G.C.E. A/L Examination June - 2016

Conducted by Field Work Centre, Thondaimanaru
In Collaboration with
Zonal Department of Education Jaffna.

FWC

Grade :- 13 (2016)	Physics - I	*Time :- Two hours*

01) $hf = A + BV^2$ In this equation, if h is the Planck constant, f is frequency and V is velocity, then A, B respectively denote

(1) force, mass

(2) energy, mass

(3) frequency, energy

(4) work, frequency

(5) force, frequency

02) What is the intensity of heat radiation (in Wm^{-2}) at a point 1m from a point that radiates heat at a rate of 50W?

(1) $\frac{25}{2\pi}$ (2) $\frac{25\pi}{2}$ (3) 25π (4) $\frac{25}{\pi}$ (5) 50π

03) The ratio between the amplitudes of two waves is 9:1. What is the ratio between the maximum and minimum sound intensities caused by the interference of these two waves?

(1) $10 : 8$ (2) $9 : 1$ (3) $25 : 16$ (4) $2 : 1$ (5) $1 : 2$

04) A man watches a stone at the bottom of a water tank from above. If the height of the water column in the tank is h, at what depth will the stone's image be? (the refractive index of water is n)

(1) h (2) nh (3) $\frac{h}{n}$ (4) $\frac{n}{h}$ (5) $(n+1)h$

05) The length of an iron rod in a Kundt's tube is 1m. If the frequency of the standing wave formed here is 2500Hz, what is the speed of sound in the iron rod?

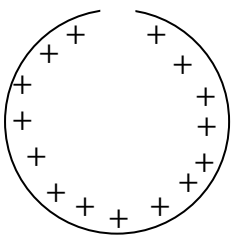
(1) $1250\ m\ s^{-1}$ (2) $2500\ m\ s^{-1}$ (3) $5000\ m\ s^{-1}$

(4) $10\ 000 m\ s^{-1}$ (5) $1000\ m\ s^{-1}$

06) The ratio of turns in the coils of a step up transformer is 250:1. This transformer has 90% efficiency. If the current through the primary coil is 250A, what is the current through the secondary coil?

(1) $0.09\ A$ (2) $0.18\ A$ (3) $0.9\ A$ (4) $1.0\ A$ (5) $9\ A$

07) A ring of charge with radius 0.5m has 0.002π m gap. If the ring carries a charge of +1 C, the electric field at the center is $\left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm^2C^{-2}\right)$



(1) $7.5 \times 10^7 NC^{-1}$

(2) $7.2 \times 10^7 NC^{-1}$

(3) $6.2 \times 10^7 NC^{-1}$

(4) $6.5 \times 10^7 NC^{-1}$

(5) $5.5 \times 10^7 NC^{-1}$

08) Which of the following statements about Ultrasound is not true?

(1) It moves with the velocity of sound.

(2) It has a higher frequency than normal sound.

(3) It cannot be heard by human ears.

(4) It has a lower wavelength than normal sound.

(5) It does not cause Doppler Effect.

09) The figure shows a uniform, solid, right circular cone kept in equilibrium with its vertex touching a horizontal surface. This equilibrium is unstable. Which of the following statements is not suitable to explain this?

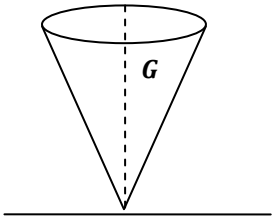
(1) The position of the center of gravity is higher.

(2) The cone is symmetrical about its axis.

(3) The narrow part is kept in contact with the surface.

(4) Its potential energy is at a higher level.

(5) The couple which acts when the cone inclines slightly, will topple it



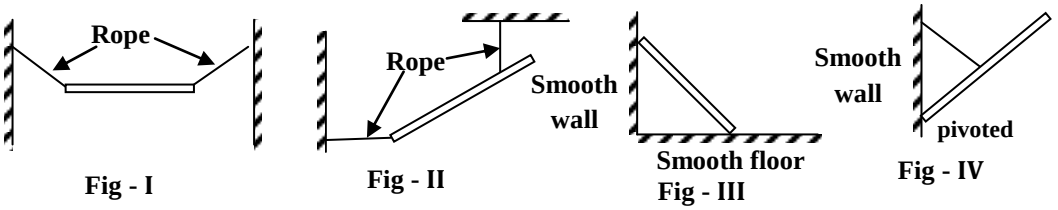
10) A driller with a power of P W is used to drill a hole in a copper block of mass M kg. The specific heat capacity of copper is S $Jkg^{-1}K^{-1}$. 40% of the power is used to heat up the drill. What is the rise in temperature of the copper block at time T s?

