GCE A/L PHYSICS 1990 (SPECIAL 1991)

PAPER I

01. Which of the following is equivalent to the unit of power, watt ?

(1) $N m s^{-2}$ (2) $N s m^{-1}$ (3) $N m s$ (4) $N m s^{-1}$ (5) $N m^2 s$

02. The displacement (s) of a particle at time (t) moving under a uniform acceleration (a) is given by the expression $s = k a t^2$. The constant k has

(1) dimension L (2) dimension LT (3) dimension LT^2 (4) dimension LT^4 (5) no dimension.

03. The symbol of the unit of absolute temperature kelvin is written as

(1) k (2) K (3) k^o (4) $K^{\ominus}$ (5) ^ok

04. In a collision between two bodies, linear momentum is conserved

(1) Only if kinetic energy is conserved. (2) Only if total mcchanical energy is conserved.
(3) Only if the bodies are not permanently deformed. (4) Only if no external forces act on the bodies.
(5) always.

05. A 2000 kg car rests on four tyres each of which are inflated to a pressure of 200 kPa. Assuming the four tyres support the weight equally. The area of contact of each tyre with the road is

(1) 0.025 m^2 (2) 0.01 m^2 (3) 0.02 m^2 (4) 0.20 m^2 (5) 0.25 m^2

06. Which of the following is not due to the effect of surface tension :

(1) Spherical shape of liquid drops (2) Flow of a liquid through a narrow tube.
(3) Spreading of liquids on solid surfaces. (4) Insects walking on water surfaces.
(5) Reaching of oil at the tip of the wick in an oil lamp.

07. Consider the following statements made about water vapour present in the atmosphere.

(A) Relative humidity of a dry atmosphere is always very small.
(B) When the absolute humidity of the atmosphere is low, the relative humidity is also low,
(C) When the relative humidity of the atmosphere is low the dew point of the atmosphere is also low.

Of the above statements

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

08. Which of the following statements made about a thermocouple is incorrect.

(1) Thermocouples are usually made of wires of two different materials.
(2) Thermomctric property of the thermocouple is the e.m.f.
(3) Thermocouple has a large heat capacity.
(4) Range of a thermocouple is larger than that of a mercury thermometer.
(5) Thermocouple is less sensitive than a gas thermometer.

09. A solar eclipse occurs only

(A) On a new moon day.
(B) When a shadow of the earth obscure part of the moon.
(C) When the earth is in between sun and the moon.

Of the a bove 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.

10. Consider the following statements made regarding optical insturments.

(A) Focusing in a camera is done by moving the lens whereas in the human eye this is achieved by changing the power of the lens.
(B) When a telescope is adjusted for viewing a distant object with minimum eye strain, its magnifying power is the ratio of the focal lengths of the objective and eye piece.
(C) In Terrestial Telescopes and compound microscopes the eyepieces act as simple magnifiers for viewing the final image.

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.

11. Consider the following statements made about sound waves:
    (A) Sound waves are transverse in solids.
    (B) Sound waves are longitudinal in gases.
    (C) Velocity of sound waves depends on the properties of the medium.
    Of these 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.

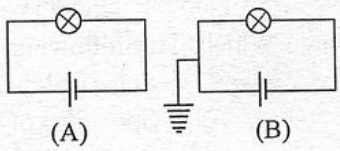
12. Resonance occurs when an object is forced to vibrate by external vibrations that are .
    (1) at a high frequency. (2) at a low frequency (3) of large amplitude.
    (4) of low amplitude. (5) matched to the natural frequency of the object.

