G.C.E. (Advanced Level) Examination - August 2001

PHYSICS - I

Two hours

Important :

- This question paper includes 60 questions in **fourteen** pages.
- Enter your **Index Number** in the space provided on the answer sheet.
- **Answer all the questions.**
- Instructions are given on the back of the answer sheet. Follow them carefully.
- In each of the questions 1 to 60, pick one of the alternatives (1), (2), (3), (4), (5) which is **correct or most appropriate** and mark your response on the answer sheet **in accordance with the instructions given therein.**

Use of calculators is not allowed.

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

01. eV (electron-volt) is a unit of

(1) power. (2) energy. (3) charge.
(4) voltage. (5) potential difference

02. A sound with intensity 10^{-12} W m^{-2} is defined to have an intensity level of 0 decibels. The intensity level of a sound of intensity 10^{-8} Wm^{-2} is

(1) -40dB (2) 20dB (3) 40dB
(4) 60dB (5) 80dB

03. Two particles A and B have equal momenta, but the velocity of the particle B is four times that of A. The

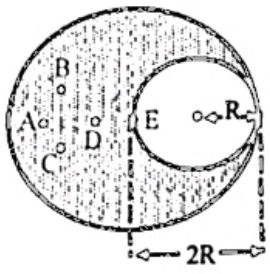
ratio $\frac{\text{kinetic energy of A}}{\text{kinetic energy of B}}$ is

(1) $\frac{1}{4}$ (2) $\frac{1}{2}$ (3) 1

(4) 2 (5) 4

04. A uniform circular plate of radius 2R has a circular hole of radius R sut out of it as shown is the figure. The centre of gravity of the plate with the hole is most likely to be found at.

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



05. Consider the following statements made about infrared, ultraviolet, X-rays, radio waves and gamma rays.

(A) All of them are electromagnetic waves.

(B) All of them travel with the same speed in free space.

(C) Radio waves have the longest wavelength.

Of the above statements

(1) only (A) is true.
(2) only (A) and (B) are true.
(3) only (A) and (C) are true
(4) only (B) and (C) are true
(5) all (A), (B) and (C) are true

06. The mercury column rises in a mercury-in-glass thermometer when the temperature is raised. The most appropriate reason for this is

(1) mercury is a good conductor of heat
(2) glass is a poor conductor or heat
(3) glass expands when heated
(4) glass expands less than mercury when heated.
(5) mercury expands uniformly with rise in temperature.

07. The electriual energy stored in a 1 μF capacitor connected across a 2 V cell is

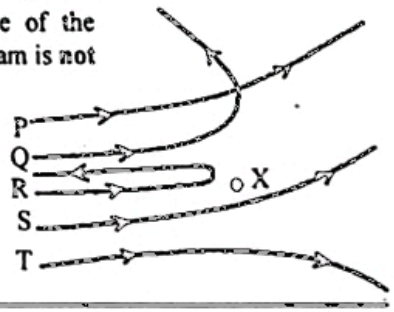
(1) 5×10^{-7} J (2) 1×10^{-6} J (3) 2×10^{-6} J
(4) 4×10^{-6} J (5) 6×10^{-6} J

08. The mass and radius of the earth is M and R respectively. The escape velocity of a rocket of mass m on the earth surface is

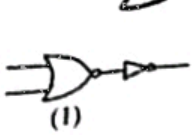
(1) $\sqrt{\frac{2Gm}{R}}$ (2) $\sqrt{\frac{Gm}{R}}$ (3) $\sqrt{\frac{2Gm}{R}}$ (4) $\sqrt{\frac{Gm}{R}}$ (5) $\sqrt{\frac{2GmM}{R}}$

09. A proton is fired at an atomic nucleus (X). Which one of the paths shown in the diagram is not possible for the proton?

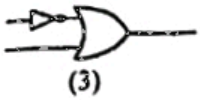
(1) P (2) Q (3) R
(4) S (5) T



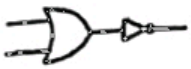
10.  The gate shown in the figure is equivalent to


(1)


(2)


(3)


(4)


(5)

11. In the equation $v^i = ka^js$, V represents the velocity, a represents the acceleration and s represents the displacement. k is a constant and i and j are integers. What should be the values of i and j in order to make the equation dimensionally correct?

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

12. A train travels along a straight track. Another train travels in the same direction behind the first at the same speed. The first train blows a whistle of frequency f_0. If the apparent frequency of the whistle heard by a stationary passenger sitting in the second train is f, then

(1) $f > f_0$ (2) $f < f_0$ (3) $f = f_0$
(4) $f = 2f_0$ (5) $f = 1/2 f_0$

13. A 50 cm long hollow cylindrical tube open at both ends is placed in air. A sound source that produces pure tones is placed adjacent to one end of the tube. The fraquency of the emitted sound is increased gradually starting from a very low value. At a frequency of 320Hz, the tube resonates. The speed of sound in air is

(1) 160 ms^{-1} (2) 320 ms^{-1} (3) 340 ms^{-1}
(4) 360ms^{-1} (5) 640ms^{-1}

14. The velocity of sound in a gas at 27°C is V. The temperature at which the velocity of sound in the gas becomes 2V is

(1) 54°C (2) 108°C (3) 600°C
(4) 927°C (5) 1200°C

15. A convex lens of focal length 25cm is kept in contact with a concave lens of focal length 10cm. The power of the lens combination in diopters is

(1) 4 (2) 6 (3) 10
(4) 14 (5) 15

16. The viscous force acting on a sphere moving in a fluid is

(A) directly proportional to the velocity of the sphere.

(B) dirctly proportional to the mass of the sphere.

(C) inversely proportional to the radius of the sphere.

