Royal College- Colombo 07

Grade 13

Final Term Test -2026 July

Physics I

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

01 | E | I

Time : 2 hours

❖ Answer all the questions.

(1) Units of magnetic flux density is,

1) T 2) Wb 3) A 4) Cd 5) Ci

(2) The equation $N = N_0\ e^{-\lambda t}$ gives the number of remaining nucleus 'N' after a time 't' here 'N_0' is the initial number of unstable nucleus. If λ is the decay constant, what are the dimensions of λ?

1) No dimensions 2) T 3) T^{-1}
4) TL 5) none of the above

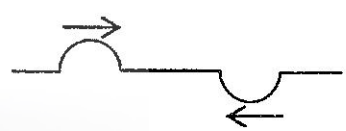
(3) Find the percentage of increase of kinetic energy of an object when its momentum increases by 300%.

1) 300% 2) 1500% 3) 900%
4) No change 5) 100%

(4) The power of the objective lens and the eye piece of an astronomical telescope is +2D and +50D. What is the magnification power of this telescope in normal adjustment?

1) 1.25 2) 12.5 3) 25 4) 125 5) 250

(5) Two identical transverse wave pulses on a string move towards each other as shown in the figure. Which one of the given statements are **wrong** about their energies at the moment when the two pulses overlap on each other?

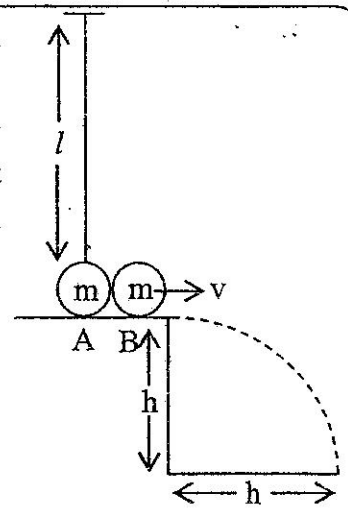


1) The potential energy of the pulses is zero.
2) The total energy of the pulses is the sum of the potential and kinetic energies of the two pulses.
3) The kinetic energies of the pulses are zero.
4) The total energy of the pulses is equal to the sum of their kinetic energies.
5) The total energy of the two pulses is a constant.

(6) An open tube of length L resonates with fundamental tone with frequency f_1 and a closed tube of length 2L vibrates with first overtone with frequency f_2. Find the ratio of $\frac{f_1}{f_2}$

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

(7) A pendulum(A) of mass m is tied to a string of length 'l'. When a small displacement is made and the pendulum is released it collides perfectly elastically with another identical mass 'm' (B) at the vertical position. If the mass B does a 'h' horizontal displacement and hit the platform which is a height 'h' below it, find the vertical upward displacement of the pendulum (A).



1) h 2) $\frac{h}{4}$ 3) l 4) 2h 5) $\frac{h}{2}$

(8) It takes 10 minutes for an object to cool from 70°C to 60°C. If the room temperature is 25°C, find the temperature of the object after another 10 minutes.

1) 50.2°C 2) 52.2 °C 3) 55.2°C
4) 57.2°C 5) 59°C

(9) A large number of small spheres are projected in different directions from point O with the same 'u' velocity as shown in the figure. They are projected so that they have maximum horizontal displacement. If the spheres hit the ground in the shaded area as shown in figure (2), find the area covered by the spheres.

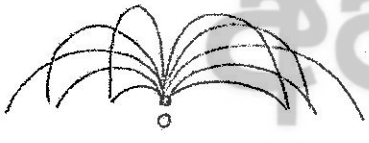


Figure I

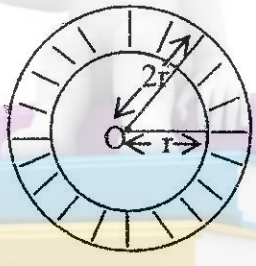
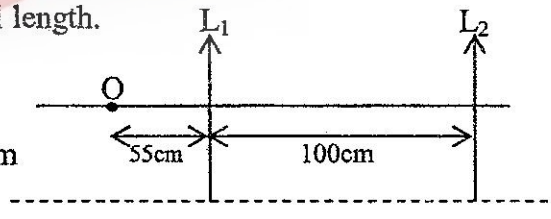


Figure II

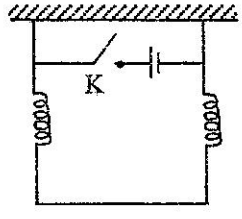
1) $\frac{\pi u^4}{g^2}$ 2) $\frac{\pi u^4}{2g^2}$ 3) $\frac{\pi u^4}{4g^2}$ 4) $\frac{u^4}{g^2}$ 5) $\frac{u^4 \sin\theta}{2g^2}$

(10) L_1 and L_2 are two convex lenses each of 50 cm focal length. If the final image of the object O forms at I, find the distance OI.



1) 54.5cm 2) 110cm 3) 200cm
4) 550 cm 5) 605 cm

(11) The AB rod of length 2m and mass 2 kg is fixed to two identical springs of spring constant (200 Nm^{-1}) as shown in the figure. When the switch is open, the rod is horizontal. The EMF of the cell is 2V and the total resistance of the springs and the rod is 4Ω. If the rod remains horizontal when the switch is closed, and there is a 0.2T magnetic field out of the page, find the extension of the springs.



1) 0.5 mm 2) 1 mm 3) 1.5mm
4) 2 mm 5) 2.5 mm

(12) The frequencies of two consecutive resonance states in a 120 cm stretched string are 60 Hz and 80 Hz. Find the velocity of waves along the stretched string.

1) 12 ms^{-1} 2) 20 ms^{-1} 3) 24 ms^{-1} 4) 48 ms^{-1} 5) 60 ms^{-1}

(13) Find the percentage of decrease of intensity level when the sound intensity is reduced from 10^{-2} Wm^{-2} to 10^{-4} Wm^{-2}.

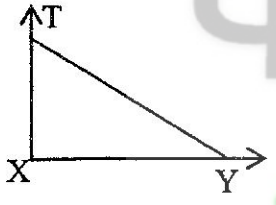
1) 10% 2) 20% 3) 40% 4) 60% 5) 80%

(14) A 2m long steel wire is tied to across a brass frame without stretching. The temperature of the frame at this moment is 20°C. Find the stress force on the string when the temperature of the frame is increased to 120°C.

$\propto$ brass $= 1.8 \times 10^{-5} C^{-1}$, $\propto$steel $= 1.2 \times 10^{-5} C^{-1}$, Ysteel $= 2 \times 10^{11} Nm^{-2}$, Ysteel $= 1.2 \times 10^{-5} Nm^{-2}$

1) $1.2 \times 10^{8} Nm^{-2}$ 2) $1.3 \times 10^{8} Nm^{-2}$ 3) $1.4 \times 10^{8} Nm^{-2}$
4) $1.5 \times 10^{8} Nm^{-2}$ 5) $2 \times 10^{8} Nm^{-2}$

(15) PQ is a metal rod and there are two thin plastic strips XP and QY connected to its two ends as shown in the figure. X and Y are maintained at 100°C and 0°C respectively. Find the graph which correctly depicts the variation of temperature T from X to Y.

1)


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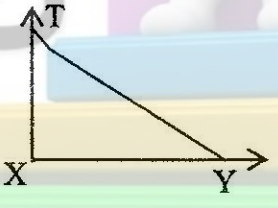

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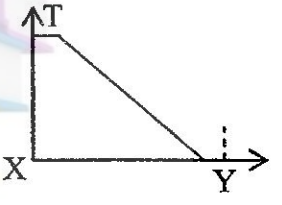

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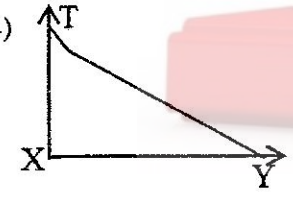

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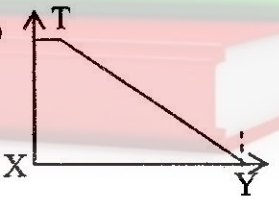
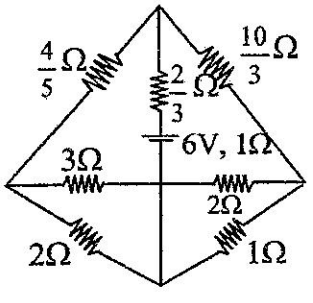


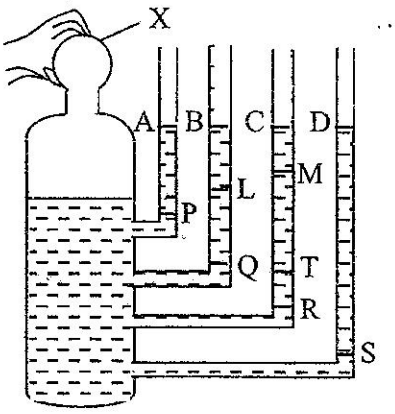
(16)


Find the current through the cell in the given circuit.

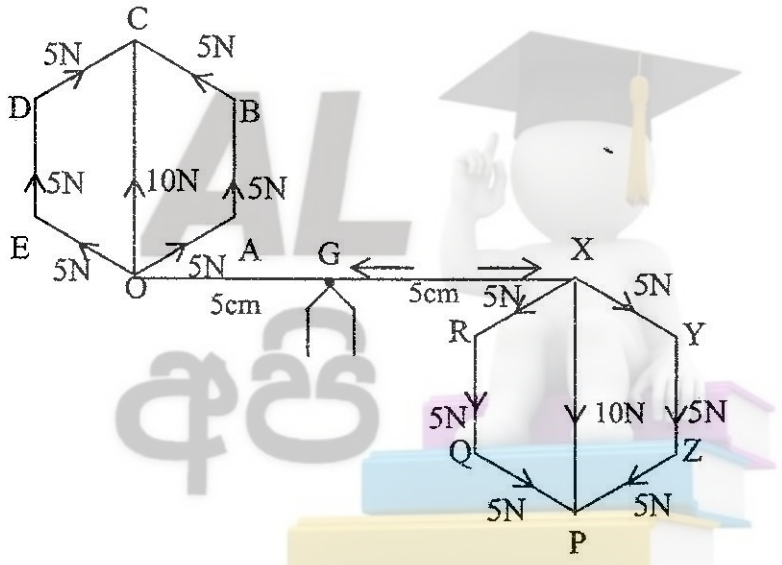
1) 0.5A 2) 1 A 3) 1.5A
4) 2 A 5) 2.5A

(17) What is the final water levels of the arms of the given apparatus after the X piston is pressed and released?

1) PQRS 2) PLMD 3) ABCD
4) ALMD 5) ALTS



(18) Two systems of forces act on the two ends of the light rod OGX as shown in the figure. What is the magnitude of the force and the distance from G that it should be applied from, so the resultant moment about G is zero?



	Force	Distance from G	side
(1)	0	0	–
(2)	120N	2.5cm	Right side ↓
(3)	30N	5 cm	Left side ↑
(4)	60N	5 cm	Left side ↓
(5)	30N	5 cm	Right side ↑

(19) Consider the following statements about laser light.

A) In order to produce laser light, it is essential to have a metastable energy level.