13. A step - up transformer is used to increase.
    (1) Current (2) voltage (3) Energy (4) power (5) all of the above

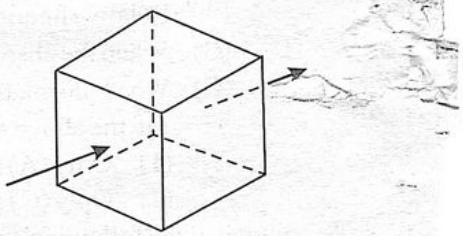
14. If 96 485 Coulombs of electrcity will liberate 1.008 g of Hydrogen, how many grams of lead (atomic weight = 207) can be deposited with the same quantity of electricity.
    (1) 1.008 (2) 103.5 (3) 207 (4) 414 (5) 96 485

15. The current through a 60 W ligh bulb connected to 240 V a.c. mains is
    (1) ¼ A (2) ½ A (3) 1 A (4) 2 A (5) 4 A

16. A light bulb is connected to a battery as shown in the figure (A). If the eircuit is now earthed as shown in figure B
    (1) the bulb glows with less brightness.
    (2) the bulb glows with more brightness.
    (3) the bulb goes off.
    (4) brightness of the bulb remains unchanged.
    (5) the bulb dims momentarily and regains its brightness.

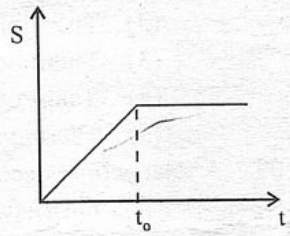


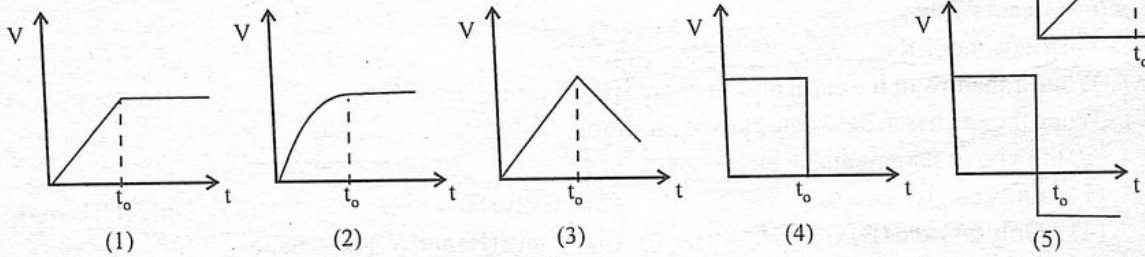
17. A current I is passed through two opposite faces of a conducting cube of length l as shown in the figure. If the resistivity of the material is p, the resistance of the cube is given by
    (1) $\frac{p}{l}$ (2) pl^2 (3) $\frac{p}{2l}$
    (4) pl^3 (5) $\frac{2p}{l}$



18. A lubricant oil should have.
    (1) a high surface tension. (2) a high viscosity.
    (3) a low viscosity. (4) a low surface tension.
    (5) a high surface tension and a low viscosity.

19. The displacement (s) with time (t) of an object is shown in the figure. Which of the following graphs best represents the the velocity (v) of the object with time (t) ?





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

20. A ball of mass 0.1 kg is thrown directly against a wall with a speed of 10 m s^{-1} and it rebounds in the opposite direction with the same speed. If the ball was in contact with the wall for 0.02 s, the average force exerted by the ball on the wall is
    (1) 200. N (2) 100 N (3) 20 N (4) 0.01 N (5) 0.002 N.

21. A cork made of a material of density 200 kg m^{-3} is floating in water of density 1 000 kg m^{-3} . The fraction of the volume of the cork **not** submerged inwater is
    (1) $\frac{1}{5}$ (2) $\frac{1}{4}$ (3) $\frac{2}{5}$ (4) $\frac{1}{2}$ (5) $\frac{4}{5}$

22. Consider the following statements made regarding the heat capacity.
    (A) Heat capacity of an object is the energy needed to raise its temperature by one degree.
    (B) The rate of cooling of a heated object depends on its heat capacity.
    (C) The heat capacity of an object depends on the mass of the object.
    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.