Of the above statements

(2) only (B) is ...

(3) only (A) and (B) are true

(4) only (B) and (C) are true.

(5) all (A), (B) and (C) are true.

17. A monochromatic ray of light undergoes minimum deviation after passing through a prism. If the angle of deviation produced by one of the prism surfaces is 20°, the angle of minimum deviation of the ray is

(1) 10° (2)20° (3) 30°
(4) 40° (5) 60°

18. A person who is long sighted has near point at 50cm. what spectacles are required for him to view objects comfortably at 25cm?

(1) Converging lens of focal length 100cm

(2) Diverging lens of focal length 100cm

(3) Converging lens of focal length 50cm

(4) Diverging lens of focal length 50cm

(5) Converging lens of focal length 25cm

19. An electric heater is used to raise the temperature of water from 20°C to 30°C and supply hot water at a rate of 1 Kg per minute. The minimum power of the heating element is (specific heat capacity of water = 4200 J kg^{-1} $°C^{-1}$)

(1)7 W (2) 70 W (3) 700 W
(4)4200 W (5) 8400 W

20. Relative humidity inside a closed chamber can be increased by

(A) adding water vapour to the chamber.

(B) by decreasing the temperature inside the chamber.

(C) by decreasing the volume of the chamber.

Of the above statements

(1) only (A) is true.

(2) only (B) is true.

(3)only (A) and (B) are true.

(4) only (B) and (C) are true

(5) all (A), (B) and (C) are true.

21. The equivalent resistance between X and Y in the network of resistances shown is

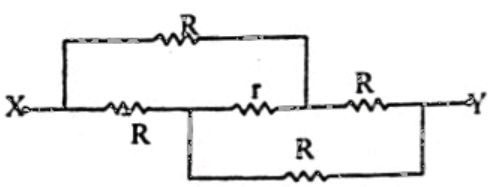
(1) r

(2) R

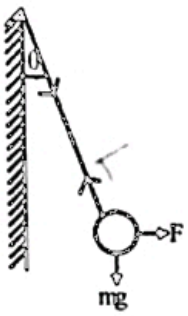
(3) 2R

(4) 2R + r

(5) 4 R + r



22. Anbject of mass m is hung by a string and is kept in equilibrium as shown in the diagram by a horizontal force F. The magnitude of F is



(1) mg tan θ

(2) mg sin θ

(3) mg

(4) mg cos θ

(5) $\frac{mg}{\tan\theta}$

23. Two equal masses *A* and *B* are attached to a light inextensible string passing over a smooth light pulley as shown in the siagram. The mass *B* is moved down, held it stationary and then released it. Which of the follwing statements is correct for the subsequent motion of *B*?

(1) *B* will move back to the original position.

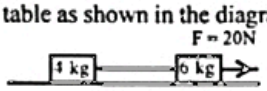
(2) *B* will start to oscillate up and down and come to rest.

(3) *B* will stay stationary.

(4) *B* will start to move downwards.

(5) *B* will start to move upwards.

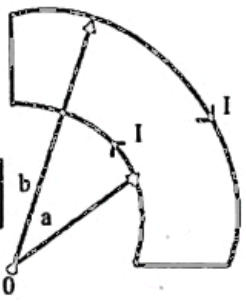
24. Two masses joined by alight string are pulled along a smooth horizontal table as shown in the diagram.



What is the tension is the string joining the masses?

(1) 4 N (2) 8 N (3) 12 N
(4) 20 N (5) 30 N

25. A current I flows around a closed loop as shown in the figure. The magnetic fiux density produced at the cntre *0* is given by



(1) $\frac{\mu_0 I}{2}\left[\frac{1}{a}+\frac{1}{b}\right]$

(2) $\frac{\mu_0 I}{4}\left[\frac{1}{a}+\frac{1}{b}\right]$

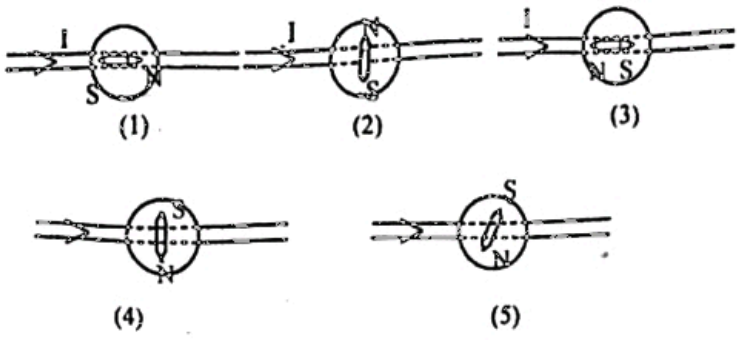
(3) $\frac{\mu_0 I}{8}\left[\frac{1}{a}+\frac{1}{b}\right]$

(4) $\frac{\mu_0 I}{8}\left[\frac{1}{a}-\frac{1}{b}\right]$

(5) $\frac{\mu_0 I}{16}\left[\frac{1}{a}-\frac{1}{b}\right]$

26. A compass is placed on top of a wire as shown in the diagram.

When a large current is passed through the wire, which one of the following diagrams best represents the direction of the compass needle? Neglect the effects due to the earth's magnetic field.



27. Radioactive $^{234}_{90}Th$ nucleus emits some β⁻ emissions followed by an α emission. The resulting nucleus will have.