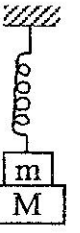
B) Laser light has the same amplitude, the same frequency, and the same phase.

C) Laser rays can be polarized

The true statement/s is/are,

1) Only A 2) Only A and C 3) Only B and C 4) Only A and B 5) All A, B and C

(20) Two masses m and M are connected to a light spring of spring constant k. The M mass detaches and falls off when the system is in equilibrium. Consider the following statements.



A) Mass m stays in equilibrium.

B) The system does a vertical simple harmonic motion of period $2\pi\sqrt{\frac{m}{k}}$

C) The system does a vertical simple harmonic motion of period $2\pi\sqrt{\frac{(m+M)}{k}}$.

Correct statement/s is/are,

1) Only A 2) Only B 3) Only C 4) Only A and B 5) Only A and C

(21) Consider the following statements about seismic waves.

(A) The speed the internal waves is laser than the speed of surface waves.

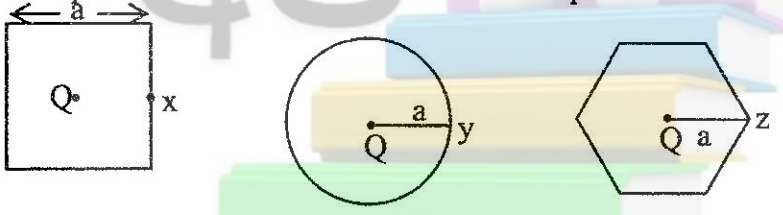
(B) Secondary waves (S waves) only travel through solid rocks.

(C) The highest amount of damage from earth quakes are due to surface waves.

Correct statement/s is/are,

1) Only A 2) Only B 3) Only C 4) Only A and B 5) Only B and C

(22) Given below are a cube of side length a, a hollow sphere of radius a, and a regular hexagon with a length a from the center to a corner. Q charges are kept at the centers of each of these. x, y and z are points on the circumference of the shapes. The correct statement/s is/are?



(A) The electric flux across all the surfaces are equal.

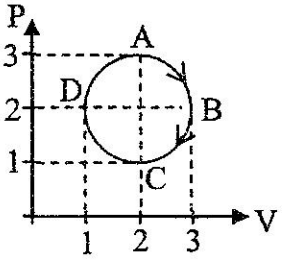
(B) The electric field intensities at x, y and z are equal.

(C) The electric potential at x, y and z are equal.

The most correct statement among the above statement/s is/are

1) Only A 2) Only B 3) Only C 4) Only A and B 5) All A, B and C

(23) Given in the figure is a cyclic thermodynamic process.
The correct statement/s is/are,



(A) The A ⟶ B process is isothermal process

(B) Heat transmits out of the system in the BCD process.

(C) in the ABC process is zero.

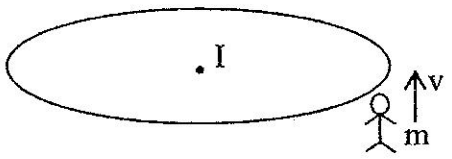
(D) Δw Work is done by the system in the ABCDA process.

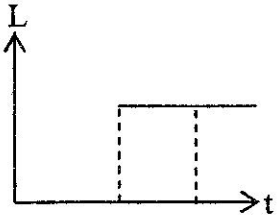
Correct statement/s is/are,

1) Only A 2) Only A and C 3) Only B and C

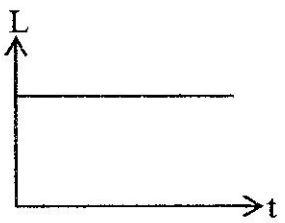
4) Only B and D 5) Only A, B and D

(24) A disk with moment of inertia 'I' can rotate about an axis through its center as shown in the figure. A child with mass 'm' come running towards the disk with 'v' velocity and climbs on to the disk. Then the child steadily moves towards the center of the disk. Which of the following graphs correctly shows the variation of angular momentum of the system with time?





1)



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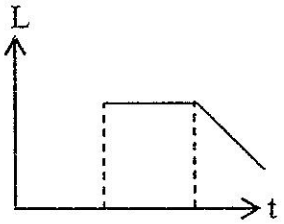

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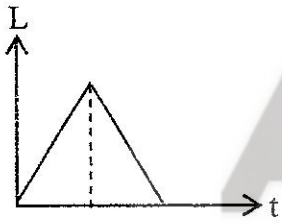
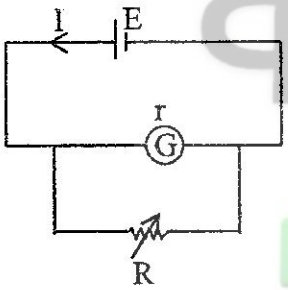
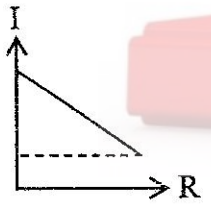


4)

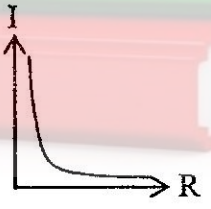
5)

(25) In the given circuit, E is and ideal cell. Which of the following graphs correctly shows the variation of 'I' with 'R'?





1)



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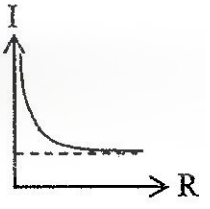

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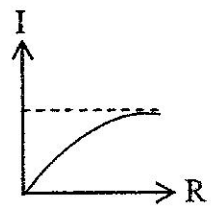

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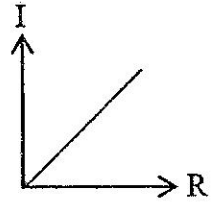
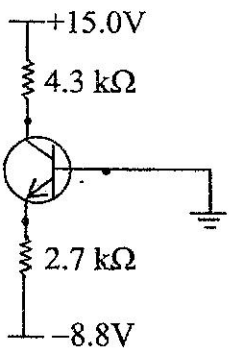


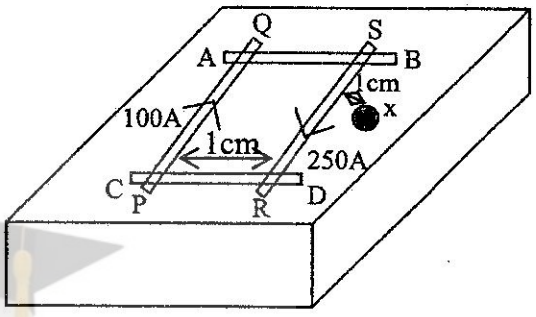
5)

(26) The transistor in the figure operates in the active region and its V_{BE} is 0.7V. If a light source with a 4.3 kΩ resistance is connected to the collector, and an unknown electrical component of resistance 2.7 kΩ is connected to the emitter, find the value of V_{CE} of this circuit.



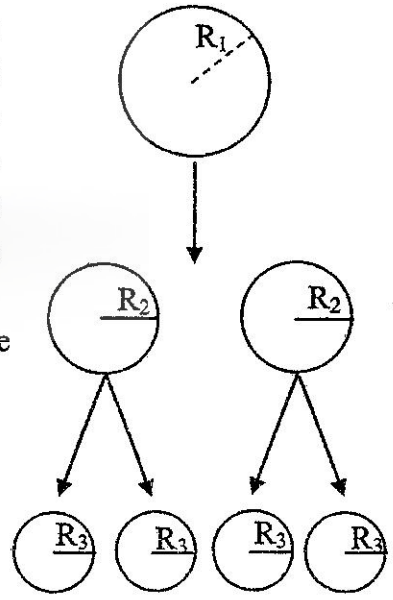
1) 0.7V 2) 1.8 V 3) 2.8 V
4) 3.6 V 5) 5.6 V

(27) Two conductors PQ and RS are kept 1 cm apart on two smooth rails AB and CD on a horizontal surface. A current of 100A flows in PQ direction and a current of 250A flows in SR direction in these two conductors. The mass of the RS conductor is 0.25 kg. A sphere 'x' of mass 0.25 kg is kept 1 cm away from the RS conductor as shown in the figure. RS conductor collides with 'x' and both the sphere and RS move together after the collision. If the current-current interaction stops just before the collision, what is the velocity of the combined object after collision? $(\frac{\mu_0}{4\pi} = 10^{-7}\ Hm^{-1})$



1) 0.07 ms^{-1} 2) 0 ms^{-1} 3) 0.32 ms^{-1} 4) 0.16 ms^{-1} 5) 0.08 ms^{-1}

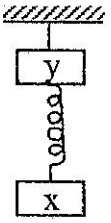
(28) A spherical rain drop in the sky with a radius R_1 radius fall down with a V terminal velocity. Then it breaks to two identical spherical drop of radius R_2 as shown in the figure. After these two drops attain V_2 terminal velocity, each breaks to two identical water drops resulting in four spherical water drops which attain a V_2 terminal velocity. Which of the following is true about V_1 and V_2?
(Do not consider the pressure difference and the temperature variations.)



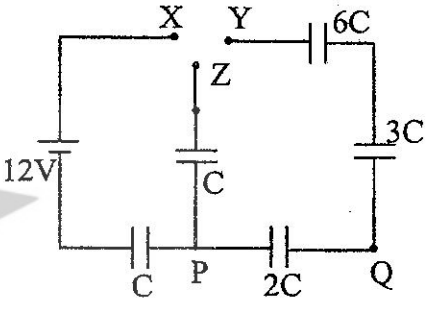
	V_1	V_2
1)	$8^{-\frac{3}{2}}V$	$2^{-\frac{3}{2}}V$
2)	$2^{-\frac{3}{2}}V$	$8^{-\frac{3}{2}} \times V$
3)	$4^{-\frac{3}{2}}V$	$2^{-\frac{3}{2}}V$
4)	$2^{-\frac{3}{2}}V$	$4^{-\frac{3}{2}}V$
5)	$4^{-\frac{3}{2}}V$	$8^{-\frac{3}{2}}V$

(29) Two masses X and Y are connected by a light spring and the system is hung on the hard surface using a light string as shown in the figure and this system is in static equilibrium. If the string is suddenly cut, what are the instantaneous accelerations of the X and Y masses?

	acceleration of x	acceleration of y
1)	g	g
2)	g	2g
3)	0	g
4)	0	2g
5)	0	g/2



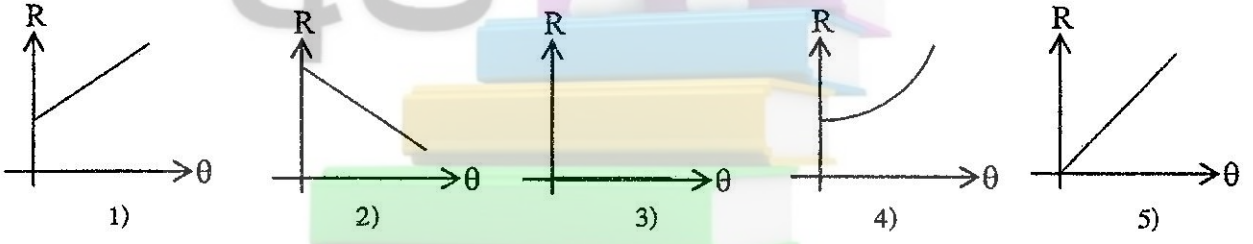
(30) A system of capacitors is connected to a cell with 12V emf as shown in the figure. (The capacitances of the capacitors are as marked in the figure). If the Z terminal is first connected to x terminal, and then connected to the y terminal, what is the potential difference between P and Q?