23. If the avagodro`s number is N and the gas constant is R, the number of gas molecules in a cubic metre of an ideal gas at STP is
    (1) $\frac{1.01 \times 10^5}{R \times 273 \times N}$ (2) $\frac{1.01 \times 10^5 \times N}{R \times 273}$ (3) $\frac{R \times 273}{1.01 \times 10^5 \times N}$
    (4) $\frac{1.01 \times 10^5 \times R \times N}{273}$ (5) $\frac{R \times N}{1.01 \times 10^5 \times 273}$

24. A sealed cylinder contains a perfect gas at 20^0C and one atmospberic pressure. To increase the pressure of the gas by three fold. Its temperature must be increased to
    (1) 60^0C (2) 313^0C (3) 506^0C (4) 606^0C (5) 660^0C

25. A wedge if formed out of two plane mirrors by placing their reflecting surfaces facing outside. A beams of parallel light falls close tothe edge of the wedge as shown. It is found that the two beams reflected from its surfaces make an angle of 40^0 with each other. The angle between the mirrors is



    (1) 80^0 (2) 60^0 (3) 40^0 (4) 20^0 (5) 10^0

26. Consider the following statements maderegarding light rays.
    (A) When light rays strike a smooth surface both reflection and refraction may take place in a plane containing the incident ray and the normal to the surface at the point of incidence.
    (B) Images formed by converging rays are real and images formed by diverging rays are virtual.
    (C) When a ray of light is incident on a rarer medium at an angle smaller than the critical angle, it is totally reflected.
    Of the above statcments,
    (1) Only (A) is true. (2) Only (B) is true. (3) Only (A) and (B) are true.
    (4) Only (A) and (C) are true. (5) all (A), (B) and (C) are true.

27. Consider the following statements made about a rainbow.
    (A) To see a rainbow the observer must face the sun.
    (B) In the formation of a rainbow light is refracted as well as reflected.
    (C) A rainbow is formed due to the presence of water droplets in air.
    Of the above statements.
    (1) Only (A) is true. (2) Only (C) is true. (3) Only (B) and (C) are true.
    (4) Only (C) and (A) are true. (5) all (A), (B) and (C) are true.

28. If the velocity of sound in air is 330 ms^{-1},the minimum length of an organ pipe, that is closed at one end and has a resonent frequency of 440 Hz, is
    (1) $\frac{3}{4}$ m (2) $\frac{3}{8}$ m (3) $\frac{3}{12}$ m (4) $\frac{3}{15}$ m (5) $\frac{3}{20}$ m

29. A copper wire with length 5 m has a mass of 0.06 kg and is under a tension of 750 N. The velocity with which transverse waves will propagatc along the wire is
    (1) $\sqrt{\frac{750 \times 5}{0.06}}\ m\ s^{-1}$ (2) $\sqrt{\frac{5 \times 0.06}{750}}\ m\ s^{-1}$ (3) $\sqrt{\frac{750 \times 0.06}{5}}\ m\ s^{-1}$
    (4) $\sqrt{\frac{0.06}{750 \times 5}}\ m\ s^{-1}$ (5) $\sqrt{\frac{750}{5 \times 0.06}}\ m\ s^{-1}$

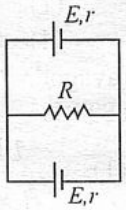
30. A long straight wire carrying a current is fixed along the East- west direction.the current is directed towards west, and a magnetic compass is kept right below and close th the wire. If the effect of the earth`s magnetic field is negligible, the compass will point towards.

(1) North (2) East (3) West (4) South (5) any direction.

31. Two cells each having an e.m.f. E and internal resistance r, are connected to a resistance R as shown in the figure. The current through the resistor is

(1) 0 (2) $\frac{E}{R+r}$ (3) $\frac{2E}{R+r}$

(4) $\frac{E}{R+\frac{r}{2}}$ (5) $\frac{2E}{R+\frac{r}{2}}$

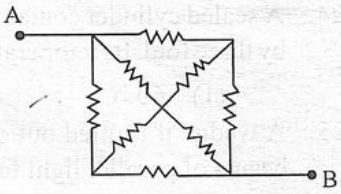


32 If the Electricity board charges Rs. 1.50 for a unit of electricity, the cost of using an electric kettle of 2 kW for 5 minutes will be

(1) Rs. 1.50 (2) Rs. 1.00 (3) Rs. 0.75 (4) Rs. 0.25 (5) Rs. 0.10

33. If each resistor in the network shown has a resistance of 2 Ω, the equivalent resistance between the terminals A and B is