(1) 86 protons and 140 neutrons

(2) 88 protons and 140 neutrons

(3) 90 protons and 140 neutrons

(4) 90 protons and 142 neutrons

(5) 96 protons and 142 neutrons

28. a fossil is found to be 72,000 years old by carbon -14 dating. If the half life of C is 6,000yrs, the ratio

$$\frac{\text{amount of } {}^{14}C \text{ present in the fossil}}{\text{amount of } {}^{14}C \text{ present in living tissue}} \text{ is}$$

(1) $\frac{1}{2}$ (2) $\frac{1}{2^3}$ (3) $\frac{1}{2^5}$ (4) $\frac{1}{2^{12}}$ (5) $\frac{1}{2^{16}}$

29. An astronomical telescope has an eyepiece of focal length 5cm. At normal adjustment the separation between the eyepiece and the objective is 85cm. The angular magnification of the telescope at normal adjustment is

(1) 90 (2) 85 (3) 80 (4) 17 (5) 16

30. A uniform elastic wire is suspended vertically from the ceiling and a mass is hung from bottom end. Consider the following statements assuming that the proportional limit of the wire is not exceeded.

(A) If the length of the wire is doubled, the strain in the wire doubles.

(B) If the area of cross section of the wire is doubled, the strain in the wire doubles.

(C) If the hung mass is doubled, the strain in the wire doubles.

Of the above statements

(1) only (A) is true. (2) only (B) is true

(3) only (C) is true (4) only (A) and (C) are true

(5) only (B) and (C) are true

31. A steel razor blade can be made to stay on the surface of water. Consider the following statements regarding this.

(A) Staying of the steel razor blade on the surface of water contradicts the Archimed's principle because there is on upthrust acting on the blade.

(B) The steel razor blade is kept on the surface of water by the forces due to the surface tension of water.

(C) Adding soap to water would couse the steel razor blade to sink because soap reduces the surface tension of water.

Of the above statements

(1) only (A) is true (2) only (B) is true

(3) only (C) is true (4) only (A) and (B) are true

(5) only (B) and (C) are true

32.

Air flows through the tube PQ at a constant rate. Two ping-pong balls are levitated in equilibrium above the tiny vertical tubes X and Y through which the air esecapes. The heights of the two balls form the tube at equilibrium are h_x and h_y respectively. Which one of the following statements is true?

(1) If air flows from P to Q, $h_x > h_y$

(2) If air flows from P to Q, $h_x = h_y$

(3) If air flows from P to Q, $h_x < h_y$

(4) If air flows from Q to P, $h_x = h_y$

(5) If air flows from Q to P, $h_x < h_y$

33. An object moves along a horizontal circular path on the inner surface of a smooth conical shaped vessel, as shown in the figure. The force/ forces acting on the object as observed by a stationary observer is/ are

(1) weight of the object only

(2) weight of the object and reaction force normal to the surface only.

(3) weight of the object and centripetal force only

(4) reaction force normal to the surface and centripetal force only.

(5) centripetal force only.

34. A weight W is hung on a tightly fixed rope as shown in the diagram.

The tension in the rope is

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

(3) less than $\frac{W}{2}$ (4) in - between $\frac{W}{2}$ and W

(5) much greater than W

35. A child of mass 20kg is sitting on a swing of negligible mass. The swing is attached to its its pivot points by two ropes, each of 3 m length. The maximum speen of the child during a swing is found to be 3ms^{-1}. The maximum tension in each rope is

(1) 130 N (2) 160 N (3) 200 N

(4) 260 N (5) 300 N

36. A given mass of water is in a calorimeter. When a 90 W heater is immersed in water, the temperature of water increases and comes to a steady value at 35°C. If a 180W heater is used, the steady temperature is 45°C. What should be the room temperature?

(1) 10°C (2) 15°C (3) 20°C

(4) 25°C (5) 30°C

37. If an object is placed on the principal axis 31 cm from a concave mirror the image formed is slightly Smaller than the object. If the object is placed 29cm from the mirror the image formed is slightly larger than the object. The approximate focal length of the mirror is

(1) 7.5 cm (2) 15 cm (3) 28 cm

(4) 30 cm (5) 32 cm

38. A glass cube of side 24cm and refractive index 1.5 contains a small air bubble. When viewed through the block from one side, the air bubbie appears to be 12cm from that side. When viewed from the opposite side, how for will the air bubbie appear from that side?

(1)16 cm (2)12 cm (3) 8 cm

(4) 6 cm (5) 4 cm

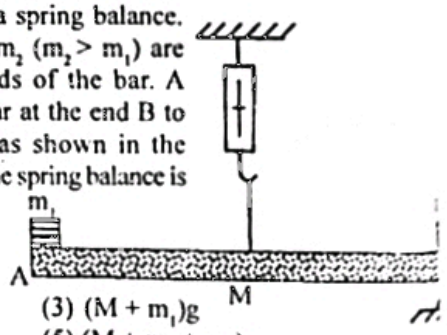
39. A rocket carries 1.8 x 10^4 kg of liquid oxygen in a vertical tank of cross section 3.0m^2. At the lift-off the rocket accelerates vertically upward at 2.0ms^{-2} relative to the earth. The pressure on the bottom of the tank at the lift-off is

(1) 1.2 x 10^3 N m^{-2} (2) 7.2 x 10^3 N m^{-2}

(3) 1.2 x 10^4 Nm^{-2} (4) 6.0 x 10^4 N m^{-2}

(5) 7.2 x 10^4 Nm^{-2}

40. A uniform bar of mass M is suspended from its midpoint by a spring balance. Two masses m_1, and m_2 ($m_2 > m_1$) are placed at the two ends of the bar. A wedge supports the bar at the end B to keep it horizontally as shown in the figure. The reading of the spring balance is