(1) $\frac{0.6PT}{MS}$ (2) $\frac{0.6P}{MST}$ (3) $\frac{0.4PT}{MS}$ (4) $\frac{0.4\,P}{MST}$ (5) $\frac{0.4PTS}{M}$

11) A sine alternating current with peak value I_0 flows through resistor R. What is the rate at which heat is produced in the resistor R?

(1) $2I_0^2R$ (2) $2I_0^2$ (3) I_0^2R (4) $\frac{I_0^2R}{\sqrt{2}}$ (5) $\frac{I_0^2R}{2}$

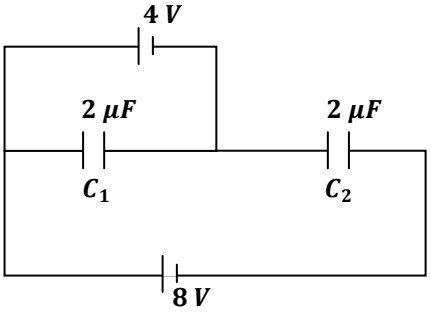
12)



Four positions of a heavy rod of weight w are shown in the above figures. In which of these figures is balance possible?

(1) I, II (2) III, IV (3) II, III (4) I, III (5) I, IV

13)



In the circuit shown in the figure, the charges stored in C_1 and C_2 respectively are,

(1) $8\mu C$, $8\mu C$

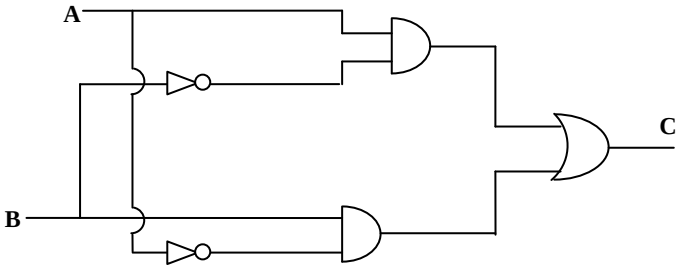
(2) $16\mu C$, $16\mu C$

(3) $8\mu C$, $16\mu C$

(4) $16\mu C$, $8\mu C$

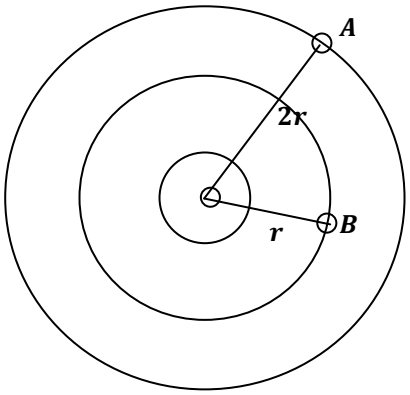
(5) $8\mu C$, $12\mu C$

14) What is the single logic gate that is equivalent to the combination of gates given below?



(1) AND gate (2) OR gate (3) XOR gate (4) NAND gate (5)NOR gate

15)



Two artificial satellites, A and B, revolve around the Earth. The mass and the radius of orbit of A are twice that of B. What is the ratio between the linear velocities $\frac{V_A}{V_B}$?

(1) $\frac{1}{4}$

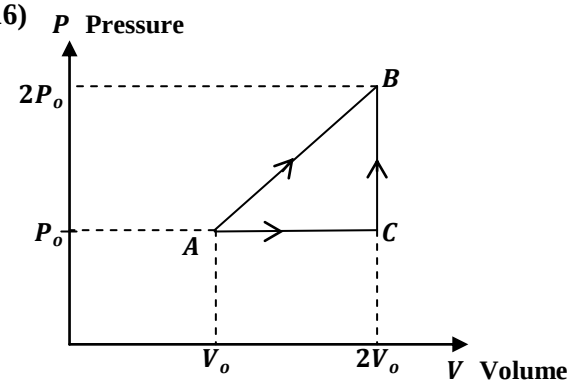
(2) $\frac{1}{2}$

(3) $\sqrt{2}$

(4) $\frac{1}{\sqrt{2}}$

(5) 1

16)



1 mol of a monatomic ideal gas is taken from A to B through path ACB. If the temperature at A is T_0, what is the amount of heat absorbed by the gas during the process$A \to C \to B$? (for a monatomic gas, $C_P = \frac{5}{2}R$ and $C_V = \frac{3}{2}R$)

(1) $\frac{9RT_0}{2}$ (2) $\frac{5RT_0}{2}$

(3) $\frac{11RT_0}{2}$ (4) $\frac{15RT_0}{2}$

(5) $\frac{17RT_0}{2}$

17) Two balls, A and B are thrown from the same spot at the same time. A is thrown vertically upwards, while B is thrown with an angle of 30^o from the vertical. If the two balls reach the ground at the same time, what is the ratio between the velocities with which each ball, A, B, is thrown?