(1) $\frac{1}{2}\ \Omega$ (2) $\frac{3}{4}\ \Omega$ (3) 1 Ω (4) $\frac{4}{3}\ \Omega$ (5) 2 Ω



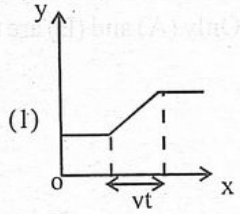
34. When a certain electrical appliance is plugged into a 5 A socket in a properly wired house, the electricity in the entire house goes off. This could possibly be due to

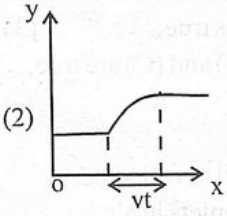
(A) the leakage of current to the earth through the appliance.
(B) a short circuiting of live and neutral wires inside the appliance.
(C) the very high current rating of the appliance which exceeds the current rating of the main fuse in the house.

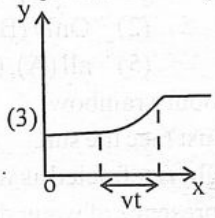
Of the reasons given

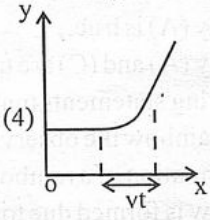
(1) Only A is true. (2) Only B is true. (3) Only C is true.
(4) Only B and C are true. (5) all A, B and C are true.

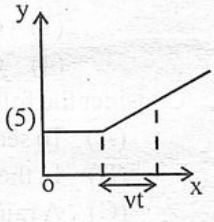
35. An object moving in the X - direction with a constant velocity (V) is acted on by a **constant** force F in the Y - direction for a duration of time t. Path of the object in the XY plane is best represented by.

(1) 

(2) 

(3) 

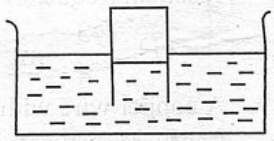
(4) 

(5) 

36. A ball is thrown straight up from the edge of the roof of a building, which is 20 m above the ground and upon coming down the ball just misses the edge of the roof and reaches the ground.if the entire journey takes 4 s the initial velocity with which the ball was thrown up is.

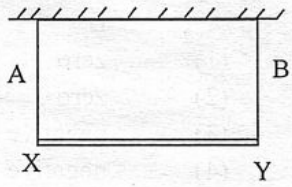
(1) 1 ms^{-1} (2) 5 ms^{-1} (3) 10 ms^{-1} (4) 15 ms^{-1} (5) 20 ms^{-1}

37. A thin walled cylindrical jar of weight W floats upside down in a large vessel of water as shown in the figure. The pressure insidethe jar depends on



(1) the weight W only.
(2) the weight W and the area of cross section of the jar only.
(3) the weight W area of cross section of the jar and the atmospheric pressure only.
(4) the atmospheric pressure, height of the jar and the density of water only.
(5) the weight W. density of water and the atmospheric pressure only.

38. A smooth light plank XY of length L is supported horizontally by two wires A and B of equal length as shown in the figure. The area of cross section and the young`s modulus of B is half of those of A. The distance from X to a point where a weight W can be placed **without sliding** along the plank is



(1) $\frac{1}{5}$ L (2) $\frac{1}{4}$ L (3) $\frac{1}{2}$ L

(4) $\frac{2}{5}$ L (5) $\frac{4}{5}$ L

39. The far point of a person suffering from short sight is at 2 m. The lens required to rectify this defect is a

(1) concave lens of 2 diopters (2) concave lens of 1 diopter (3) concave lens of 0.5 diopter

(4) convex lens of 2 diopters (5) convex lens of 1 diopter.