(1) 0

(2) $m_1 g$ (3) $(M + m_1)g$

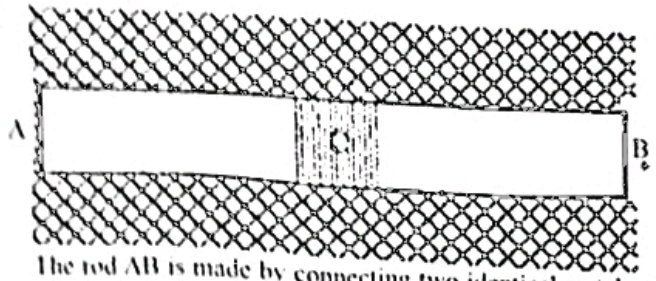
(4) $(M + 2m_1)g$ (5) $(M + m_1 + m_2)g$

41. The frequency of a tuning fork is 256Hz. When it sounded with a sonometer wire, 3 beats per second were heard. When the tension of the wire was reduced, again 3 beats per second were heard. The frequency of the sonometer wire after reducing the tension is

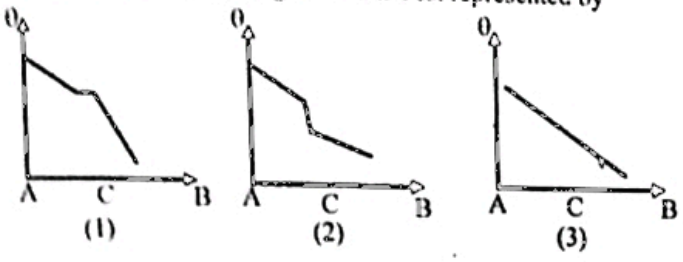
(1) 250 Hz (2) 253 Hz (3) 256 Hz

(4) 259 Hz (5) 262 Hz

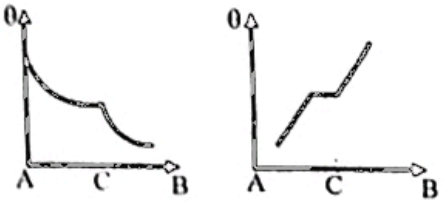
42.



The rod AB is made by connecting two identical metal rode with a thin piece of a poorly conducting material C as shown in the figure. The rod is well lagged except at the two ends. If a steady heat flow in maintained from A to B, the variation of the temperature (0) along the rod is best represented by

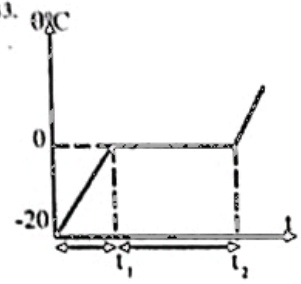


(1) (2) (3)



(4) (5)

43.

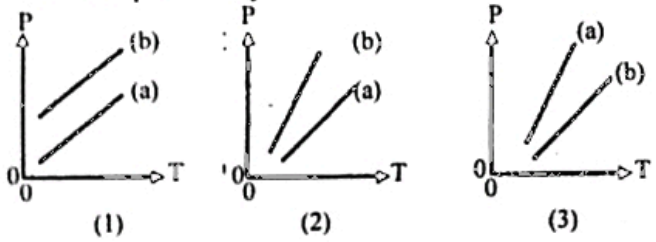


Heat is supplied at a constant rate to a certain amount of ice. The variation of temperature θ with time t is shown in the figure. If the specific heat capacity of ice is C and specific latent heat of fusion of ice is L, $\frac{t_2}{t_1}$ ratio is

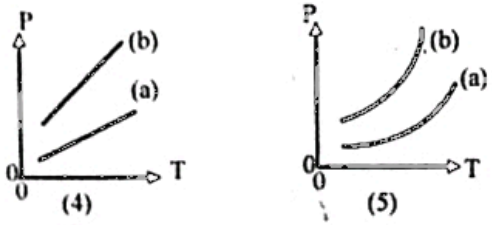
(1) $\frac{L}{C}$ (2) $\frac{C}{L}$ (3) $\frac{20L}{C}$

(4) $\frac{L}{20C}$ (5) $\frac{LC}{20}$

44. An ideal gas is kept inside a rigid container. The another ideal gas is added into the container. The variations of pressure (P) inside the container with the absolute temperature (T) before adding the second gas (a) and after adding the seconde gas (b) are best represented by

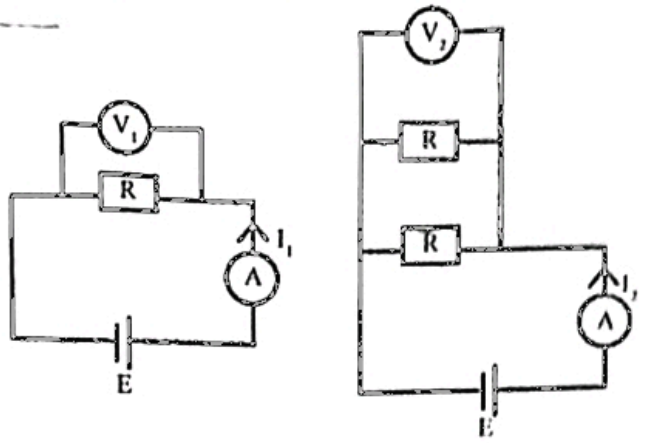


(1) (2) (3)



(4) (5)

45. Consider the following two circuit diagrams. V_1 and V_2 are voltmeter readings and I_1 and I_2 are ammeter readings. If the voltmeters and ammeters are ideal and the internal resistance of the cells are negligible which of the following is true?