1) 1V 2) 1.2V 3) 1.5V

4) 6V 5) $\frac{12}{11}$V

(31) Which of the following graphs correctly depicts the variation of the resistance (R) on either ends of a piece of semiconductor, with temperature (θ)?



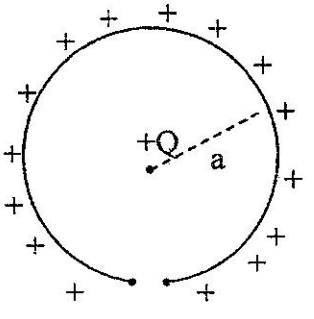
(32) A light beam of wavelength 250 nm incidents on a metal surface with 3.2eV work function. Find the stopping potential. (hc = 1240 ev nm)

1) 0.8V 2) 1.0V

3) 1.2V 4) 1.5V

5) 2.0V

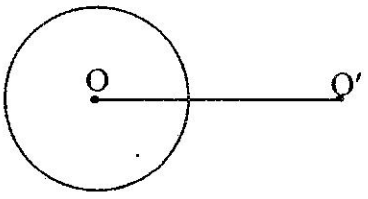
(33) A charge is given to a metal ring so that its linear charge density is ρ. If a small part of the ring is cut out so the a Δθ charge is removed from the ring, find the magnitude and direction of the resultant force on a +Q charge kept at the center of the ring.

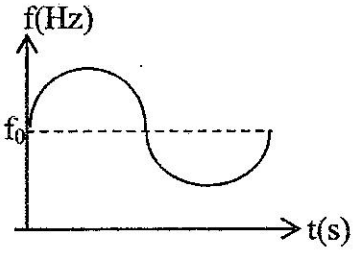


1) $\frac{(2\pi a\rho - \Delta\theta)Q}{4\pi\varepsilon_0 a^2}$ 2) $\frac{2\pi a\rho Q}{4\pi\varepsilon_0 a^2}$ 3) $2\pi\varepsilon_0 a^2$

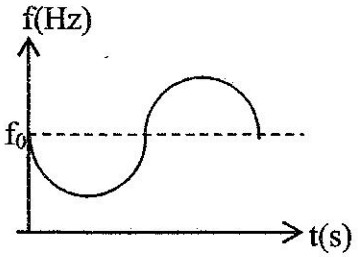
4) $\frac{\Delta\theta q}{4\pi\varepsilon_0 a^2}$ 5) 0

(34) A sound source is moving in a circular path with center O with a constant angular velocity while emitting sound of frequency f_0. Which of the following graphs show the variation of the frequency (f) heard by an observer at a point O ' which is outside the circle with time (t).





1)



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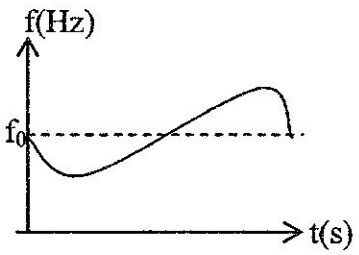

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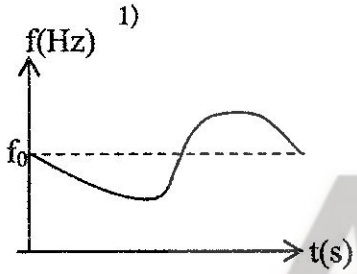
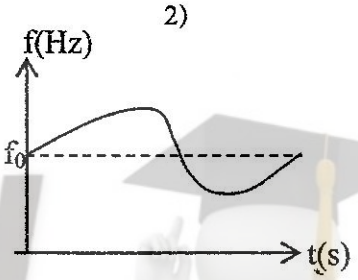
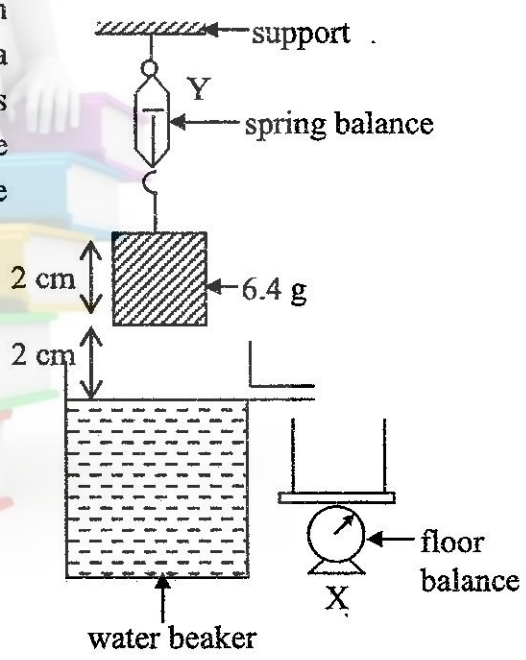


4)



5)

(35) A cube shaped block of mass 6.4 g and side length 2 cm is hung by a spring balance and kept 2 cm above a water tank kept on a (floor balance). If the block is moved 5 cm down from this position, what are the readings of the spring balance (X) and the floor balance (Y) ? (Density of water = 1000 kgm^{-3})



	1)	2)	3)	4)	5)
X(g)	6.4	6.4	0	0	6.4
Y(g)	6.4	0	6.4	4.8	4.8

(36) Given below is how two physical quantities P and Q vary with time. What is the relationship between the phases of these two quantities?

1) P leads Q by $\frac{\pi}{2}$

2) P leads Q by $\frac{\pi}{4}$

3) Q leads P by $\frac{\pi}{2}$

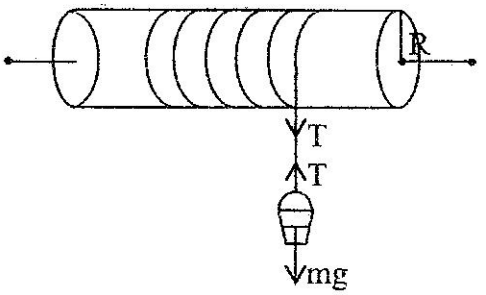
4) Q leads P by $\frac{\pi}{4}$

5) P leads Q by π

(37) Experiencing short sight and long sight at the same time occurs in most peoples over 40 years of age due to natural causes. If such a person has a near point of 100 cm and a far point of 10 m, find the power of the lens this person should wear in order to correct his far point?

1) + 1.0 D 2) –1.0D 3) +0.1 D 4) –0.1 D 5) + 10 D

(38) The apparatus in the figure consists of a cylindrical part of moment of inertia 'I' rotating about an axis through its center and a bucket with water of collective mass 'm' which is wound around it using a light inextensible string. If 'a' is the linear acceleration of the bucket and α is the angular acceleration of the cylindrical part.



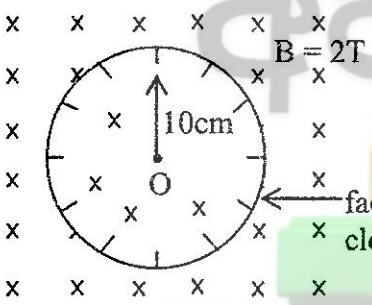
a) $mg - T - ma$ b) $\alpha = aR$ c) $a = \dfrac{g}{1+\dfrac{I}{mR^2}}$

d) The velocity of the bucket after it has fallen a height 'h' = $\sqrt{\dfrac{2gh}{1+\dfrac{I}{mR^2}}}$

The correct statement/s is/are,

1) Only a 2) Only b 3) Only a, c and d 4) Only c and d 5) All a, b, c and d

(39)

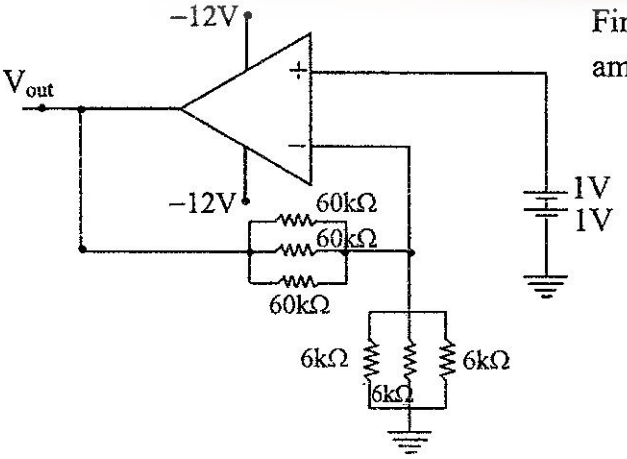


There is a uniform magnetic field of 2T flux density perpendicular to a clock, who's second hand is 10 cm long, as shown in the figure. If the second hand moves about O continuously. Find the emf induced between the two ends of the second hand. (consider $\pi = 3$)

1) 10^{-1}V 2) 10^{-2}V 3) 10^{-3}V

4) 10^{-4}V 5) 10^{-5}V

(40)



Find the output voltage (V_{out}) of the operational amplifier shown in the figure approximately.

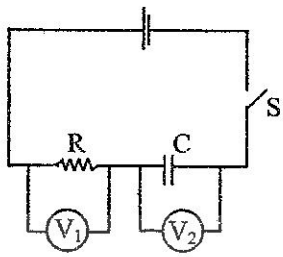
1) +20V 2) –20V 3) +12V

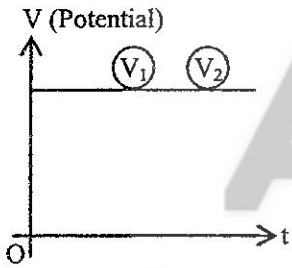
4) –12V 5) +10V

(41) A radioactive sample contains only nuclide x. After 20 days, 15/16 of the original nuclei have decayed. The time required for the activity of the sample to decrease to 1/32 of its initial value is,

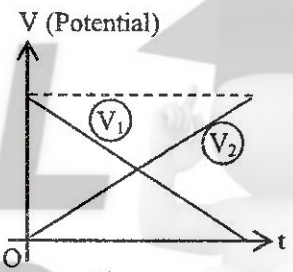
1) 20 days 2) 25 days 3) 40 days 4) 50 days 5) 60 days

(42) Given in the figure is how a resistor (R) is connected to two parallel plate capacitors in series. S is a switch and V_1 and V_2 are voltmeters with high resistance. Which of the following graphs show the variation of the readings of V_1 and V_2 , after the switch S is closed, with time?

