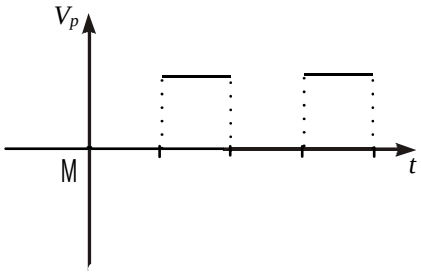

Figure I

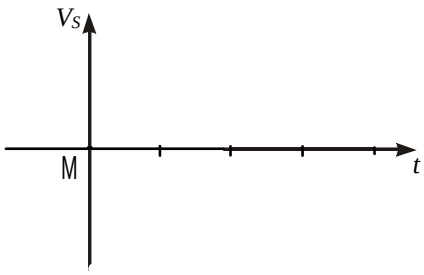

Figure II

(g) By using transformers the voltage difference of the sign waves can be increased or decreased. But alternative current of square wave form cannot be stepped-up or stepped-down. Give reasons.

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(h) The number of turns in primary and secondary coils are 6000 and 600 respectively. When an alternate current voltage of 240 V is applied to the primary coil what will be the voltage at the secondary coil?

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(i) Why does step up transformer is used in transmitting electric power?

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[See page 08

மொறட்டுவைப் பல்கலைக்கழக பொறியியற்பீட தமிழ் மாணவர்கள் நடாத்தும்
கல்விப் பொதுத் தராதர உயர்தர (கணித, விஞ்ஞான) மாணவர்களுக்கான 6 ஆவது
முன்னோடிப் பரீட்சை -2015

கல்விப் பொதுத் தராதரப் பத்திர(உயர் தர) முன்னோடிப் பரீட்சை – 2015

General Certificate of Education (Adv. Level) Pilot Examination - 2015

Physics II பௌதிகவியல் **II**	01	T	II	Three hours

Answer any four questions only.

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

5. Most of the motions in nature include linear and rotational motions.

(a) (i) Figure (1) shows a woman with weight *W* who is running along a circular path with velocity *v*. Copy the diagram in your answer sheet, denote the two forces exerted on her foot by the ground and name them. Mention separately which is responsible for providing those forces.

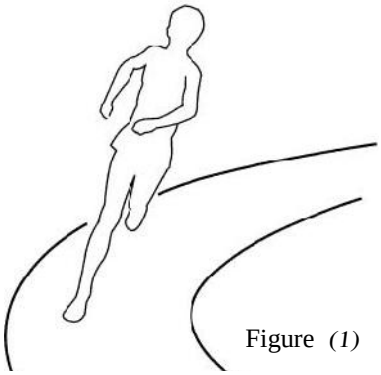

Figure *(1)*

(ii) Draw the resultant force acting on her foot and denote her centre of gravity (G) approximately. What is the reason for denoting it in that position?

(iii) While running she would be inclined towards the centre of the circular path. What is the reason for that?

(b) (i) If her weight is *W*, velocity is *v*, resultant force exerted by the ground is F_r and angle of inclination with vertical is , find the horizontal and vertical components of the resultant force in terms of radius of the circular path *R*, *W* and *v*. From this obtain an expression for tan .

(ii) If the radius of the circular path is 15m and running speed is $7ms^{-1}$, find the angle of inclination to the vertical.

(c) (i) Most of the body movements while walking (as in figure 2) and running can be explained with the help of simple harmonic motion. Each step made by the foot can be considered approximately as half the oscillation period of simple harmonic motion. If a man is able to walk at a speed of 2 steps per second and he moves 90cm for every single step, what is his speed of walking?

(ii) What is the maximum speed of the oscillating foot while walking? Compared to the speed of walking approximately how many times is the maximum speed?

(iii) What is the maximum acceleration of the oscillating foot? Compared to the gravitational acceleration how many is this maximum acceleration?