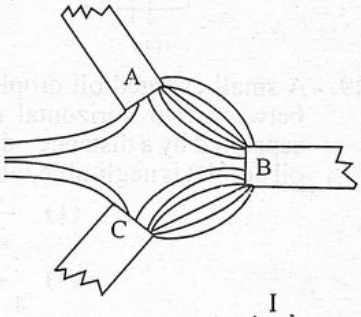
40. To an observer looking straight down into a barrel of water, the barrel appears to be half full. If the refractive index of water is $\frac{4}{3}$ the fraction of the barrel that is actually filled with water is

(1) $\frac{3}{4}$ (2) $\frac{2}{3}$ (3) $\frac{4}{7}$ (4) $\frac{1}{2}$ (5) $\frac{3}{8}$

41. An object is placed at a fixed distance away from a screen and a converging lens is placed in between and closer to the object. When the lens is moved towards the screen, for two positions of the lens clear images are observed on the screen. If the height of these two images are h_1 and h_2 the height of the object is,

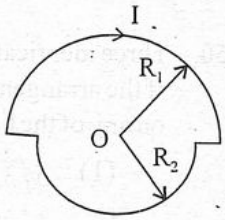
(1) $\frac{h_1 + h_2}{2}$ (2) $h_1 - h_2$ (3) $\sqrt{h_1 h_2}$ (4) $\frac{\sqrt{h_1 h_2}}{2}$ (5) $\sqrt{h_1^2 + h_2^2}$

42. Three bar magnets are arranged and their lines of force are indicated as shown in the figure. The poles A, B and C of the magnets should be



	A	B	C
(1)	N	N	S
(2)	N	S	N
(3)	S	N	N
(4)	S	S	N
(5)	N	N	N

43. A wire bent in the form as shown in the figure and carrying a current I has two semicircular portions of radii R_1 and R_2 the magnitude and direction of the magetic flux density at the common centre O are given by



(1) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$ directed into the paper

(2) $\frac{\mu_0 I}{2}\left(\frac{1}{R_2} - \frac{1}{R_1}\right)$ directed out of the paper (3) $\frac{\mu_0 I}{4}\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$ directed into the paper

(4) $\frac{\mu_0 I}{4}\left(\frac{1}{R_2} - \frac{1}{R_1}\right)$ directed out of the paper (5) $\frac{\mu_0 I}{2(R_1 + R_2)}$ directed into the paper

44. An athlete of height 1.6 m runs along a horizontal stright track dircctly towards the east with a constant speed of 10 m s^{-1} if the horzontal component of the earth`s magnetic flux density at the place of running is 1.8×10^{-5} T, the induced e.m.f. between the head and the toe of the athlete will be

(1) $1.8 \times 1.6 \times 10^{-6}$ V directed towards the head. (2) $\frac{1.8}{1.6} \times 10^{-6}$ V directed towards the toe.

(3) $1.8 \times 1.6 \times 10^{-4}$ V directed towards the toe. (4) $\frac{1.8}{1.6} \times 10^{-4}$ V directed towards the head.

(5) $1.8 \times 1.6 \times 10^{-4}$ V directed towards the head.

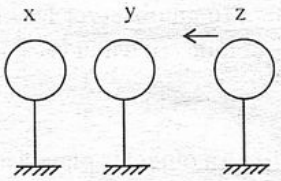
45. A current of 1 A is flowing in each of two long straight parallel wires separated by a distance 1 m, the force acting per unit length (1 m) of each wire is ($\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1})

(1) 2×10^{-7} N (2) 4×10^{-7} N (3) $2\pi \times 10^{-7}$ N (4) $4\pi \times 10^{-7}$ N (5) 1 N

46. The electric field and the potential inside an uncharged isolated copper ball are initially zero. If negative charges are placed on the ball, the electric field (E) and electric potential (V) inside the ball will be

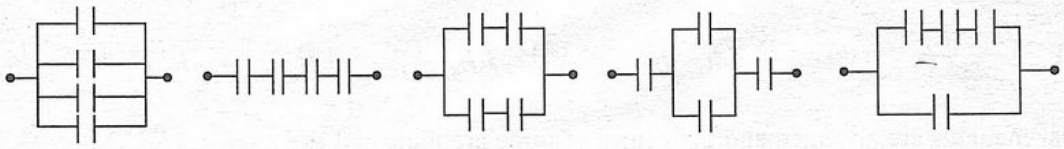
	E	V
(1)	zero	zero
(2)	zero	negative
(3)	negative	zero
(4)	negative	negative
(5)	positive	negative

47. An isolated metal ball Z carrying a positive charge is brought near two uncharged and isolated metal balls X and Y as shown in the figure. Balls X and Y are then Joined mementarily by a wire and subsequently the ball Z is removed. When this is done



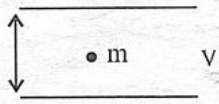
(1) balls X and Y are still uncharged.
(2) balls X and Y both become positively charged.
(3) balls X and Y both become negatively charged.
(4) ball X becomes negatively charged and Y becomes positively charged.
(5) ball X becomes positively charged and Y becomes negatively charged.