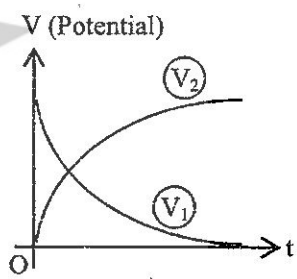




1)



2)



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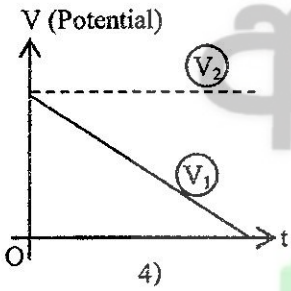
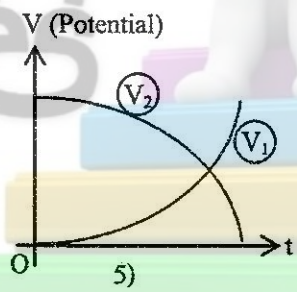
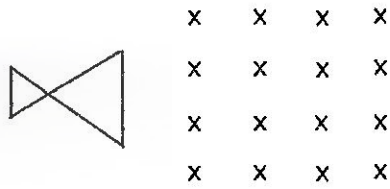


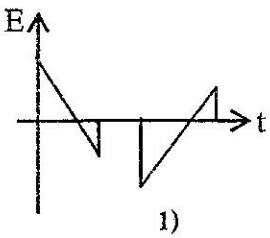
4)



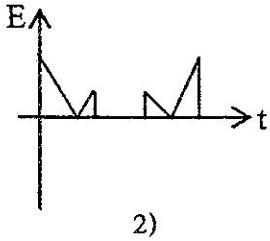
5)

(43) A metal frame moves perpendicular to a uniform magnetic field with uniform velocity as shown in the figure. Find the graph which correctly shows the variation of the induced emf (E) with time (t)?





1)



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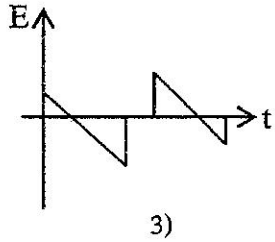

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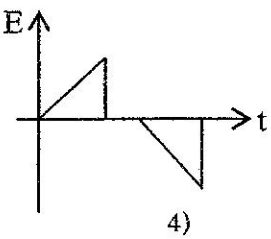
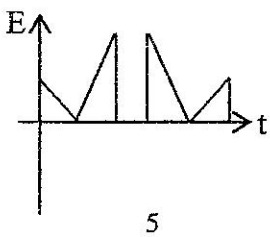


4)

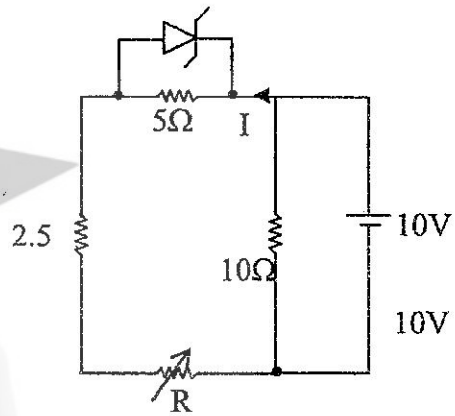


5

(44) Two bubbles with radius 5cm and 12cm which are made of a certain liquid exists at 27°C. These two bubbles are pressed against each other forming a common curved surface. Afterwards the two bubbles combined to form a single bubble at the same temperature. Find the radius of the common curved surface before bubbles combined and the radius of the final bubble respectively.

	before	after
1)	17cm	17cm
2)	4.3cm	17cm
3)	13cm	13cm
4)	13cm	8.6cm
5)	8.6cm	13cm

(45) The breakdown voltage of the zener diode shown in the figure is 5V. The internal resistance of the cell can be neglected. What is the change of the current in the circuit (I) when the value of R is changed from 0Ω to 2.5Ω.



1) from 1.3A to 1.0 A
2) from 4.0 A to 2.0 A
3) from 2.0 A to 1.3 A
4) from 2.0 A to 1.0 A
5) from 2.7 A to 2.0 A

(46) If a certain washing machine emits a warning signal if its given the electric supply while its lid is open or when the water supply is unavailable. Three sensors in the washing machine give signals as X = 1 when the lid is open, Y = 1 when the electric supply is available and Z = 1 when the water supply is unavailable. The alarm sounds when F = 1. Given below are 5 truth tables taken by some students for F. which of these F_1, F_2, F_3, F_4 and F_5 are correct?

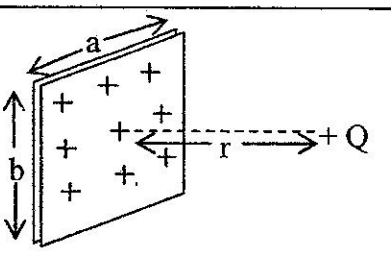
X	Y	Z	F_1	F_2	F_3	F_4	F_5
0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	1	1	0	0	0
0	1	1	1	0	1	0	1
1	0	0	1	0	0	0	0
1	0	1	1	0	1	0	0
1	1	0	1	1	1	0	1
1	1	1	1	1	1	1	1

1) F_1 2) F_2 3) F_3 4) F_4 5) F_5

(47) A black body emits radiation with a peak wavelength 1.2 μm with a total power P. The temperature of the black body is increased so that the peak wavelength shifts to 0.6 μm, while its surface area remains unchanged. The new total power radiated is?

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

(48) One side of a uniform rectangular metal plate of side length 'a' and width 'b' is given a +Q uniform charge as shown in the figure. If another +Q charge is kept perpendicular to metal plate as in the figure, find the magnitude and direction of the electric force on the +Q charge.



(ε – permittivity of the free space)

1) $\frac{2Q}{ab\varepsilon_0}$ 2) $\frac{Q}{ab\varepsilon_0}$ 3) $\frac{Q}{r\varepsilon_0}$ 4) $\frac{Qr}{ab\varepsilon_0}$ 5) $\frac{Q}{2ab\varepsilon_0}$

(49) A given structure of concrete consists of concrete and steel wires. The relationship between the tensile stress $\left(\frac{F}{A}\right)_s$ and strain $\left(\frac{\Delta l}{l}\right)_s$ for the soft steel (S) can be given in the figure(1). Although concrete is a brittle material, The relationship between the tensile stress $\left(\frac{F}{A}\right)_c$ and strain $\left(\frac{\Delta l}{l}\right)_c$ for concrete (C) can be given in figure(2).

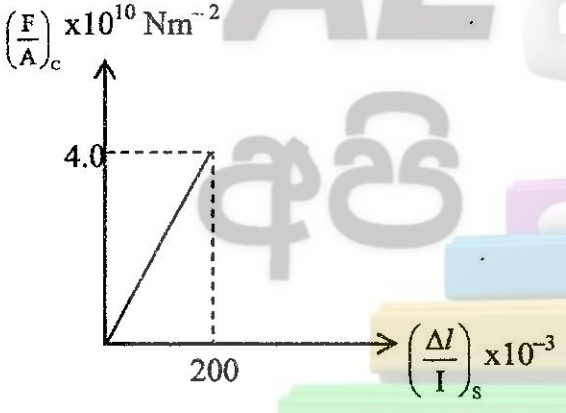


Figure 1

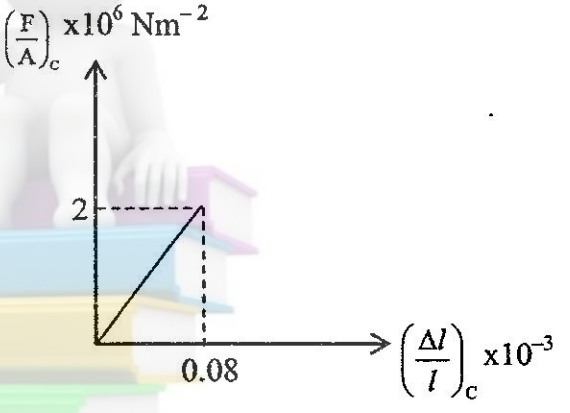
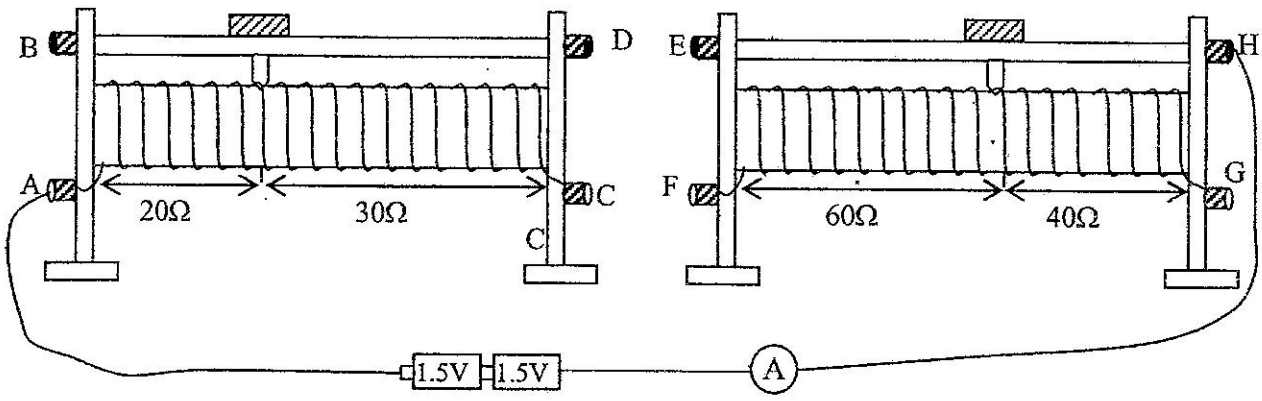


Figure 2

Which of the following is true?

Total strain energy of steel	Stain energy per unit volume of steel	total strain energy of concrete	strain energy per unit volume of concrete
1) 8.0×10^9	4.0×10^9	16.0×10^1	8.0×10^1
2) 8.0×10^9	inconclusive	16.0×10^1	inconclusive
3) inconclusive	8.0×10^9	can't say	16.0×10^1
4) 4.0×10^9	inconclusive	8.0×10^9	inconclusive
5) inconclusive	4.0×10^9	inconclusive	8.0×10^1

(50)



The (A) ammeter and the cells in the figures are ideal. Choose the answer that best represents how the terminals of the rheostats should be connected for the ammeter reading to be 0.2A.

1) D should be connected to E
2) C should be connected to F
3) C should be connected to E
4) F and A should be connected to each other and D and H should be connected to each other as well.
5) A and E should be connected to each other and D and H should be connected to each other as well.