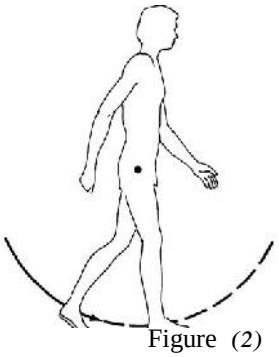

Figure *(2)*

(d) (i) While running (as shown in figure 3), legs not only rotate about the hip joint but also rotate about the knee joint. But as the oscillation about the hip joint is prominent, considering the rotation about the hip joint only mention which provides the required energy to run with the help of oscillating legs.

(ii) If the moment of inertia of the leg about the hip is *I* and the highest angular velocity of the foot while oscillating is $_{max}$, mention where does this highest velocity is achieved (A or B) and obtain an expression for the maximum rotational kinetic energy. Does this energy provide the required energy for running? Explain.

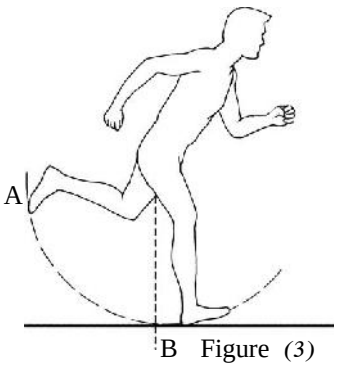

Figure *(3)*

[See page 09

6. (*a*) When waves travel from one medium to another, they involve to reflection or refraction. Considering a longitudinal wave explain hard and soft reflections with the help of change in wave length, frequency and phase change of vibrating particles.

(*b*) A boy close to a well is producing a pulse from a sound source above the well on a day with environmental temperature 16°C. While observing the reflection of the pulse he heard two sounds. The time interval between the two sounds is 0.002s.

(i) Find the depth of water in the well. (Velocity of the longitudinal wave in water is 1500ms^{-1})

(ii) The sound which is heard first is of high intensity and it was observed 0.04s after vibrating the sound source. If the speed of sound in air is 340ms^{-1}, find the depth of the well.

(iii) When the sound source is vibrated continuously, the incident ray and refracted ray from the water form standing wave and it has been observed that the air column in the well is vibrating in the first overtone. Find the frequency of the sound source.

(c) (i) On a day with environmental temperature 27°C, a boy drops a stone into the well. After how long would he hear the sound from the instant the stone strikes the water?

(ii) If the stone is dropped in the middle of the well, the wave length of the formed circular transitional wave is 1.8m. The velocity of this wave is given by $v \quad \sqrt{gh}$. Find the frequency of the wave.

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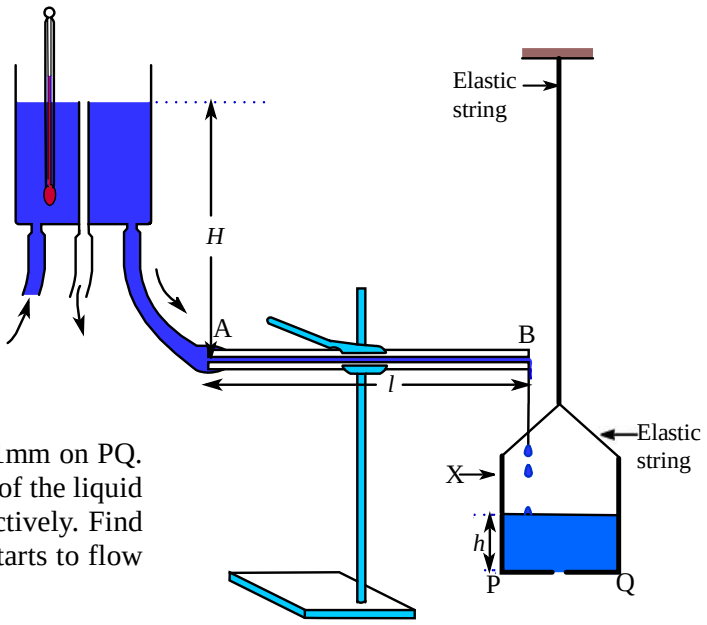
7. (*a*) There is a small hole of radius *r* in the bottom of a vessel. A liquid is poured slowly into the vessel. Draw the figures representing the progress of the liquid bubble with the depth of the liquid *h*. From this obtain an expression for *h* when the liquid starts to flow out through the hole in terms of density of the liquid , surface tension *T* and radius of the hole *r*.