48. If each capacitor has a capacitance of 2 μ F, which of the following circuit has an equivalent capacitance of 0.8 μF.



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

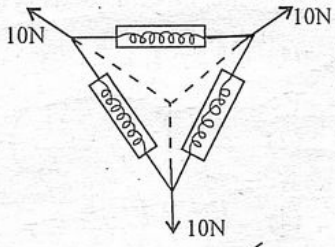
49. A small charged oil droplet of mass m and charge q is placed stationary between two horizontal metal plates kept at a potential difference V and separated by a distance d as shown in the figure. If the upthrust acting on the oil droplet is negligible,then



(1) $\frac{q}{d^2} = mg$ (2) $qV = mg$ (3) $\frac{qV}{d} = mg$

(4) $\frac{q}{4\pi\epsilon_0 d^2} = mg$ (5) $qd = mg$

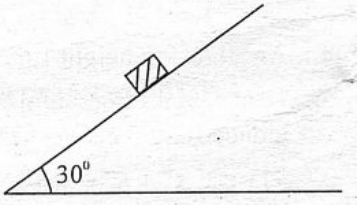
50. Three identical light spring balances are connected together to form an equilateral triangle as shown in the figure. If the arrangement is subjected to three equal coplanar forces of 10 N and the system is in equilibrium the reading on any of the balanecs will be



(1) $5\sqrt{3}$ N (2) 10 N (3) $\frac{10}{\sqrt{3}}$ N

(4) $\frac{1}{\sqrt{3}}$ N (5) 0

51. A body of mass m just rests without sliding on a rough inclined plane as shown in the figure. When the inclination of the plane is increased from 30^0 to 60^0 the body will move with an acceleration of



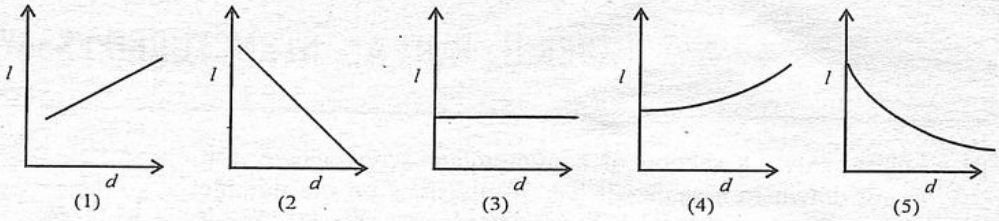
(1) $\frac{g}{\sqrt{3}}$ (2) $\frac{\sqrt{3}}{2}$ g (3) $\frac{g}{2}(\sqrt{3} - 1)$

(4) g (5) $\frac{g}{2}$

52. An illuminated object and a screen are placed 1.5 m apart. A lens kept in between produces an inverted image of twice the size as the object on the screen. The object distance and the type of lens required for this is,

(1) 50 cm and a converging lens. (2) 50 cm and a diverging lens.
(3) 100 cm and a converging lens. (4) 100 cm anda diverging lens.
(5) 150 cm and a converging lens.

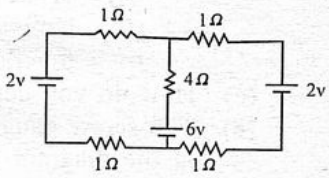
53. A boy looking through a thin flat glass wall of a fish tank sees a fish swimming towards him. Which one of the following graphs best illustrates the variation of the apparant length of the fish (l) as seen by the boy with the distance (d) of the fish from the glass wall.