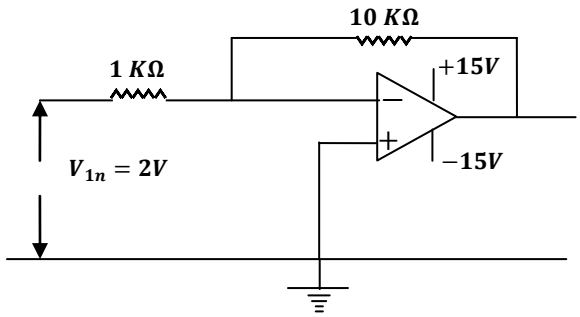
(1) $\sqrt{3} : 1$ (2) $1 : \sqrt{3}$ (3) $\sqrt{3} : 2$ (4) $2 : \sqrt{3}$ (5) $1 : 1$

18) A ring of radius r and mass m, which is made from a thin wire, is placed horizontally within a liquid of surface tension T. What is the minimum force required to tale this ring out through the liquid surface? (the contact angle is zero)

(1) $mg - 2\pi rT$ (2) $mg + 2\pi rT$ (3) $mg + 4\pi rT$

(4) $mg + \pi r^2 T$ (5) $mg + 2\pi r^2 T$

19)

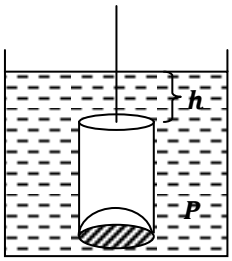


The operational amplifier shown in the diagram works with a supply of +15V - -15V. What is the output voltage, V_{out}, of the circuit?

(1) $+15V$ (2) $-15V$ (3) $+20\,V$

(4) $-20V$ (5) $+2\,V$

20)



A hemispherical portion has been removed from a solid cylinder of radius r. the mass and volume of the remaining part of the cylinder is m and v respectively. As shown in the figure, this cylinder is held by a string in a liquid of density ρ, with its upper surface at depth h. What is the force exerted by the liquid on the lower surface of the cylinder?

(1) mg

(2) $mg - vpg$

(3) $mg + \pi r^2 hpg$

(4) $vpg + \pi r^2 hpg$

(5) $vpg - \pi r^2 hpg$

21) If the wavelength of maximum intensity of the sun's radiation is 510nm and that of another star is 350nm, what is the ratio between the surface temperatures of the sun and the other star?

(1) 1.46 (2) 0.69 (3) 1.21

(4) 0.83 (5) 2.43

22) A compound microscope has two converging lenses of focal length 3cm and 5cm. A man with least distinct vision at 25cm observes an object kept 4cm in front of the objective. The microscope is adjusted so that the final image is at infinity. What is the separation of the lenses?

(1) $12\ cm$

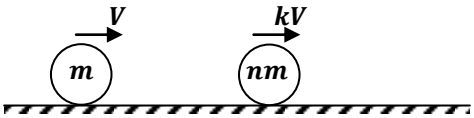
(2) $17\ cm$

(3) $8\ cm$

(4) $\frac{161}{2}\ cm$

(5) $25\ cm$

23)

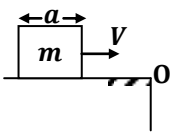


Sphere A of mass m, moving with velocity V, collides with sphere B of mass nm, travelling in the same direction with velocity kV. After the collision, if sphere A comes to rest, what is the velocity of sphere B?

(1) $\left(\frac{n}{1+nk}\right)V$ (2) $\left(\frac{1+nk}{n}\right)V$ (3) $\left(\frac{1-nk}{n}\right)V$

(4) $\left(\frac{n}{1-nk}\right)V$ (5) $\left(\frac{nk}{1+n}\right)V$

24)

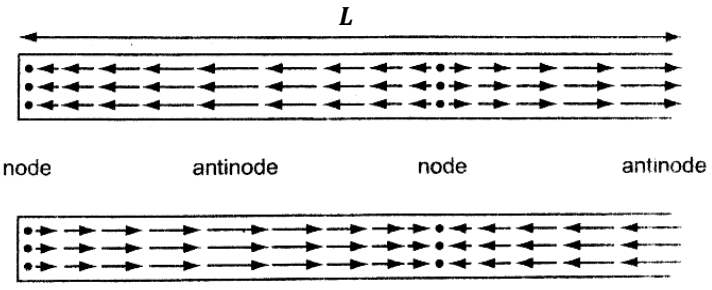


A cube of side length a, moves with velocity V, along a smooth horizontal surface, as shown in the figure. It collides with an obstacle at point O. What is the angular velocity of the block after the collision? (The moment of inertia of the block about a perpendicular to plane horizontal axis through one of its vertex is $\frac{2}{3}ma^2$)