(*b*) X is an open hollow cylinder. A weightless base PQ is in a position as shown in the figure due to the tension of an elastic string. Assume that the liquid does not leak through the joint where the cylinder and the base join. AB is a 44cm long uniform tube of 1mm radius. A viscous liquid is collected in the cylindrical vessel under H cmHg pressure.



(*i*) There is a small hole of radius 1mm on PQ. The density and surface tension of the liquid are 10 kgm^{-3} and 0.5Nm^{-1} respectively. Find the value of *h* when the liquid starts to flow out through the hole.

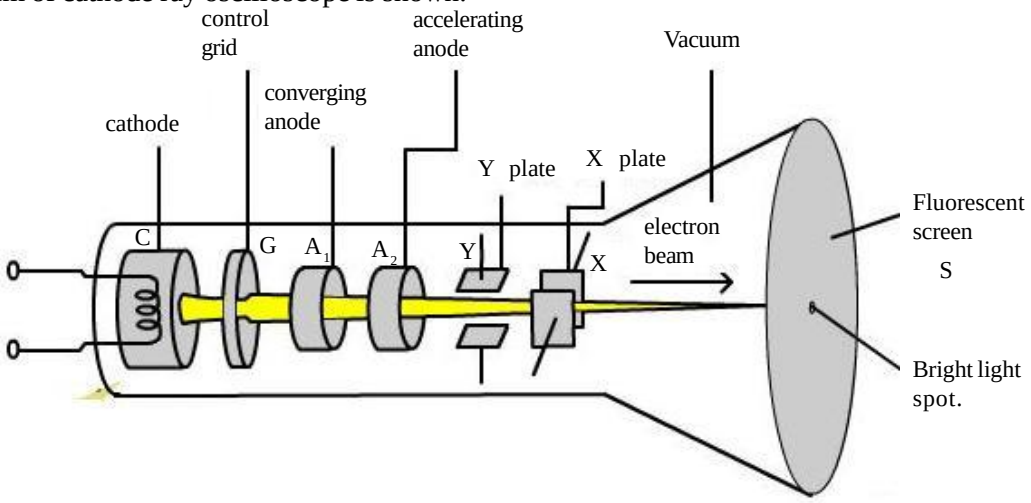
(*ii*) (*a*) If the volume of the liquid flowing through AB in one second is Q, write down Poiseuille's equation for Q.

(*b*) If the viscosity of the liquid is 2 x 10^{-2} Pa s and H = 70cm, find the time taken for the liquid to flow out through the hole from the instant the liquid flows into the vessel. The surface area of the base PQ is 10^{-2} m^2.

(*iii*) The natural length of a rubber belt is 1m and its area of cross section is 10^{-6} m^2. What is the extension that should be given to the belt to prevent the leakage of liquid through the joint before it flows out through the hole? (Young's modulus of rubber is 5 x 10^6 Pa)

[See page 10

8 Cathode ray oscilloscope (CRO) is an important electrostatis instrument in technological field. A simple diagram of cathode ray oscilloscope is shown.

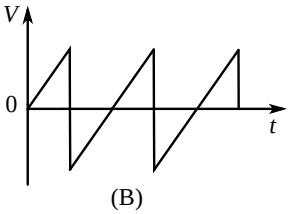


It has a vacuum glass tube and a screen S coated with ZnS. The functions of some electrostatic components are given below.

The electrons formed by heating the cathode (C) are accelerated by the anode A_2 which is at a high potential relative to cathode. Most of these electrons passes through the plates X,Y and hit the screen S coated with ZnS. This screen emits green light due to fluorescence.