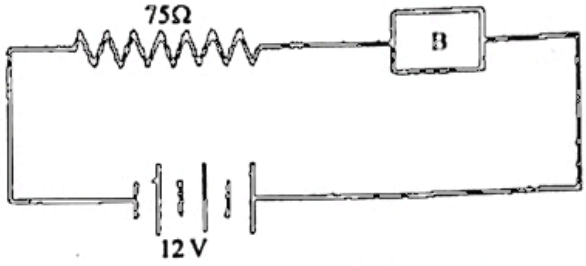


(1) $V_2 = V_1$ and $I_2 > I_1$ (2) $V_2 = V_1$ and $I_2 < I_1$

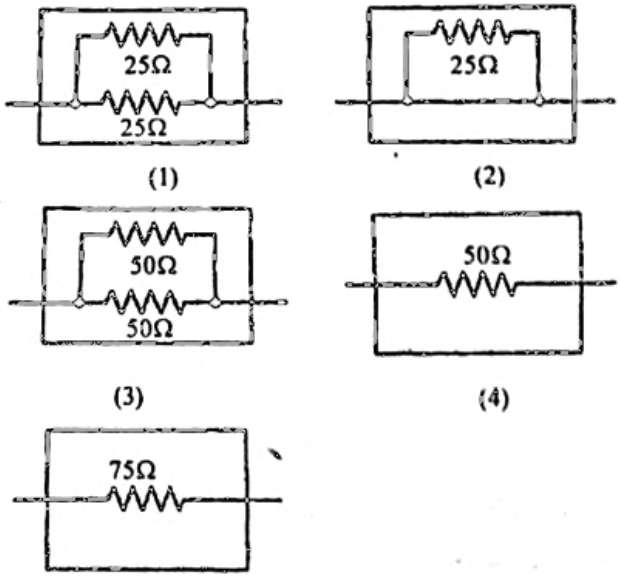
(3) $V_2 > V_1$ and $I_2 > I_1$ (4) $V_2 > V_1$ and $I_2 > I_1$

(5) $V_2 = V_1$ and $I_2 = I_1$

46. A circuit Contains 75 Ω resistor and an unknown resistor/ resistors in a box (B) as shown in the diagram. The internal resistance of the battery is neglible.

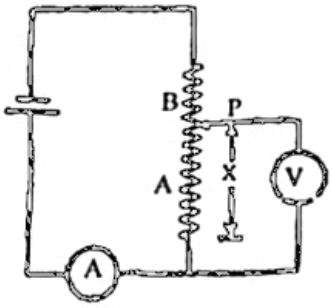


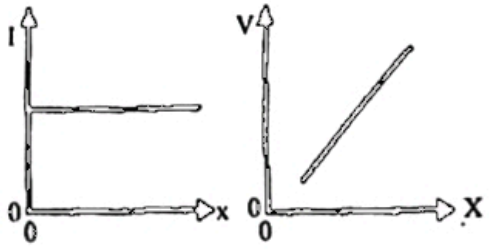
If the voltage across 75Ω is 9V, which of the following represents the unknown resistor/resistors?



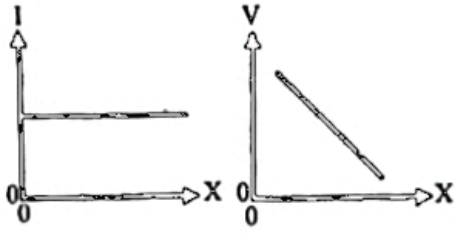
(1) (2) (3) (4) (5)

47. The diagram shows a resistance (AB), an ideal voltmeter and an ideal ammeter connected to a voltage source. The voltmeter reading (V) and the ammeter reading (I) were taken while the contact P is Sliding along the resistance AB from A to B. Which pair of graphs would correctly represents the variation of I and V with x?





(1)



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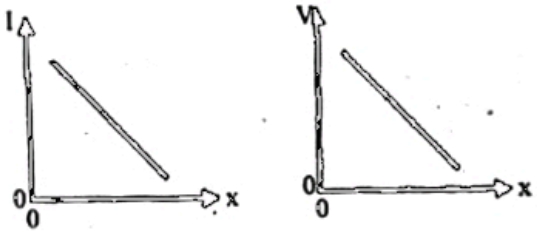
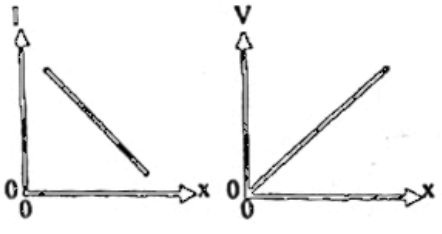
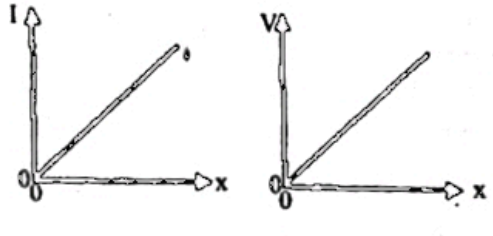


(3)

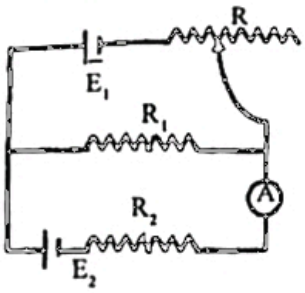


(4)



(5)

48. The two celis of e.m.f.'s E_1 and E_2 ($E_1 > E_2$) shown in the circuit have negligible internal resistance. For what value of R will the ammeter A reads Zero curren?