(1) $\frac{3V}{4a}$ (2) $\frac{3V}{2a}$ (3) $\frac{\sqrt{3}V}{\sqrt{2}a}$

(4) $\frac{\sqrt{3}V}{2a}$ (5) 0

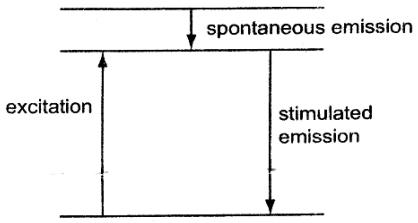
25) The diagrams show particle movement in an air column when a stationary wave exists in the column. The first diagram shows the displacement of some particles at one instant and the second diagram shows the displacement of particles half a cycle later.



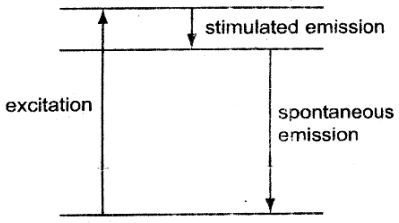
What is the length L if the column in terms of the wavelength λ, and at which position within the column does the pressure change by the largest amount?

	Length L	**maximum pressure change at**
(1)	$\frac{3}{4}\lambda$	node
(2)	$\frac{3}{4}\lambda$	antinode
(3)	$\frac{3}{2}\lambda$	node
(4)	$\frac{3}{2}\lambda$	antinode
(5)	$\frac{1}{2}\lambda$	antinode

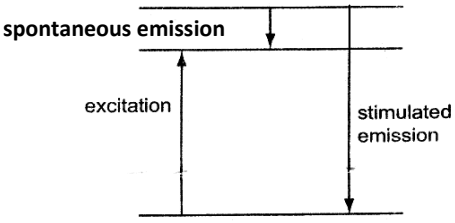
26) In a helium-neon laser, helium atoms collide with neon atoms and excite them. This produces a population inversion which allows stimulated emission. Which neon energy level diagram correctly shows the excitation of the neon atoms by the helium atoms, the spontaneous infra-red emission from the neon, and the stimulated emission of red light?



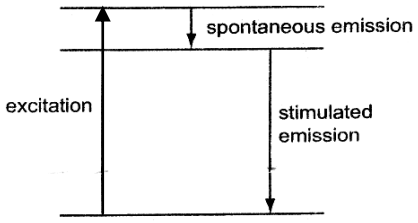
(1)



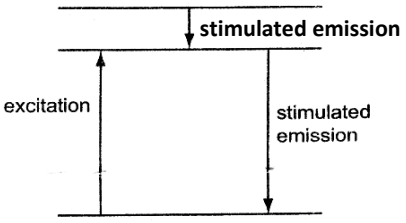
(2)



(3)

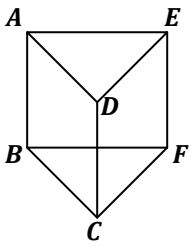


(4)



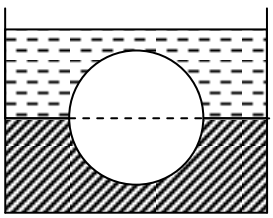
(5)

27) In a prism shaped network made of nine conductors, each having 5Ω resistance, what is the equivalent resistance between the point A and B?



(1) 2 Ω
(2) 15 Ω
(3) 12 Ω
(4) 4 Ω
(5) 3 Ω

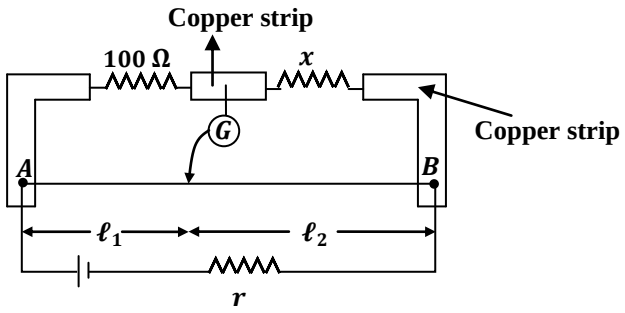
28)



The figure shows a metal ball of volume 400cm^3, floating in a mercury-water interface in a vessel. Half of the ball is immersed in mercury. What will happen if liquid X, with density 9400kgm^{-3} is poured into this vessel? (The density of mercury is 13600 kgm^{-3} and that of water is 1000 kgm^{-3})