13233 42233 1441a 43452 5a423 3a443 aa4(4/5)3 34333 23154 54aa4

Royal College - Colombo 07
Grade 13
Final Term test – July 2026
Physics II

01 E II

Time : 3 hours
Reading time : 10 minutes

Important :

- *The question paper consists of **21** pages*
- *The question paper comprises **Part A** and **Part B**. The time allotted for both part is **3 hours***
- *Use of calculators is **not** allowed*

Part A - Structured Essay
(10 pages)

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

Part B - Essay
(11 pages)

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

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

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

For Examiner's use only

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

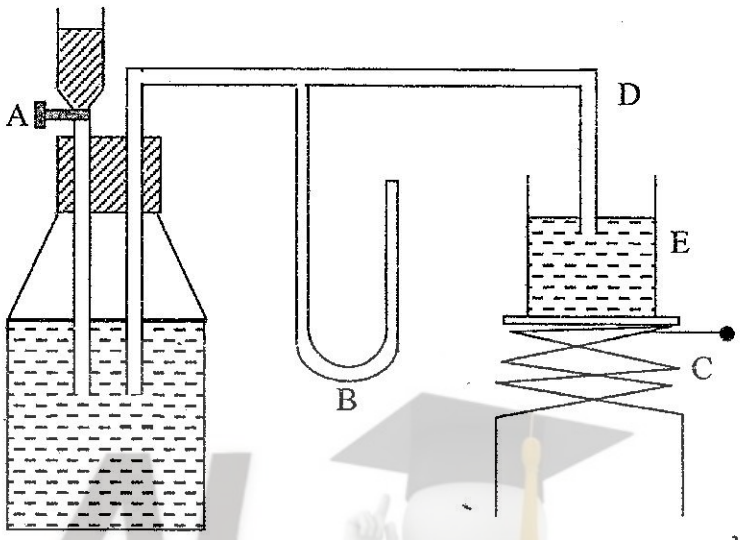
Final Marks

In numbers	
In words	

Part A – Structured Essay

Answer All question

(1) Jegger's method can be used to determine the co-efficient of surface tension of a liquid using the concept of the additional pressure. The experimental setup is hown in the following figure.



a) i) I) Define the co-efficient of surface tension.

.....

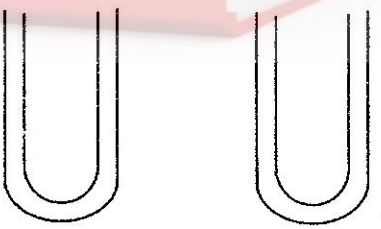
.....

.....

II) Write down the dimensions of surface tension.

.....

ii) I) Draw the liquid levels in the manaometer B before and after the tap A is opened in below given figures.



Before After

II) Write down the reasons for liquid levels are setting up as the above figures in part (a) ii I) at relevant instances.

Before open the tap A .....

.....

After open the tap .....

.....

iii) Consider the instance of releasing an air buble at the end of the tube D. The pressure inside the air bubble is P_1 and the pressure outside the air bubble is P_2, the radius the tube D is **r**, and the diameter of the air bubble is **d**. Write down the requrements to fullfil to release the air buble from the tube D.

I) a) Using the pressure difference

.....

b) Using the radius of the tube.

.....

II) What can you say about the difference of the liquid levels of the manometer when releasing the air bubble from the tube D.

.....

b) Consider the surface tension of the liquid is T and the density of the liquid is ρ_1, The density of the liquid in the manometer is ρ_2, the difference of the liquid levels between the manometer when the air bubble is released is h_2, the distance between water level of the vessel E and the bottom end of the tube D is h_1 and the atmospheric pressure is P_0.

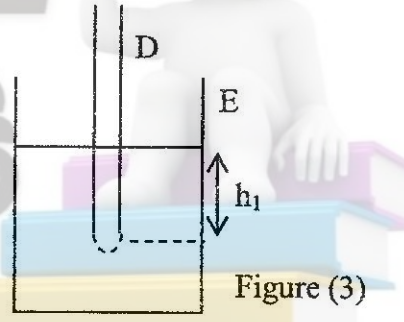


Figure (3)

i) Write down an equation for the internal pressure (P_1) of the air bubble created at the end of tube D.

.....

ii) Write down an equation for the external pressure (P_2) at the instance of releasing the air bubble at the end of tube D.

.....

iii) Obtain an expression for the additional pressure ($P_1 - P_2$) using theresults obtained in above part (b)(i) and (ii).

.....

.....

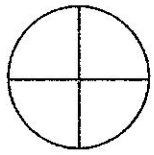
iv) Hens write down an expression for the surface tension (T) interms of above given symbols.

.....

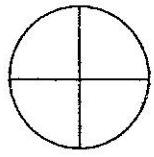
.....

v) Draw the index ↓ which is used to read the water level of the vessel E of tube D is inserted at the appropriate position.

vi) When the travelling microscope is focused at of the liquid surface and the end of the tube D to obtain the height h_1, draw the appearance of them on the cross wires given below.



index



end of the capillary tube

vii) Explain the steps of measuring h_1.

.....

.....

.....

c) i) Write down the special characteristic which should be in the manometer liquid.

.....

.....

ii) What is effect of the special characteristic of the liquid in part (c)(i) on the experiment?

.....

.....

iii) A student says that coconut oil can be used as the manometer liquid. Explain whether it is true or false.

.....

.....

iv) Another student plans an experiment to find the surface tension (T) of the liquid using the capillary rise method. Write down two advantages using the Jeggars method than the capillary rise method.

(I).....

(II).....

v) What effect can be expected, if the rate of collecting water in to the Jeggers vessel is increased?

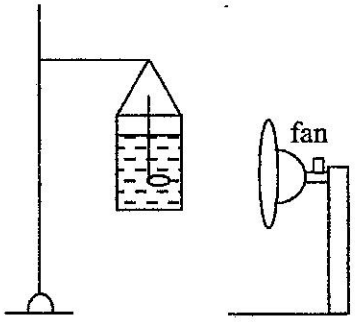
.....

.....

vi) What is the special observation can be seen in above c (v).

.....

(2) The figure shows an experimental setup to determine the specific heat capacity of cocnut oil using the Newton's Cooling Law. A polished copper calorimeter with a lid, stirrer, heated coconut oil, heated water and a stand are provided.



a) Name three mesuring instruments which are using in this experiment.

.....

.....

b) Write down the equation of Newton's Cooling Law using the usual symbols and name them.

.....

c) Write down the reason for using the same calorimeter for both water and cocnut oil.

.....

.....

d) What is the reason for using a polished calorimeter in this experiment.

.....

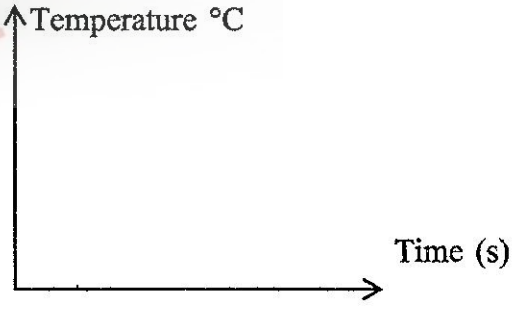
e) Write down the experimental step which is used to equalise the internal and the external temperetautre of the calorimeter.

.....

f) Which physical quantity can be maintained constant by using the equal volumes of water and coconut oil.

.....

g) Draw the rough sketch of two cooling curves for cocnut oil and water in the given axes and name them.



h) The readings and data for calculating specific heat capacity of coconut are given below.

Mass of the calorimeter(m_c) = 0.15 kg

Specific heat capacity of the material of the calaorimeter(S_c) = 400 $Jkg^{-1}k^{-1}$

Mass of the water (m_1) = 0.25 kg

Specific heat capacity of water(s_1) = 4200 $J\,kg^{-1}k^{-1}$

Mass of the coconut oil (m_2) = 0.20 kg

The time taken to cooling the water and the coconut oil from from θ_1 to θ_2 are t_w and t_l respectively. Write down an expression for the specific heat capacity of coconut oil (s_2).

.....

.....

i) If t_w = 15 minutes and t_l = 6 minutes, determine the specific heat capacitiy (s_2) of coconut oil.

.....

.....

.....

K) If the same practical is done for another liquid (X) of having higher heat capacity than water, draw the cooling curve the liquid X for above given axes in part (h) and name it.

(3) You are asked to determine the frequency of a tuninig fork of unkown frequency using the sonometer. A set of weights each 0.5kg, a tuninig fork of unkown frequency and a meter ruler are provided. The practical setup is arranged below.

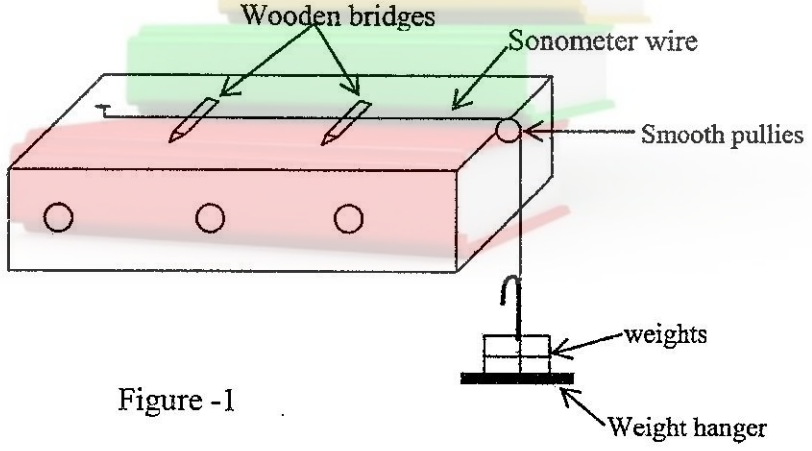
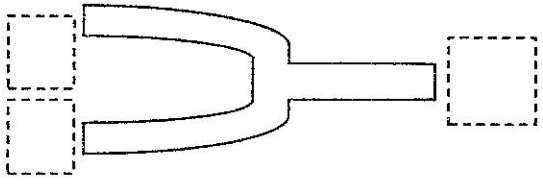


Figure -1

a) When the tuning fork is held by hand, draw the vibrating dirrections (both side) of the stem and the prongs in the given dashed squares using arrows.



b) When the vibrating tuning fork is kept on the sonometer box, state the the type of the wave formed in the sonometer wire.

I) Longitudinal/ Transvers.

II) Stationary/ Progressive.

.....

.....

c) The teacher says that, the stem of the vibrated tuninig fork should be kept on the sonometer box perpendularly between the two bridges closer to the sonometer wire. Are you agreed with the teacher's statement? State Yes/No and give the reason for your answer.

.....

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.....

d) When the tension of the wire is T, mass per unit length is m, write down an expression for the velocity of transverse wave V.

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.....

e) Write down the four experimental steps up to the obtaining the first reading.

1. .....
2. .....
3. .....
4. .....

f) i) What is other item which is required in this practical.

.....

ii) Draw the vibrating pattern of the wire between P and Q when you are taking the first reading.

iii) Explain the reason for using the above instance to obtain the readings.

.....

.....

g) The total mass with the weight holder is M, the frequency of unknown tuning fork is f, the mass per unit length m, the gap between the two bridges is *l*. Arrange variables to determine f.

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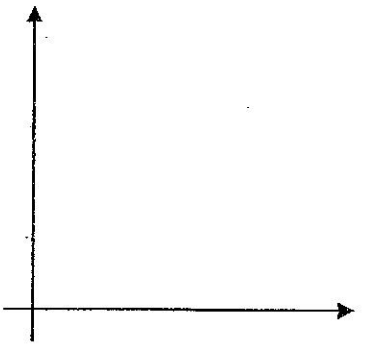
h) Draw the rough sketh of the expected graph in the below axes. Name the axes.



i) The gradient of the graph in SI units is 4.0 and the mass per unit length is 1.25×10^{-3} kg m^{-} Determine the gradient of the graph.

.....

.....

j) State two methods other than the method used in this practical to identify the resonance of the tuning fork and the sonometer wire.