54. For an ideal gas at absolute temperature T, the average kinetic energy of translation of a gas molecule is $E = \frac{3}{2}$ kT, where k is the Boltzmann constant. If the volume of a given mass of the gas is kept constant and the pressure is doubled, E will increase by a factor of

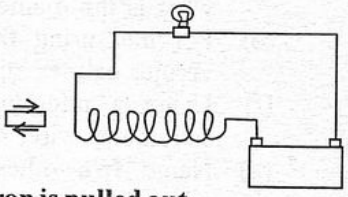
(1) 1 (2) 2 (3) 4 (4) 6 (5) 8

55. In the circuit shown, the batteries have negligible internal resistances the current through the 4Ω resistor is



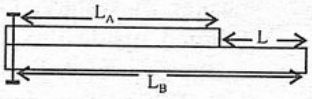
(1) $\frac{1}{3}$ A (2) $\frac{2}{5}$ A (3) $\frac{2}{3}$ A (4) $\frac{4}{5}$ A (5) $\frac{3}{2}$ A

56. A coil of wire is connected to a circuit containing a buttery and a light bulb as shown in the figure, A piece of soft iron is then inserted into the coil, kept it stationary inside the coil for some time and subsequently pulled out. Which of the following correctly represents the variation of the brightness of the bulb in the above three operations?



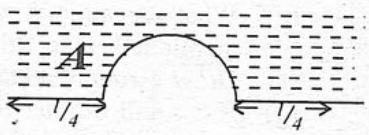
	As the irons is inserted in	When it is stationary inside	As the iron is pulled out
(1)	dims	no change	becomes brighter
(2)	becomes brighter	no change	dims
(3)	dims	dims	dims
(4)	becomes brighter	becomes brighter	becomes brighter
(5)	no change	no change	no change

57. Two metal bars A and B with linear expansivity α_A and α_B have lengths L_A and L_B such that $L_A \alpha_A = L_B \alpha_B$, the two rods are bolted at one end and kept horizontally as shown in the figure, when the temperature of the system is raised:



(1) bars will remain straight and the separation L between the two free ends will not change.
(2) bars will remain straight and the separation L between the two free ends will decrease.
(3) bars will remain straight and the separation L between the two free ends will increase.
(4) bars will bent upwards and the sparation L between the two free ends will not change.
(5) bars will bent downwards and the separation L between the two free ends will not change.

58. A thin wire of length l and mass m has a semicircular part in the middle as shown in figure, and it floats horizontally on a liquid surface whose surface tension is T_1 if the surface tension of the liquid on one side of this wire (ie. side A) is changed to T_2 then the wire will begin to move with an acceleration of



(1) $l(T_1 - T_2)/m$ (2) $\left(\frac{l}{2} + \pi l\right)(T_1 - T_2)/m$

(3) $\left(\frac{l}{2} + 2\pi l\right)(T_1 + T_2)/m$ (4) $l T_1 T_2/(T_1 + T_2)m$ (5) $\left(\frac{l}{2} + \frac{l}{\pi}\right)(T_1 - T_2)/m$

59. A metal ball is projected vertically up from the bottom of a deep lake with a velocity greater than its terminal velocity in water. The upthrust acting on the ball is negligible. Which of the following is correct regarding the subsequent motion of the ball in the lake?

(1) It may achieve the terminal velocity during the upward journey.
(2) It will definctely achieve a terminal velocity during the upward journey.
(3) It may achieve the terminal velocity during the downward journey.
(4) It will definetely achieve the terminal velocity during the downward journey.
(5) It will never achieve the terminal velocity during the course of the journey.

60. Four stainless steel electric kettles A, B, C and D each having a flat bottom of area of cross section 3×10^{-2} m^2 and thickness 2.5×10^{-3} m are filled with water and kept in contact with a surface maintained at O^0 C.the powers of the kettles A, B, C and D are 750 W, 1 000 w, 1 500 W, and 2 000 W respectively. The cocfficient of thermal conductivity of stainless steel is 50 $Jm^{-1} s^{-1} {}^0C^{-1}$ when the kettles are switched on, in which of the above kettle/ kettles will the water reach its boiling points of 100 ^{0}C.?

(1) (D) Only (2) (C) and (D) Only (3) (B), (C) and (D) Only.
(4) All (A), (B), (C) and (D) (5) None.