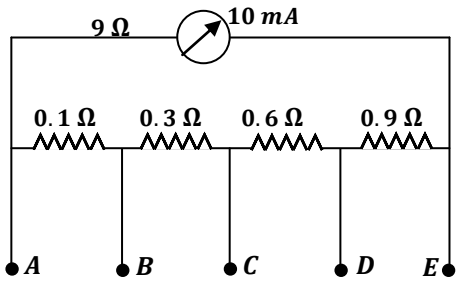
(1) The ball will float with 300 cm^3 in liquid X and 100 cm^3 in mercury.
(2) The ball will float with 300 cm^3 in liquid X and 100 cm^3 in water.
(3) The ball will float with 100 cm^3 in liquid X and 300 cm^3 in water.
(4) The ball will float with 200 cm^3 in liquid X and 200 cm^3 in water.
(5) The ball will float with 200 cm^3 in liquid X and 200 cm^3 in mercury.

29) In a practical Wheatstone bridge circuit, when one more resistance of 100Ω is connected in parallel with unknown resistance x, then the ratio of $\frac{l_1}{l_2}$ becomes 2. l_1 is the balance length. AB is a uniform wire. Then the value of x must be



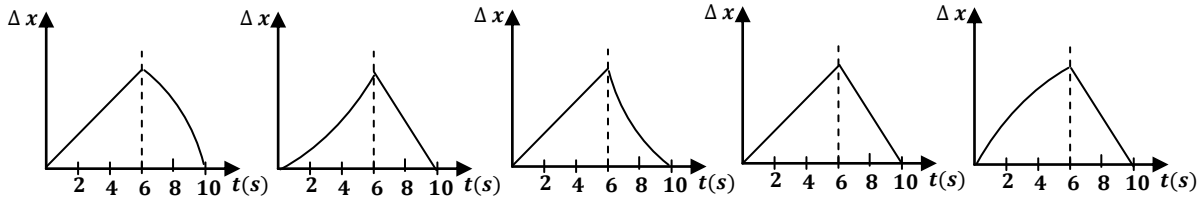
(1) $50\ \Omega$ (2) $100\ \Omega$ (3) $200\ \Omega$ (4) $400\ \Omega$ (5) $50\ \Omega$

30) A milli-ammeter of range 10mA and resistance 9Ω is joined in a circuit as shown in the figure. The meter gives full scale deflection, when current in the main circuit is I, and A and D are used as terminals. The value of I is



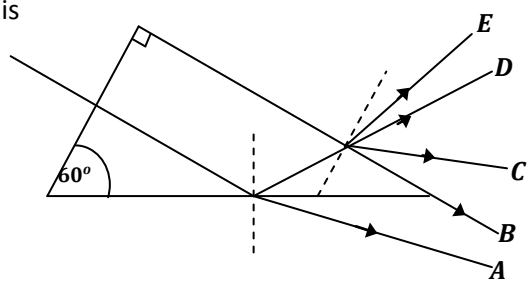
(1) $1.09\ A$ (2) $0.9\ A$ (3) 0 (4) $0.109\ A$ (5) $100\ mA$

31) Two stones are thrown vertically upwards at the same time with velocities u_1, u_2 ($u_2 > u_1$). They reach the ground in 6s and 10s respectively. Which graph shows the change of difference in displacement, Δx, of the two stones during the journey with time? Consider that the stones do not bounce on hitting the ground.



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

32) The figure shows a light ray entering normal to a surface of a glass right prism, of which one angle is 60^o. the emergent ray is



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

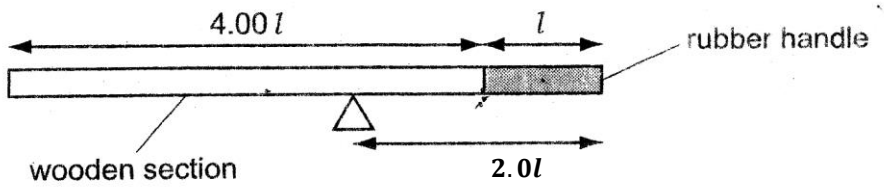
33) A bungee jumper has 24kJ of gravitational potential energy at the top of his jump. He is attached to an elastic rope which starts to stretch after a short time of free fall. The values of gravitational potential energy, elastic potential energy and kinetic energy are given for the top and bottom of the jump.

	Gravitational potential energy (kJ)	**Elastic potential energy (kJ)**	**Kinetic energy (kJ)**
Top	24	0	0
Bottom	0	24	0

Which row of the table below shows possible values of these three energies when the jumper is halfway down? Losses of energy through air resistance are negligible.