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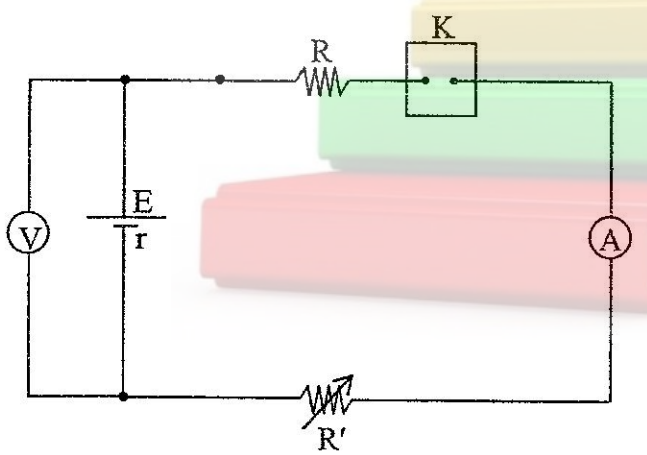
k) Draw the graph in above axes in part (h) for a sonometer wire which is having the two times linear density than the wire used in part(g). Name it as x.

(04) An experiment is planned by a student to determine an internal resistance and the electromotive force of a dry cell. The circuit is shown in the following figure.



V - Digital Voltmeter
A - milli ammeter
E - Electromotive force of dry cell
r - internal resistance of dry cell
R - 10Ω resistor
R^{1} - variable resistor

a) Mark the polarities of the voltmeter and the ammeter as + and - which are shown in the figure -01.

b) Write an advantage of using a digital voltmeter in this practical.

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.....

c) What would be used as the variable resistor R^1? (Resistance box or Rheostat)
Write down the reason for your selection.

.....

Reason:- :.....

.....

d) The electromotive force and the internal resistance of the dry cell is E and r respectively. The current drawn by the cell is I, the reading of the voltmeter is V. Write down an expression for V, interms of the given symbols.

.....

.....

e) Re-arrange the variables in the expresson of above part (c) to determine E and r by plotting a graph. Write down the independent and the dependent variable separately.

.....

.....

Independent Variable :– .....

Dependent Variable.:– .....

f) Mension whether a tap key or a plug key should be used as the key K in the above circuit. Write down the reason for your selection.

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g) The co-ordinates of the plotted graph are given below.
(0.00, 1.45), (0.14, 1.05) (1.05, 1.40), (2.00. 0.00)
The range of readings taken for the x- coordinate is from 0.10 to 1.50. By using the given informations,

i) Determine the internal resistance of the dry cell (r).

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.....

ii) Determine the electromotive force (E) of the dry cell.

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h) Write down the reason for using a 10Ω resistor as R in the circuit shown in the figure-(01).

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i) Another student said that if the (A) R and R^1 are exchange each other, no effect for the experiment. Are you agree with that that student? State yes or No. Mension the reason for your selection.

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j) In this practical, R^1 is varied from the highest value to lowest value. State the reason.

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k) Another student is taking the reading of the voltmeter while the switch K is opened. What is meant by that reading taken by him.

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l) A student says that the readings were not correct due to the cell was discharged. How can you assure that the cell was discharged?

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m) If you are asked to design a cell of less discharging and you are allowed to use another cell with the given cell, draw the newly designd cell combination.

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Royal College - Colombo 07

Grade 13

Final Term Test – July 2026

Physics II

01 | E | II

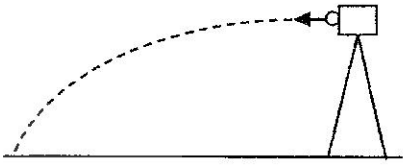
Kosala Pradeep
Physics Teacher
Royal College
Colombo 07.
0718140841

Part B

Answer 4 questions only

5) Obtain an expression for horizontal range (R) of an object projected upward with θ angle to the horizontal using the initial velocity u , gravitational acceleration g and θ angle.

(a) A ball is projected towards a batsman using a cricket bowling machine in an instance of practicing cricket. The batsman hits the ball. The mass of the ball is 200 g. The ball is released from the machine with a velocity of 25 ms^{-1}



(i) What is the initial kinetic energy of the ball?

(ii) The horizontal distance between the machine which emits the ball and the batsman is 5m. What is the kinetic energy of the ball when it reaches the batsman?

(iii) The cricket bowling machine projects the ball by compressing 5 cm by the spring which is inside the machine. What is the spring constant of the spring if the efficiency of the machine is 50%?

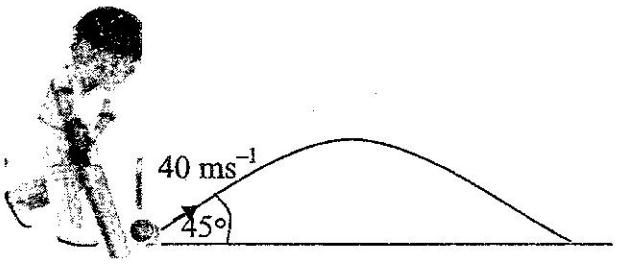
(b) In another instance, the ball of mass 200g reaches the batsman with 20 ms^{-1} horizontal velocity. The batsman hits that ball.

(i) After the ball is struck, if it moves back horizontally at a velocity of 30 ms^{-1} along the same path it was bowled and the time the ball was in contact with the bat is 0.2 s, what is the average force acting on the ball?

(ii) After the ball is struck, if it moves back with a velocity of $10\sqrt{17}$ at an θ angle incline to the horizontal, what is the change in momentum of the ball?

(Take $\tan\theta = \frac{1}{4}$ and $\sqrt{37} = 6.1$)

(c) In a cricket match, a batsman projects a ball at an 45^0 inclined to the horizontal with velocity of 40 ms^{-1} as shown in the below figure.



(i) 1) What is the maximum horizontal range that can be obtained by the ball?

2) Calculate the maximum height attained by the ball.

(ii) When the ball is struck with a velocity of 40ms^{-1} at another inclination, it just touches the top of a flag pole which is $60\sqrt{3}$ m away from the striking point after 3 s. Calculate the height of the flag pole.

(d) When this ball is gently released from the surface of a lake having a depth of 9 m, it takes 3 s for the ball to reach the bottom of the lake. Calculate the effective density of the ball by neglecting the viscosity forces.

6) Astronomical telescopes are used to observe clear and enlarged images of an astronomical objects which are far away without any strain to the eye.

(a) Define the angular magnification (M) of an astronomical telescope.

(b) What is name of the adjustment which you have to do, to form the final image of the telescope at infinity?

(c) Draw a clear ray diagram relevant to the above (b) adjustment by considering the focal length of the lens with the large focal length as f_0 and the focal length of the lens with the small focal length as f_e.

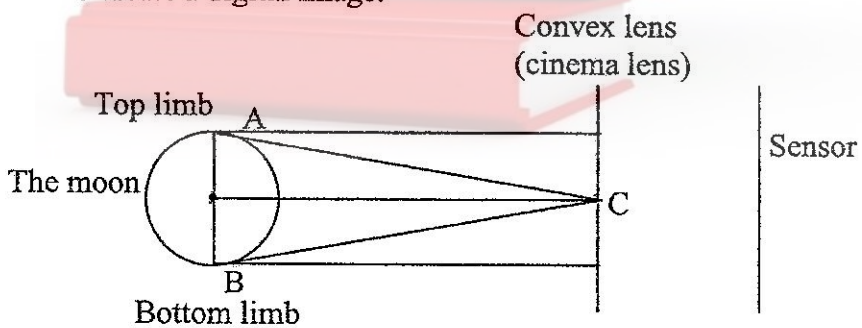
(d) When an astronomical telescope is focused to the infinity the distance between two lenses is 84 cm and the angular magnification is 20.

(i) Find the focal length of each lens.

(ii) Then eye piece is moved is moved 4cm outwards to focus an object distance with less than infinity. Find the object distance and the angular magnification of the image. (Assume that the telescope is adjusted so that the final image is formed at infinity at both instances.)

(iii) Find the angular magnification when the apparatus is adjusted to form the final image at the least distance of distinct vision of the eye (25 cm).

(e) On April 01,2026, NASA successfully launched the historical Artemis II mission, sending the first crewed spacecraft to orbit the Moon. There are no traditional telescopes inside the spacecraft for observing lunar objects. Instead, a highly advanced Navigation Camera (OpNav) with a visual sensor is used. Light rays emitted from the upper and lower limits of the moon travel through the camera lens and the image thus formed is projected onto the sensor. Subsequently, the image processing software of the camera processes the data as required to create a digital image.



(i) By drawing the two rays emitted from the upper part (A) and the lower part (B) of the moon shown in the above figure, determine the position of the moon's image. (copy the figure shown above onto our answer sheet.)

(ii) State one common thing between the image obtained from above part c (i) and an image obtained from an ordinary astronomical telescope.

(iii) Describe in steps how the light reflected from the moon is converted into a digital image.

7) A petrol filling station mechanism ensures that volatile fuels are safely stored, precisely measured and cleanly dispensed to customers without overflowing. Fuel is stored in big underground tanks. Fuel thus stored is supplied to the fuel dispensing machines via rigid tubes.

a) Poiseuille's equation can be used to measure volume velocity (Q) of viscous liquids flowing through rigid tubes under constant pressure.

i) Write down Poiseuille's equation for the flow of a viscous liquid through a tube, identifying the symbols.

ii) State two conditions which Poiseuille's equation is valid.

iii) Obtain an expression for the resultant force (F) acting on the liquid due to the constant ((ΔP) pressure difference using the symbols used in a(i).

iv) From above, find the rate of work (w/t) done using the ((ΔP) pressure difference and the volume flow rate.

b) i) A cylindrical pipe with a radius of 1.5 cm and a length of 2 m is connected to the pump which dispense fuel to vehicles. The pump maintains a pressure difference of 25 kPa across the hose at daytime. If the dynamic viscosity coefficient of petrol at room temperature is 6.0×10^{-4} Pas. Calculate the volume flow rate through the hose assuming the laminar flow and the hose is a straight one. Take $\pi = 3$.

ii) If the efficiency of the fuel pump is 80%, calculate the power of this fuel pump to supply the fuel with same rate of volume mentioned in above (b) (i).

iii) The pump mentioned in above (b) (i) supply fuel to a fuel tank of capacity 80 m^3. What is the time taken to completely fill this fuel tank?

c) i) In early morning, the dynamic viscosity of fuel increases by 50% compared to its value in day time. Assuming the filling station pump operates at the same pressure difference and uses the same pump mentioned in above (b) (i), the new flow rate will be increase or decrease. Explain the reason.

ii) Find the percentage of rate of flow change.

d) Generally, soil is a complex mixture of minerals such as clay, silt and sand along with organic matter and air. In order to maintain the stability of soil mixed with sand, the water bridges in the order of nanometers forms the cohesive forces in the sands. When digging ground to prepare large tanks for fuel stations, the pores in soil should be considered.

i) Below figure (1) shows a water bridge formed between two spherical sand particles. Consider this water bridge as a water column of height h trapped in a capillary tube.