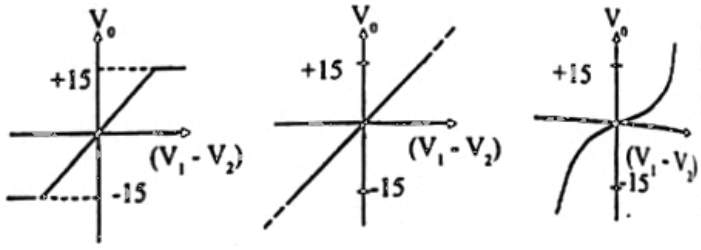


(1) $\frac{E_1}{E_2}R_2$ (2) $\left[\frac{E_1+E_2}{E_1}\right]$

(3) $\left[\frac{E_1-E_2}{E_1}\right]R_1$ (4) $\left[\frac{E_1+E_2}{E_2}\right]$

(5) $\left[\frac{E_1-E_2}{E_2}\right]R_1$

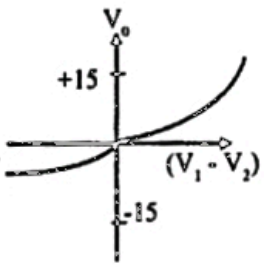
49. A 741 operational amplifier is powered with supply viltages of ± 15V. If V_1 and V_2 represent the input voltages and V_0 represents the output voltage, the variation of V_0 with $(V_1 - V_2)$ is best represented by



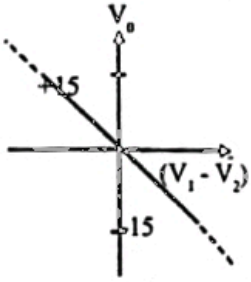
(1)

(2)

(3)

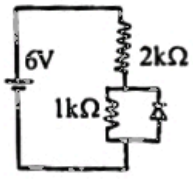


(4)

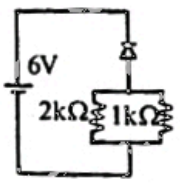


(5)

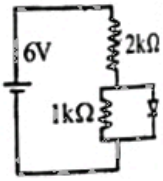
50. Which one of the following circuits draws the largest current from the 6V cell?



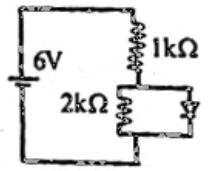
(1)



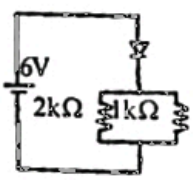
(2)



(3)



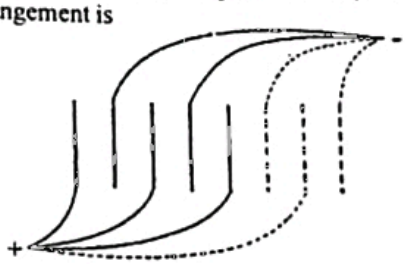
(4)



(5)

51. A capacitor consists of n number of equally spaced, parallel conducting sheets. Alternate sheets connected together compose the positive plate, and the other alternate sheets compose the

negative plate as shown in the figure. If A is the raea of each sheet and d is the spacing between two adjacent sheets, the capacitance of the arrangement is



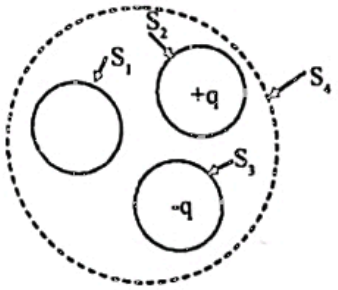
(1) $\frac{\varepsilon_0 A}{(n-1)d}$

(2) $\frac{2\varepsilon_0 A}{nd}$

(3) $\frac{(n-1)\varepsilon_0 A}{d}$

(4) $\frac{n\varepsilon_0 A}{d}$ (5) $\frac{\varepsilon_0 A}{nd}$

52. S_1, S_2, S_3 and S_4 are four Gaussian surfaces drawn in the vicinity of two equa and opposite charges +q and -q as shown. The net electric flux through the surfaces S_1, S_2, S_3 and S_4 are repersented by ϕ_1, ϕ_2, ϕ_3 and ϕ_4 respectively. Which of the following is correct?



(1) $\phi_1 = 0,\ \phi_2 = 0,\ \phi_3 = 0,\ \phi_4 = 0$

(2) $\phi_1 = 0,\ \phi_2 > 0,\ \phi_3 < 0,\ \phi_4 = 0$

(3) $\phi_1 > 0,\ \phi_2 > 0,\ \phi_3 < 0,\ \phi_4 > 0$

(4) $\phi_1 > 0,\ \phi_2 > 0,\ \phi_3 < 0,\ \phi_4 = 0$

(5) $\phi_1 < 0,\ \phi_2 > 0,\ \phi_3 < 0,\ \phi_4 > 0$

53. An ideal gas is taken through a cyclic process as shown in the P - V diagram.

If Ub > Ua , consider the following statements.

(A) The net work done by the gas is positive for the whole process.

(B) Heat is absorbed along the path a → b whereas heat is librated along the path b → a.

(C) The temperature of the gas the besinnig of the process is same as that at the end of the process.

Of the above statements

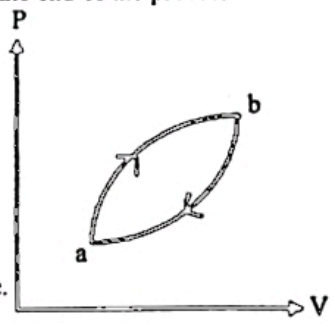
(1) only (A) is true.

(2) only (A) and (B) are true.

(3) only (A) and (C) aare true.

(4) only (B) and (C) are true.

(5) all (A), (B) and (C) are true.



54. Electrons are emitted from a certain metal when a monochromatic light of wavelength λ is incident on it. *h* is the Planck canstant and c is the velocity of light. Consider the following statements.

(A) Kinetic energy of electrons emitted from the metal is less than hc/λ.

(B) Kinetic energy of electrons emitted from the metal does not depend on the material of the metal.