	Gravitational potential energy (kJ)	**Elastic potential energy (kJ)**	**Kinetic energy (kJ)**
(1)	12	10	2
(2)	12	8	4
(3)	8	8	8
(4)	12	2	10
(5)	12	9	3

34) As shown in the figure, a uniform rod has a wooden section and a solid rubber handle. The length of the handle is l and the length of the wooden section is 4 l. The rod balances at a distance of 2 l from the rubber end. What is the ratio between the densities of rubber and wood?



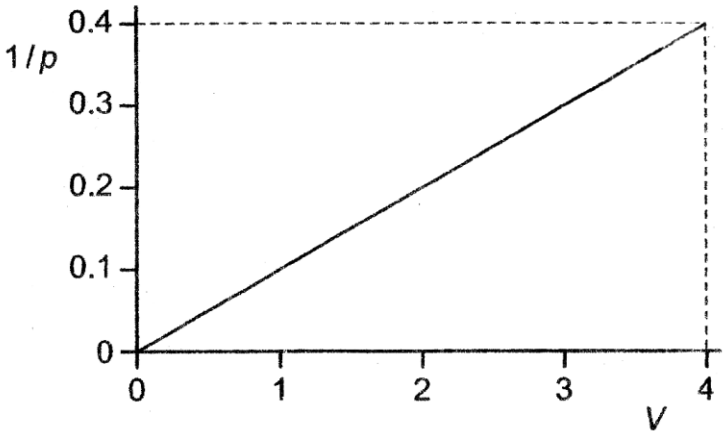
(1) 1 : 1 (2) 2 : 3 (3) 8 : 3
(4) 4 : 1 (5) 1 : 5

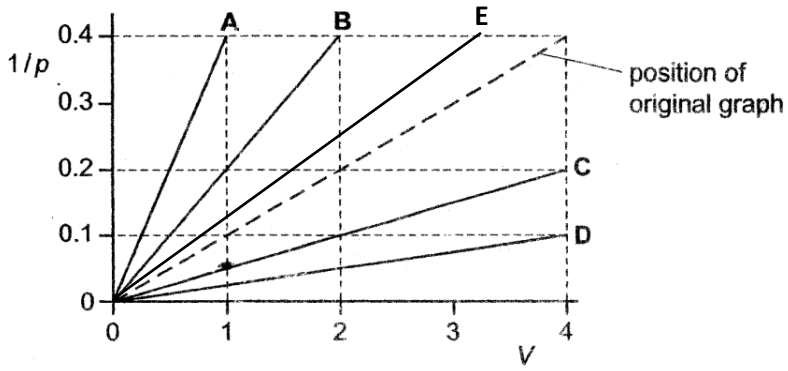
35) The least distance of distinct vision of an old man is 60cm. He can see distant objects clearly. If the distance between his eye lens and retina is 3cm, what is the least focal length that his eye lens can achieve?

(1) $\frac{10}{7}$cm (2) $\frac{20}{7}$cm (3) $\frac{30}{7}$cm

(4) $\frac{40}{7}$cm (5) $\frac{50}{7}$cm

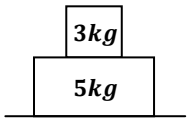
36) A fixed amount of ideal gas has pressure P and volume V. The graph shows the variation of $\frac{1}{P}$ with V at a constant temperature. The amount of gas and the thermodynamic temperature are both doubled. Which line will be produced?





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

37)



Two blocks of masses 5kg and 3kg, are placed on a horizontal surface as shown in the figure. The coefficient of friction between the two blocks is 0.5. The coefficient of friction between the 5kg block and the surface is 0.7. What is the maximum horizontal force that can be applied to the 5kg block, so that the two blocks move without sliding against each other?

(1) $4\ N$ (2) $6\ N$ (3) $24\ N$ (4) $48\ N$ (5) $96\ N$

38) A, B, C, D, P and Q are points in a uniform electric field. The potentials at these points are $V(A) = 2V, V(P) = V(B) = V(D) = 5V$, and $V(C) = 8V$. Find the electric filed at P.

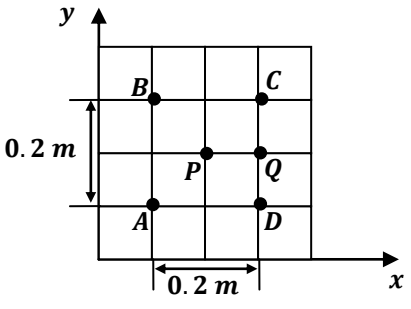
(1) $15\ Vm^{-1}$

(2) $15\sqrt{2}\ Vm^{-1}$

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

(4) $30\sqrt{2}\ Vm^{-1}$

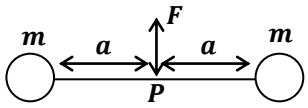
(5) $10\sqrt{2}\ Vm^{-1}$



39) A small lead ball falls through a liquid with a speed of 10 cm s^{-1}. If the liquid exerts an upward force on the ball that is equal to its effective weight. What is the speed with which the ball will move up?