As the inside is coated with graphite, the region from A_2 to S acts as equipotential region. As a result the electron beam moves without any deflection and hit the screen with constant velocity. G is the brightness control grid. The potential at G is always negative relative to the cathode C and controls the amount of electrons. Therefore, the brghthess of light falling on the screen is also controlled.

If we apply a varying potential difference across X plates as shown in diagram (B), the electron beam passing through it moves from left to right, then immediately to left. Process is repeated again and again due to a frequency based on time. The voltage can be altered by a time based knob.



(B)

Due to the electric field intensity created according to the variation of voltage difference between Y plates the electron beam executes both horizontal and vertical motion. Due to this the variation of voltage of the form of electric signal, to measore small time ofifference and to observe the wave form of an audible frequency signal.

(a) (i) Why does the cathode ray tube is evacuated?
(ii) Why does electric field is not created in the region with graphite?
(iii) Why the intensity of fluorescense light decreases when the negative potential of G is increased?
(iv) Between which plates does output signal has to be connected?

(*b*) (i) When observing through the eye, if the maximum time that can be memorized is 0.1s, find the minimum frequency that has to be applied between X plates to see the horizontal light beam.
(ii) When this frequency increases, draw the wave observed on screen when a 100 Hz sinusodiac voltage is given.

(*c*) Find the final velocity of electrons when they are accelerated through a potential difference of 45V. (e = 1.6 10^{-19} C, m_e=9 10^{-31} kg)

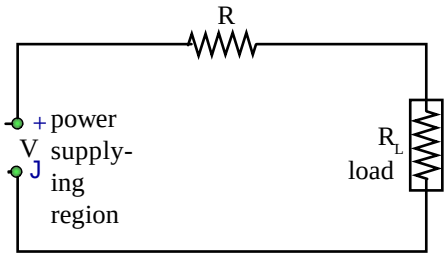
The distance between Y plates is 4mm and the length of the plate is 4cm. Find the voltage that has to be applied between Y plates for the electrons to exit without colliding with plates. (neglect the gravitational forces)

[See page 11

(*d*) While electrons travel in magentic field a force is created. Explain why that force cannot be used to accelerate them in straight line.

9. Answer either part (A) or part (B) only.

(A) (*a*) Power is supplied to a load from a power supply of power P under voltage V. The resistance of joining wires when power is supplied to the load is R.



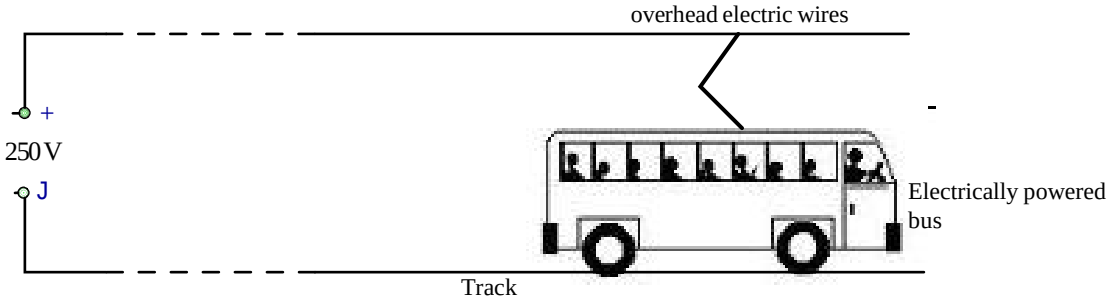
(*i*) Write an expression for the electric current supplied from the power supply.

(*ii*) Write an expression for the voltage difference across the load R_L

(*iii*) Obtain an expression for the power consumed in R_L

(*iv*) Write an expression for the power dissipated in joining wires.

(*b*) There are two types of buses which work by electric energy. One is autonomous which stores energy in batteries and works from it. Other one is non autonomous. It gets electrical energy from a power supply where electrical energy comes through one cable and goes through the other cable. Such a bus is shown below.