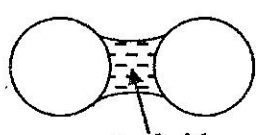


figure (1)

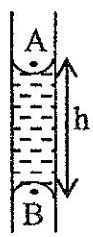


figure (2)

ii) If the radius of upper meniscus is r_1, the lower meniscus is r_2 and the pressures at A and B points are equal to the atmospheric pressure P_0, obtain an expression for the height h of the water bridge using the given symbols.
Take the surface tension of water as T, the contact angle between the sand particles and water as zero, and the density of water as d.

If above $r_1 = 2$ mm, $r_2 = 0.6$ mm, $T = 7.2 \times 10^{-2}$ Nm^{-1}, $d = 1 \times 10^3$ kgm^{-3}, calculate the value of h.

iii) (I) The curvature of the water bridge created between the two sand particles is gradually increasing due to a force acting on the soil layer which is in above to the two sand particles. When the pressure acting on point B remains as the atmospheric pressure (P_0), the pressure at the point A is increased, calculate the needed maximum pressure difference (ΔP) at A to break the lower meniscus of the water bridge. Use the above figure (2). Consider the radius of the tube as r.

(II) Considering that the radius of the tube $r = 3 \times 10^{-3}$mm, atmospheric pressure $= 1 \times 10^5$ Nm^{-2}, surface tension of water $= 7.2 \times 10^{-2}$ Nm^{-1}, density of water $= 1000$ kgm^{-3}. Find the pressure difference that should occur at the upper meniscus in order that lower meniscus to break by maintaining the height of the water column derived in d (i) when radius of the upper meniscus $(r_1) = 4 \times 10^{-3}$ mm.

08) +q charge is entered with velocity v to an area of magnetic field of density B as shown in the figure. The path of +q is circular if the magnetic field is adequate.

a) i) Write down an expression for the force acting on the q charge.

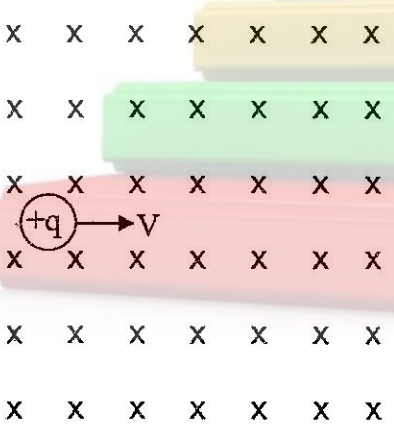


Figure (A)

ii) Obtain an expression for the radius of the circular path.

iii) Find the period of time of the charge and the frequency.

iv) If this charge enters this field with θ angle with the initial direction,

I. Explain the path of the charge.

II. Write an expression for the pitch of the above path.

v) Find the ratio of periods of time between the initial instance and the second instance.

b) Above mentioned charge is moving in a ¼ th of the circular path. The charge is released from the field as shown in figure (B), along the middle line of the two plates having 2a distance between them and the two plates are charged and an electric field E is acting between them. If the charge leaves the plate area from point Y after it moves between the plates during a time interval which equals to the time interval it moves in the magnetic field, write down expressions using m, E, B, q and V for,

(i) a

(ii) d

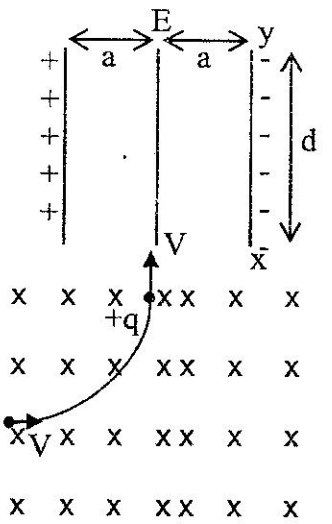


Figure B

c)

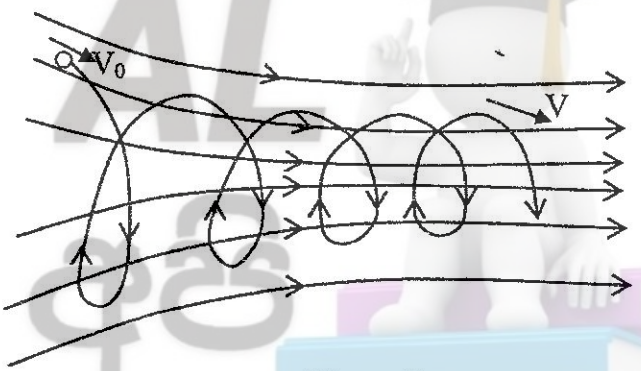


Figure C

The charged particle enters a magnetic field parallel to the magnetic field lines. The magnetic field strength increases gradually. Then the parallel component of the force acting on the charge particle gradually decreases. This situation is called the magnetic mirror. Explain this situation. For that explanation should be consist with,

(i) The change of direction of the velocity of the particle.

(ii) How the shape is created by it.

Answer part (A) or (B) only.

09)(A) Any electrician should have a multimeter. Mainly, using a multimeter a resistance can be measured, a voltage can be measured, and also a current can be measured. There are two types called analog multimeters and digital multimeters. A Digital multimeter is made using electronic circuits and analog multimeter is made using a moving coil meter, the concepts of which were studied under current electricity.

a) A certain moving coil meter has a full scale deflection of current I = 1mA, the full scale deflection angle $\theta = 90°$, the full scale deflection voltage V = 0.1V, Area of the coil $A = 2 \times 10^{-4}\ m^2$, the number of turns N=450, and the magnetic flux density B = 0.1T.

(i) Calculate the value of the torsion constant c of the moving coil.

(ii) Calculate the value of the resistance R_0 of the moving coil.

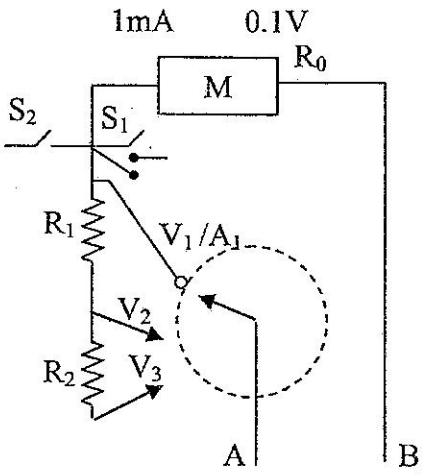
b) Figure shows the circuit of the above mentioned moving Coil is used in a multimeter as a voltmeter of having three ranges. It is given as $R_1 = 900\Omega$ and $V_3 = 20V$. S is opened.

(i) Calculate the value of V_1.

(ii) Calculate the value of V_2.

(iii) If $V_3 = 20V$, calculate the value of R_2.

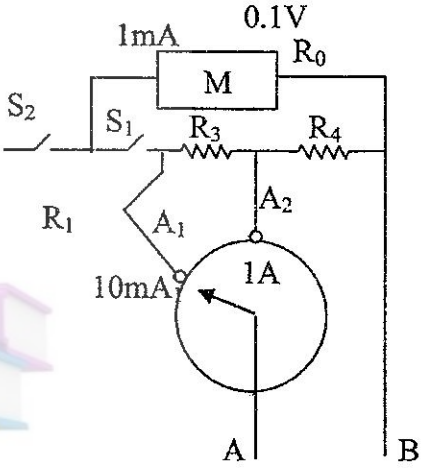
(iv) Two $20k\Omega$ resistors are connected serially with a cell of no internal resistance. When this multimeter is turned to 20V range and the voltage difference across one resistor is measured, the value obtained is 4V. Calculate the current which flowed through the resistor before connecting the voltmeter.



c) The figure shows circuit of the multimeter with above moving coil used to measure only currents in the current range. S_1 switch opens automatically when angle of range is pointed to current range.

(i) Considering the currents flowing across the resistances when using 10MA current range, write down an expression which includes R_3 and R_4 resistances.

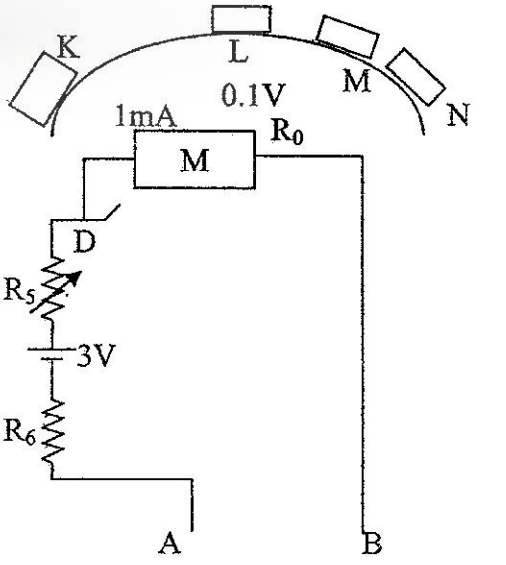
(ii) When using 1A current range, write down an expression for the flowing currents. Find the values of R_3 and R_4 to the nearest one decimal.



d) Figure shows a circuit for the moving coil meter mentioned in above (a) which relates to one range of ohm range. R_5 is a variable resistor of range $0\text{-}1000\Omega$. $R_6 = 1900\Omega$ of fixed resistance.

(i) In an instance of two new batteries of 1.5V connected in series to the multimeter, the zero adjustment should be done before measuring the resistance. Mention how do you do that adjustment. After adjusting, what is the value of R_5?

(ii) After adjusting the zero, when measuring the resistance of a certain Nichrome wire, the index is deflected with half of the full scale deflection (45°). What is the value of resistance measured?



(iii) Another instance, after adjusting the zero, when measuring the resistance, the index is deflected with ¾ of the full scale deflection. What is the value of resistance measured?

(iv) By using the answers obtained above and from your knowledge, write down the resistance values that K, L, M, N should have.

(v) Due to the multimeter being used for a period of time, the total voltage of the two batteries inside it have become 2.4V. Now, the zero adjustment is done before measuring the resistance. Then, what is the resistance value of R_5?

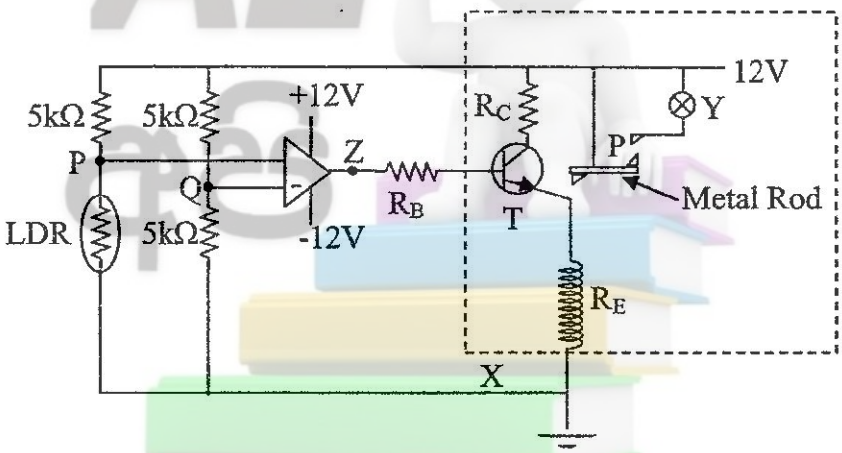
9) **(B)** (a) The security lamp fixed to the main door can be lit by turning on the switch A fixed on that door and the switch B fixed inside the room. Only one the of switches should be turned on to light the bulb. When both switches are in on position or are in off position, the bulb is not lit.