(1) $10\ cm\ s^{-1}$ (2) $20\ cm\ s^{-1}$ (3) $5\ cm\ s^{-1}$

(4) $15\ cm\ s^{-1}$ (5) $0\ cm\ s^{-1}$.

40) 

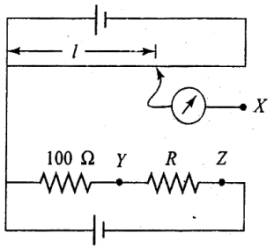
Two particles, each of mass m, are joined by a light, inextensible string of length 2a, as shown in the figure. This system is kept on a smooth surface such that the string remains taught.

A small, constant horizontal force F is applied at the centre of the string, P, causes the two particles to move towards each other. When the distance between the two particles is $2x$, what is the value of acceleration?

(1) $\frac{F}{2m} \cdot \frac{a}{\sqrt{a^2-x^2}}$ (2) $\frac{F}{2m} \cdot \frac{x}{\sqrt{a^2-x^2}}$ (3) $\frac{F}{2m} \cdot \frac{x}{a}$

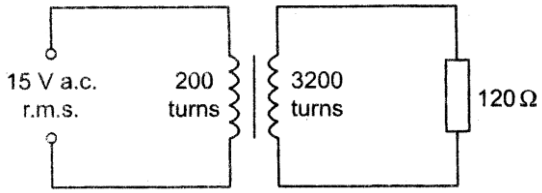
(4) $\frac{F}{2m} \cdot \frac{\sqrt{a^2-x^2}}{x}$ (5) $\frac{F}{2m} \cdot \frac{\sqrt{a^2-x^2}}{a}$

41) The figure shows a circuit that may be used to compare the resistance R of an unknown resistor with a 100Ω standard. The distances l from one end of the potentiometer slider wire to the balance point are 400 mm and 588 mm when X is connected to Y and Z respectively. The length of the slider wire is 1.00 m. What is the value of resistance R?



(1) 32 Ω (2) 47 Ω (3) 68 Ω (4) 147 Ω (5) 188 Ω

42) The primary coil of an ideal transformer has 200 turns and is connected to a 15V r.m.s supply. The secondary coil has 3200 turns and is connected to a resistor of resistance 120Ω, as shown in the diagram. What are the possible values of the secondary voltage, the secondary current and the mean power dissipated in the resistor?



	Secondary voltage (V r.m.s)	Secondary current (A r.m.s)	Power dissipated at the resistor (W)
(1)	24	0.020	4.8
(2)	24	0.20	48
(3)	240	0.50	120
(4)	240	2.0	480
(5)	240	1.0	480

43) $3/5^{th}$ portion of a glass vessel is filled with mercury. The coefficient of volume expansion of the glass and mercury are $9\times10^{-6}\ {}^{o}C^{-1}$ and $18\times10^{-5}\ {}^{o}C^{-1}$, respectively. The coefficient of apparent volume expansion of mercury is

(1) $17.1 \times 10^{-5}\ {}^{o}C^{-1}$

(2) $9.9 \times 10^{-5}\ {}^{o}C^{-1}$

(3) $19.5 \times 10^{-5}\ {}^{o}C^{-1}$

(4) $18 \times 10^{-5}\ {}^{o}C^{-1}$

(5) $16.5 \times X10^{-5}\ {}^{o}C^{-1}$

44)

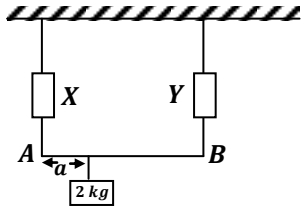


Fig - I

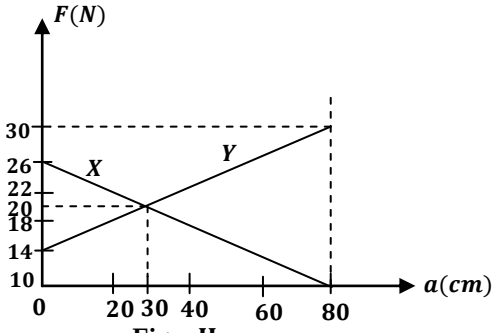
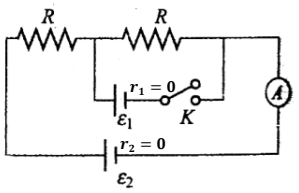