(i) Write an expression for the electric resistance of wires used in terms of cross section area *A*, length and resistivity °.

(ii) Cross section area and resistivity are 5 10^{-3} m^2 and 1.75 10^{-8} m^{-1} for an over heated wire of length 1 km. Find its resistance.

(ii) Electric bus is joined to 250V supply. Electricity is supplied to the bus motor by wire and resistance of the track is negligible. Starting point of bus is near the power supply and the power supply gives 67 kW power. Find the current passing through the motor of the bus.

(iii) Electric current in the circuit is 180A when the bus is at a distance of 30km from the power supply. What is the potential difference applied for the motor of bus?

(iv) In this state what is the power absorbed by the motor?

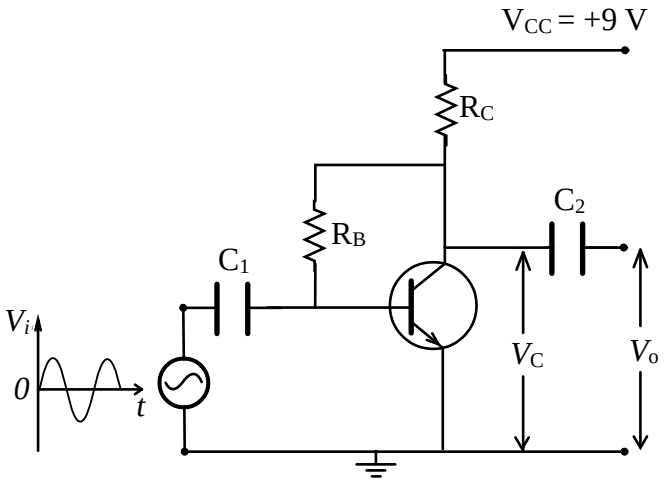
(v) What percentage of power supplied from the power supply is used by bus?

[See page 12

(B) (*a*) (i) Draw the output characteristic (I_D *vs* V_{DS}) for the common source arrangement in JFET transistor and name the active, saturation and cut off regions.

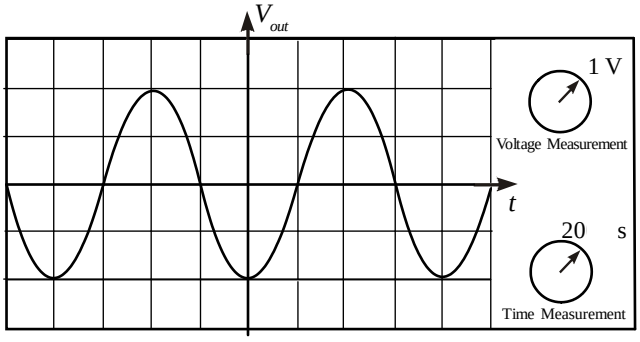
(*ii*) Which parameter is kept constant in labeling the curves above in (a)(i)?

(*iii*) In the (a)(i) above, which region/regions are suitable for amplification?



(*b*) Above circuit is an npn transistor amplifier circuit. Transistor is biased to supply voltage V_{CC} = +9 V. Voltage of base relative to emitter is 0.6V. The base current and collector current are 20 A and 2.98m A respectively. The collector potential relative to earth (V_{BE}) is 4.5V.

(i) What are the uses of capacitors C_1 and C_2 ?
(ii) Calculate the value of resistance R_B
(iii) Calculate resistance R_C
(iv) Draw a graph showing the variation of collector current I_C and V_C collector voltage with time when a small input voltage signal is applied.
(v) The output voltage (V_{out}) obtained in cathode ray oscilloscope is shown below. The height of a small square represents 1V and its width represents 20 s. Find the following.



(1) Maximum value of output voltage.
(2) Frequency of output voltage.

[See page 13

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

(A) (*a*) The rate of heat flow perpendicular to a surface is given by

(*i*) Define each term.

(*ii*) Give two conditions, under which the above equation is valid.