(i) Take the output voltage level as '1' when the bulb is lit and output voltage level as '0' when the bulb is not lit. Construct the truth table relevant to the above process for the input and output.

(ii) Construct the Boolean expression relevant to the above (ii) and draw the circuit symbol.

(iii) Write the name relevant to the above (ii) and draw the circuit symbol.

(b) Below figure shows a light sensitive circuit which is connected to the above security lamp.



(i) Draw a rough sketch for the variation of the light intensity with the resistance of a light sensitive resistor (LDR)

(ii) Which type of operational amplifier is given in the above figure?

(iii) Find the potential at Q in the above figure.

(iv) When the high intensity of light incidents on the light dependent resistor, its resistance is 500Ω and when in dim light, its resistance is 5kΩ and when in darkness its resistance is 15kΩ. Calculate the potential of point P relevant to each instance above.

(v) Write down the equation for the voltage gain A by using the non inverting input voltage V_1, and the inverting input voltage V_2.

(vi) If the value of $A=10^5$, calculate V_2 values of 3 instances relevants to above (b) (iv).

(c) In the above circuit, a spiral wire coil (R_E) is connected to the part marked as X. T represent a Si transistor and Y represent a bulb. R_C=3kΩ, R_E=5kΩ, R_B=100kΩ. Take the current gain as 100.

(i) Explain the purpose of applying R_B resistance.

(ii) Explain the change of current in R_E and in part marked as X according to the change of potential of Z and accordingly explain lighting of the bulb Y.

(iv) When the light incidents and do not incident on LDR according to above (c)(ii), what is the lighting of the bulb Y?

(v) Determine the current through R_B and R_C.

(d) By removing the above part X and the end of R_B is connected to the S end of the SR flip flop.

(i) Write down the truth table of SR flip flop.

(ii) The end R of the SR flip flop is connected to a switch L. This switch can be operated manually. This switch L can be used to disconnect the bulb which is connected to the output of SR flip flop. If the below given instances occur in order, draw the relevant table according to given order by mentioning the input and output of the bulb.

1. L switch is disconnected when in the dark
2. When light incidents L switch is disconnected.
3. When light incidents L switch is connected.

Answer part (A) or (B) only.

10) (A) Due to letting 100 people in to a closed hall which can hold only 75 people, the temperature inside increased instantly. Then the rise of body temperature of these people can be controlled by sweating. The heat needed to evaporate the sweat is provided by the body and therefore the body temperature will not rise.

(a) When a person of average mass 100 kg is in this closed hall talking, the rate of energy produced is 200W. The average body temperature of this person is 37^0C and the average specific heat capacity of the body is 3600 $Jkg^{-1}k^{-1}$

(i) Write down an expression for heat absorbed ΔQ by an object of specific heat capacity C and mass m when the temperature of the object is increased by Δθ.

(ii) What is the amount of heat produced by this person during one hour of talking inside the hall?

(iii) Calculate the temperature rise of the body during this one hour period if this amount of heat produced is not released from his body as sweat.

(iv) What is the mass of water that should be evaporated in order to release the above heat calculated in (a)(ii)? The specific heat of evaporation of water at body temperature is 2.4×10^6 Jkg^{-1}.

(b) The above person inhales a volume of air $4.5 \times 10^{-4} m^3$ at atmospheric pressure and 27^0C in each breath. The respiratory rate of the person is 20 breaths per minute. After one breath he exhales a volume of air $4.65 \times 10^{-4} m^3$ at atmospheric pressure from his lungs to outside. The volume of the hall in which all 100 persons above are in is $300 m^3$. Consider that the density of air inside the hall at room temperature 27^0C is $1.2 kgm^{-3}$ and 100 persons are inside this hall during one hour time duration.

(i) Determine the temperature of air exhaled out by the lungs at atmospheric pressure after each breath inhaled.

(ii) If the density of exhaled air released by lungs at atmospheric pressure is $1.15\ kg^{-3}$, calculate the mass of exhaled air released by all 100 persons during a period of one hour.

(iii) If the specific heat capacity of exhaled air is $1150\ J\ kg^{-1}\ K^{-1}$, calculate the heat energy released to the hall by exhaled air.

(iv) If the rate of heat energy produced by the body due to metabolism is 10W, calculate the amount of heat energy produced by these 100 people.

(v) What is the total heat energy added to this closed hall due to the exhaled air and the metabolism of human bodies?

(vi) What is the mass of air at 27^0C temperature existing in this closed hall?

(vii) What is the amount of temperature increase of this closed hall due to the calculated total heat energy in above part (b) (v)? Specific heat capacity of air existing in this hall is $1000\ Jkg^{-1}K^{-1}$.

(c) When people are not in this closed hall, the temperature inside this hall is 30^0C and the relative humidity is 75%. At 30^0C absolute humidity of saturated vapour pressure of water is $30gm^{-3}$.

(i) What is the mass of water vapour existing inside this hall?

(ii) Now, if all 100 people enter this closed hall, calculate the mass of water vapour released by them using the above calculation of the water vapour mass released by one person in part (a) (iv) and determine the total mass of water vapour present in the hall.

(iii) Due to the increase of number of persons inside this hall, the temperature inside this hall is decreased up to 20^0C using air conditioners and the water vapour mass removed by these air conditioners is 32250g. What is the relative humidity inside this hall at 20^0C? Absolute humidity of saturated water vapour at 20^0C is $20gm^{-3}$.

(10)(B) Several conclusions can be arrived at by studying quantitatively and qualitatively the radiation of heat emitted by an object that have been heated to a high temperature. Scientists such as Boltzman, Stephan, Wein and Max Planck have conducted experiments regarding radiation emission and absorption and found Laws regarding them.

a) i) Explain that what is a black body.

ii) Write down an expression for the effective rate of radiation of an object at absolute temperature T having placed an environment of an absolute temperature T_0 ($T > T_0$) according to the Steffan's Law related to the black body radiation. Take the Stefan constant as σ.

iii) Find how much wave length is taken from the rate of emitted radiation at two instances of absolute temperatures T_1 and $T_2(T_2 > T_1)$ of the heated object above. Draw in the same graph by showing the intensity of radiation versus the wave length (Name the relevant graphs for T_1 and T_2 separately.)

iv) Write down three fundamental characteristics or properties regarding the radiation emission according to the above intensity distribution graphs.

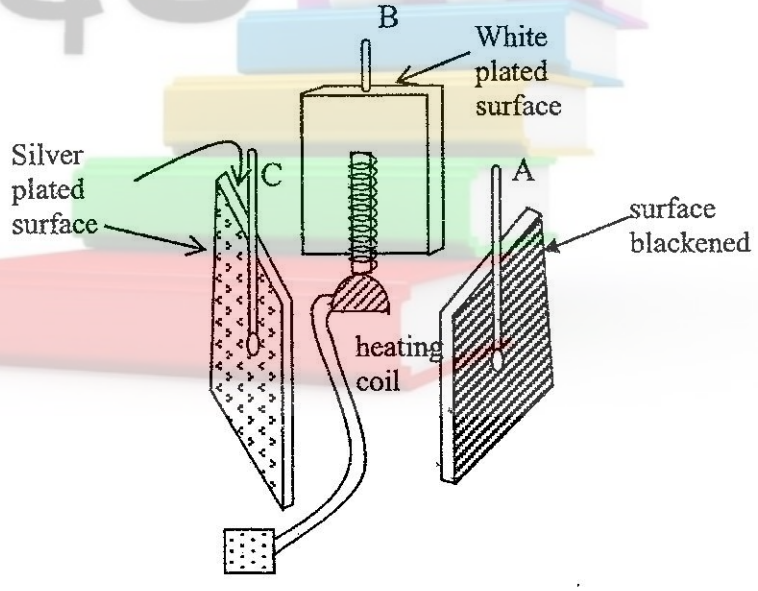
v) When the temperature of the heated object is 2000K, the wave length of the most emitted radiation of the radiation emitted intensity is 500 nm. What is the wave length of the most emitted radiation, when the temperature of it is increased to 2500K?

vi) A mathematical theory is constructed for the practical curve in (a) (iii). Wein and Rayleigh Jeans are two scientists who forwarded theories closely relevant to the practical curve.

a) Weins law with practical curve and

b) Rayleigh-Jeans law with practical curve match with which part. Show using graphs (For this you have to choose one of the graphs drawn for T_1 or T_2 temperatures).

b) Heated metal surfaces can be done both radiation emission and radiation absorption. It can be shown practically that this will depend on the factors of the nature of the surface, area of the surface and the temperature of the surface. Below figure is a rough sketch of an experiment done by a student to show that the surface heat absorption changes with the nature of the surface.



All plates above have equal areas and are placed equidistance from the heating coil. Reading of thermometers connected to the plates, before the switch of the coil is turned on and 10 minutes after the switch is turned on are marked on a table.

	Temperature before the switch is turned on (°C)	Temperature 10 minutes after the switch is turned on (°C)
1)	19	21
2)	19	29
3)	19	23

i) Out of the above named 1, 2, and 3, which plate shows the readings of A.

ii) Which of the below mentioned quantities can be explained from the above experiment that they are affected or not affected for the radiation absorption.

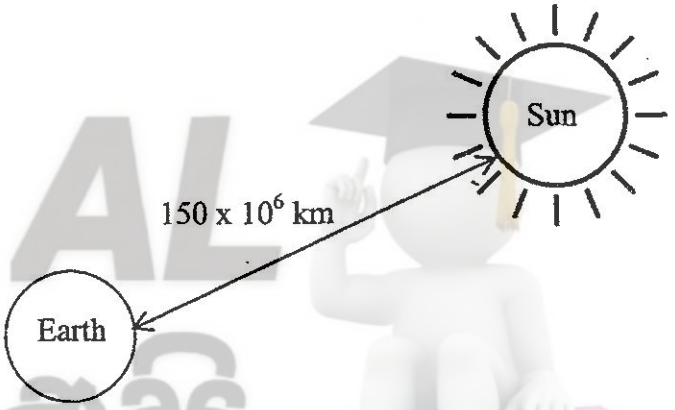
a) The distance between the heating coil and the plates.

b) The power of the heating coil.

c) The temperature before switching on the heating coil.

d) Type of the plates.

c)



By the experiments, it has been found that, when the solar energy incidents on earth the solar constant on earth's surface is 1400 Wm^{-2}.

i) Explain what is meant by the solar constant.

ii) If the distance between the earth and the sun is 150×10^6 km, calculate the power of the solar radiation emission of the sun. (Assume from the total radiation emission of sun, 79.2% is emitted as the heat radiation.) When doing simplification assume the radii of the sun and earth are small.

iii) From the above calculated power of the sun, in (c) (ii) what is the surface temperature of the sun? (Take the Average radius of the sun as 7×10^5 km, the Stefan constant as 5×10^{-11} Wm^{-2} K^{-4} and $(88)^{1/4}=3$.)