Fig - II

A non-uniform thin rod AB of length 1m and mass 2kg is hung using 2 spring balances as shown in figure (1). When a 2kg mass was hung ɑ distance from A, the two balances showed different readings. The graph shows the readings of X and Y, when the 2kg mass is hung at different values of ɑ while keeping the rod horizontal. The distance of the centre of gravity of the rod from A is

(1) $30\ cm$ (2) $40\ cm$ (3) $50\ cm$ (4) $70\ cm$ (5) $80\ cm$

45) In the given circuit, when key K is open, reading of the ammeter is I. If the key K is closed, which of the following statements are correct?



(1) If $\varepsilon_1 < IR$, reading of the ammeter is less than I.

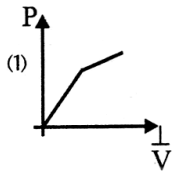
(2) If $IR < \varepsilon_1$, reading of the ammeter is greater than I.

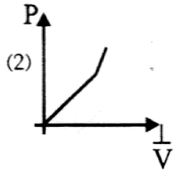
(3) If $\varepsilon_1 < 2IR$, reading of the ammeter will be zero.

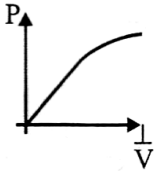
(4) Reading of the ammeter won't change.

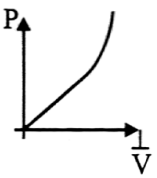
(5) If $\mathcal{E}_1 = 2IR$ reading of the ammeter will be zero.

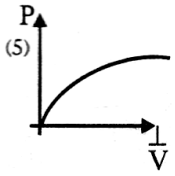
46) A vessel contains a mixture of air and water vapour. at constant temperature its pressure, P, was measured by changing it volume, V. Which graph best represents the P vs $\frac{1}{V}$ curve that was obtained?

(1) 

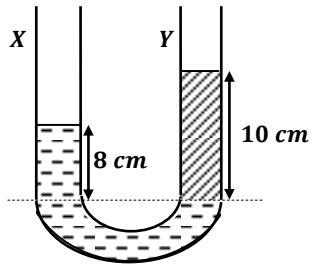
(2) 

(3) 

(4) 

(5) 

47)



A "U" tube containing water and coconut oil is kept in a place with still air, as shown in the figure. (Density of water - 1000 kgm^{-3}, density of coconut oil - 800 kgm^{-3}, density of air - 1 kgm^{-3}) To maintain the liquid levels in the two arms of the "U" tube at the same horizontal level,

(1) Air should be blown horizontally, in the direction into the paper above the arm X with a speed of 20ms^{-1}.

(2) Air should be blown horizontally, in the direction into the paper above the arm Y with a speed of 20ms^{-1}.

(3) Air should be blown horizontally, in the direction into the paper above the arm X with a speed of 10ms^{-1}.

(4) Air should be blown horizontally, in the direction into the paper above the arm Y with a speed of 10ms^{-1}.

(5) Air should be blown horizontally, in the direction into the paper above the arm X with a speed of 5ms^{-1}.

48) A screen and an object are separated by a distance x. When a converging lens is placed between them, the magnification by the lens was m. What is the focal length of the lens?

(1) $\frac{mx}{(m+1)^2}$ (2) $\frac{mx}{(m-1)^2}$ (3) $\frac{(m+1)^2}{mx}$ (4) $\frac{(m-1)^2}{mx}$ (5) $\frac{(2m+1)^2}{mx}$

49) Two hollow spheres, A and B, of the same thickness but made of different materials, are filled with ice cubes. The inner radius of A is twice that of B. When compared to the radius, the thickness of these spheres can be neglected. The ratio between the time taken for the complete melting of ice in A and that in B is 25:16. What is the ratio between the thermal conductivities of A and B?

(1) $25 : 32$ (2) $32 : 25$ (3) $5 : 4$ (4) $8 : 25$ (5) $25 : 8$

50) A sound source placed very far from the observer emits a sound with frequency f. The sound source starts to move towards the observer with a constant acceleration a. A short (just) while after the source starts moving, what is the frequency of the sound perceived by the observer? (the speed of sound in air is v)

(1) $\frac{Vf^2}{2Vf-a}$ (2) $\frac{2Vf^2}{2Vf+a}$ (3) $\frac{2Vf^2}{3Vf-a}$ (4) $\frac{2Vf^2}{2Vf-a}$ (5) $\frac{Vf^2}{Vf-a}$