(*b*) When an athlete runs, heat is generated at a rate of 1000 kJ min^{-1}. Moreover, internal body temperature increases to 44 ^{o}C. A portion of this heat flows perpendicular to the body muscle and is released to the environment. The average thickness of the muscle is 1cm, average surface area of the body is 1.8 m^2 and temperature of the external body surface is 34 ^{o}C. 1/5 portion of the heat generated by the body is released through other ways and the remaining flows perpendicular to the muscle.

(*i*) Calculate the average thermal conductivity of the muscle.

(*ii*) What are the other methods through which the heat generated by the body is wasted?

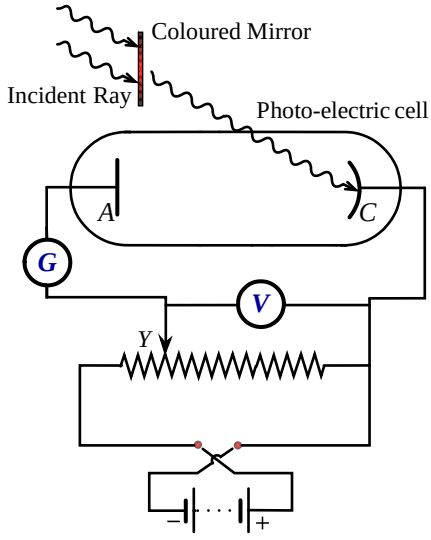
(*iii*) If the room temperature is 30 ^{0}C, calculate the cooling constant k.

(*c*) He is wearing a skinny tightly which is 1mm thick, covering his body surface completely. The thermal conductivity of the skinny is 1/4 of the body muscle. Moreover, its area is equal to the surface area of the body. The internal temperature is 44 ^{0}C and the temperature of the external surface of skinny is 31 ^{0}C. Assume that the heat loss due to other methods remains the same as earlier. Calculate the external body temperature now.

(*d*) There is a gap between the body and the skinny. Would the external body temperature be the same as in part (c)? Explain.

(*e*) While he is running without covering the body as much as possible, they will wet his body using water. What would you expect through this action?

(B) Photo electric effect is defined by the equation, $\boldsymbol{hf = F + E_K}$. Name the terms F and E_K. The experimental setup made by a student to examine the photo electric effect is shown.



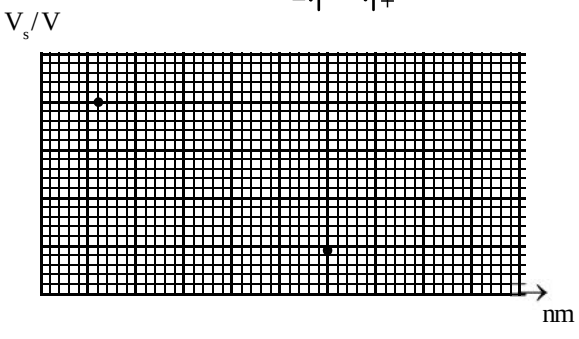
(a) Draw a sketch to show the variation of the potential difference (V) across the electrodes with the photo current (I) for the light with constant intensity and frequency.

(1) When increasing the frequency without changing the intensity

(2) When doubling the light intensity without changing the frequency

Draw the expected variation of I with V on the above sketch. Name the condition (1) as X and condition (2) as Y.

The stopping potential V_S for two values of wavelength l was measured. It is denoted in the given V_S vs l graph.Here, stopping potential is the sufficient potential for preventing the electrons from reaching the anode.



(*b*) What is the maximum kinetic energy of the photo electrons, when a radiation of wavelength 380nm falls on a radiative metal surface?

(*c*) What is the energy of photon of wavelength 380nm?

(*d*) Calculate the work function of the metal.

(*e*) Calculate the threshold wavelength.

(*f*) Explain why the threshold wavelength of the metal could not be deduced from the data in the above graph.

(Planck's constant h = 6.635 10^{-34} J s, velocity of light c = 3 10^{8} m s^{-1} charge of electron e = 1.6 10^{-19} C)