(C) Rate of emission of electrons depends on the wavelength λ.

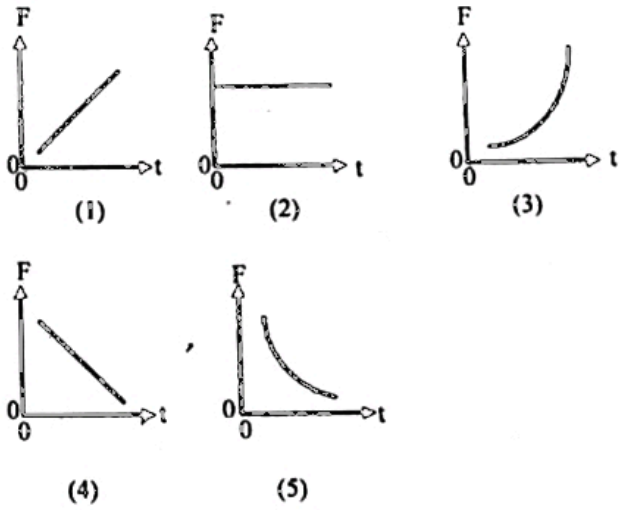
Of the above statements,

(1) only (A) is true. (2) only (A) and (B) are true

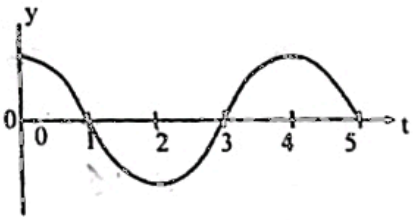
(3) only (A) and (C) are true (4) only (B) and (C) are true

(5) all (A), (B) and (C) are true

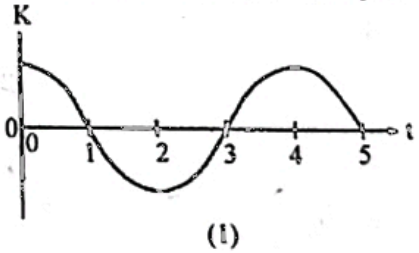
55. A mass is attached to the lower end of a vertical elastic string which is rigidly fixed at the other end. The mass is then moved downward with a constant velocity by applying a force F. The variation of F with time t is best represented by

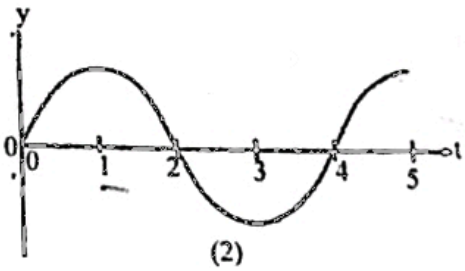


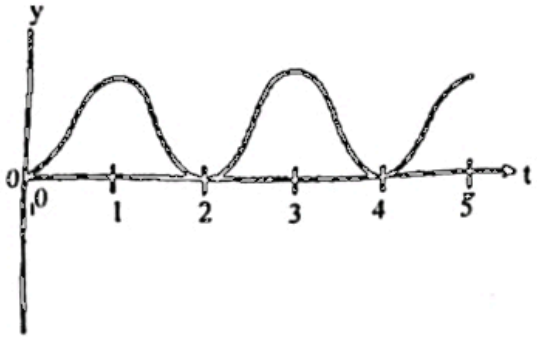
56. The graph shows the variation of displacement (*y*) of on object with time (*t*).



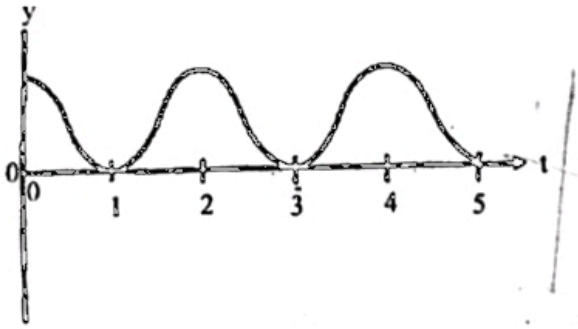
Which one of the foilowing graphs best represents the variation of kinetic energy (*K*) of the object with time (*t*)?



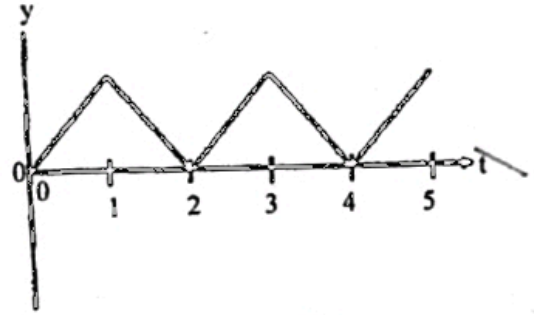




(3)

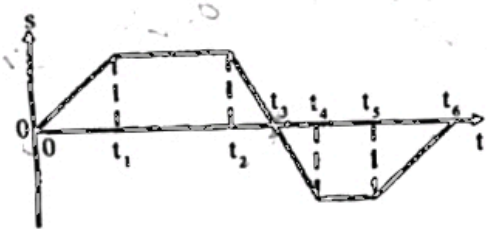


(4)

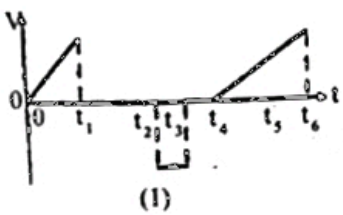


(5)

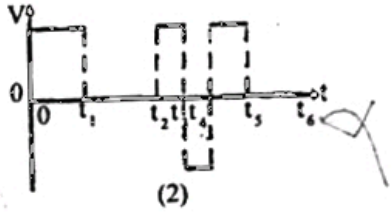
57. The displacement (s) - time (t) curve of an object is shown in the figure.



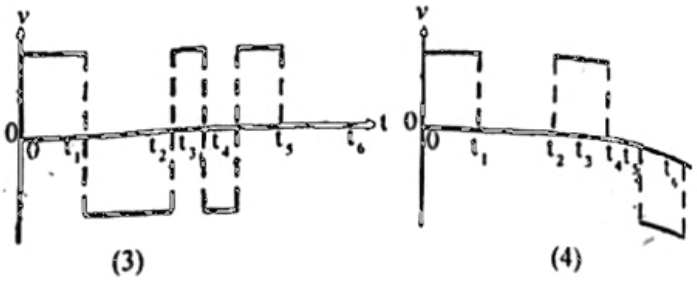
The corresponding velocity (v) - time (t) curve is best represented by .



(1)

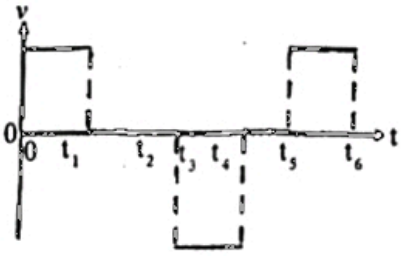


(2)



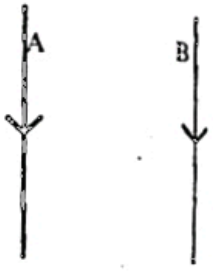
(3)

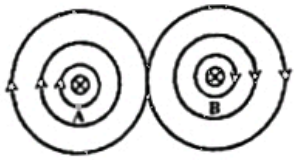
(4)



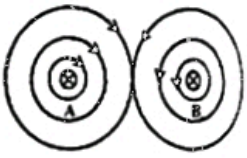
(5)

58. Two parallel long wires A and B carry identical currents in the same direction as shown in the diagram. Which of the following diagrams best represents the magnetic fild in a plane perpendicular to the wires?

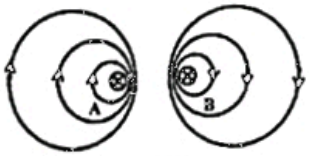




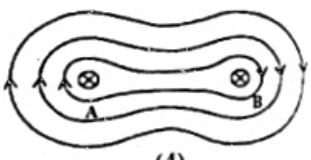
(1)



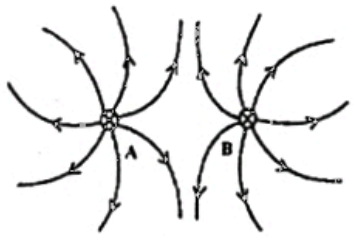
(2)



(3)

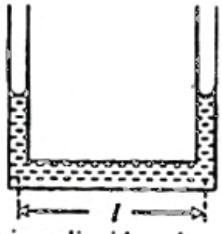


(4)



(5)

59.

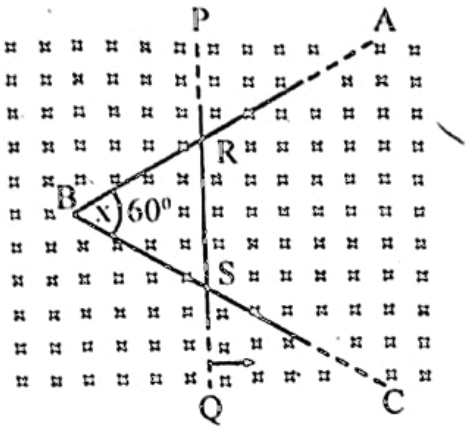


A U-tube contains a liquid as shown in the figure. When the tube is moved horizontally to the right with a constant acceleration a, the difference in the heights of liquid columns in the limbs is

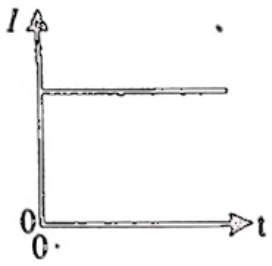
(1) $\frac{la}{g}$ (2) $\frac{lg}{a}$ (3) $\frac{l(g+a)}{a}$

(4) $\frac{lg}{(a+g)}$ (5) $\frac{l(g+a)}{g}$

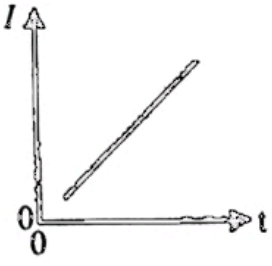
60.



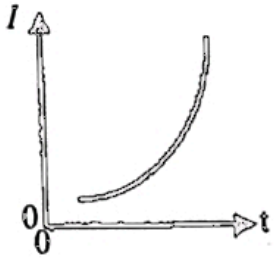
A long wire ABC is bent to form a 60° angle and kept in a plane perpendicular to a uniform magnetic field, as shown is the figur e. Another long straight wire PQ made of the same material with the same cross-sectional area is pulled with a constant velocity on the wire ABC, so that the trangle RBS is always equilateral. The induced current (I) in the triangle RBS varies with time (t) as



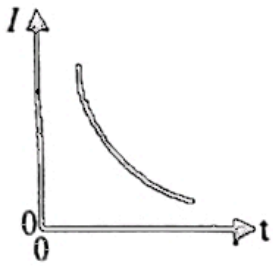
(1)



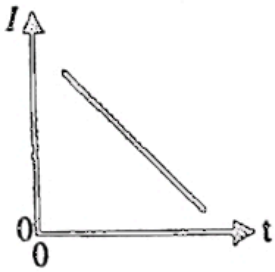
(2)



(3)



(4)



(5)