Physics

1. If a magnet of pole strength m is divided into four parts such that the length and width of each part is half that of initial one, then the pole strength of each part will be

   a) $m/4$ b) $m/2$

   c) $m/8$ d) $4m$

2. A short bar magnet of magnetic moment $0.4\ J\ T^{-1}$ is placed in a uniform magnetic field of $0.16\ T$. The magnet is in stable equilibrium when the potential energy is

   a) $-\ 0.082\ J$ b) $0.064\ J$

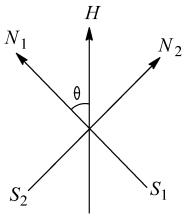
   c) $-\ 0.064\ J$ d) Zero

3. Two identical short bar magnets, each having magnetic moment M, are placed a distance of $2d$ apart with axes perpendicular to each other in a horizontal plane. The magnetic induction at a point midway between them is

   a) $\frac{\mu_0}{4\pi}\left(\sqrt{2}\right)\frac{M}{d^3}$ b) $\frac{\mu_0}{4\pi}\left(\sqrt{3}\right)\frac{M}{d^3}$

   c) $\left(\frac{2\mu_0}{\pi}\right)\frac{M}{d^3}$ d) $\frac{\mu_0}{4\pi}\left(\sqrt{5}\right)\frac{M}{d^3}$

4. Two magnets of equal mass are joined at 90° each other as shown in figure. Magnet $N_1 S_1$ has a magnetic moment $\sqrt{3}$ times that of $N_2 S_2$. The arrangement is pivoted so that it is free to rotate in horizontal plane. When in equilibrium, what angle should $N_1 S_1$ make with magnetic meridian?



   a) 75° b) 60°

   c) 30° d) 45°

5. A magnet makes 5 oscillations per min in $B = 0.3\times10^{-4}$ T. By what amount should the field be increased so that number of oscillations is 10 in the same time?

   a) 0.3×10^{-4} T b) 0.6×10^{-4} T

   c) 0.9×10^{-4} T d) 1.2×10^{-4} T

6. The magnetized wire of moment M and length l is bent in the form of semicircle of radius r. Then its magnetic moment is

   a) $\frac{2M}{\pi}$ b) 2 M

c) $\frac{M}{\pi}$ d) Zero

7. If 'S' is stress and 'Y' is Young's modulus of a wire material, then energy stored in the wire per unit volume, is?

(A)2y/S (B)S/2y (C)$2S^2y$ (D)$S^2/2y$

8. The pressure of a medium is changed from 1.01×10^5 Pa to 1.165×10^5 Pa and change in volume is 10% keeping temperature constant. The bulk modulus of the medium is

(A)1.55×10^5 Pa (B)15.5×10^5 Pa (C)155×10^5 Pa (D)0.155×10^5 Pa

9. For aluminium the bulk modulus and modulus of rigidity are $7.5\times10^{10}Nm^{-2}$. Find the velocity of longitudinal waves in the mediu. Density of aluminium is $2.7\times10^3kgm^3$

(A) $5.27\times10^3ms^{-1}$ (B) $4.13\times10^3ms^{-1}$ (C) $0.23\times10^3ms^{-1}$ (D) $2.24\times10^3ms^{-1}$

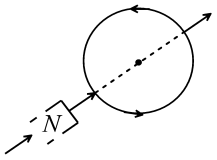
10. A coil of area $80\ square\ cm$ and 50 turns is rotating with $2000\ revolutions\ per\ minute$ about an axis perpendicular to a magnetic filed of $0.05\ tesla$. The maximum value of the e.m.f. developed in it is

a) $200\ \pi\ volt$ b) $\frac{10\pi}{3} volt$

c) $\frac{4\pi}{3} volt$ d) $\frac{2}{3} volt$

11. Which of the following figure correctly depicts the Lenz's law. The arrows show the movement of the labelled pole of a bar magnet into a closed circular loop and the arrows on the circle show the direction of the induced current

a)



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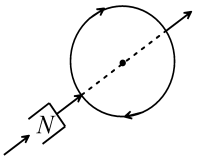

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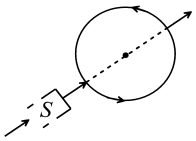
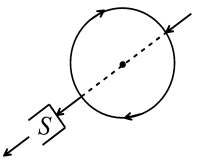


d)

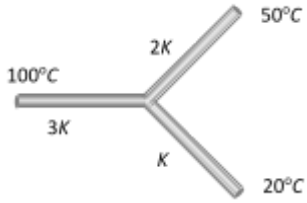


12. A $10\ metre$ wire kept in east-west direction is falling with velocity $5m/sec$ perpendicular to the field $0.3\times10^{-4}Wb/m^2$. The induced e.m.f. across the terminal will be

a) $0.15\ V$ b) $1.5\ mV$

c) $1.5\ V$ d) $15.0\ V$

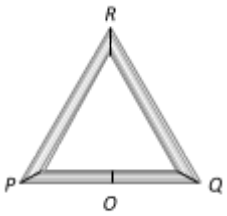
13. Three rods of the same dimension have thermal conductivities $3K$, $2K$ and K. They are arranged as shown in fig. Given below, with their ends at $100°C$, $50°C$ and $20°C$. The temperature of their junction is



a) $60℃$ b) $70℃$

c) $50℃$ d) $35℃$

14. Three rods of equal length l are joined to form an equilateral triangle PQR. O is the mid point of PQ. Distance OR remains same for small change in temperature. Coefficient of linear expansion for PR and RQ is same, $i.e.,\ \alpha_2$ but that for PQ is α_1. Then



a) $\alpha_2 = 3\alpha_1$ b) $\alpha_2 = 4\alpha_1$

c) $\alpha_1 = 3\alpha_2$ d) $\alpha_1 = 4\alpha_2$

15. The surface area of a black body is $5\times10^{-4}\ m^2$ and its temperature is 727℃ . the energy radiated by it per minute is ($\sigma = 5.67\times10^{-8}\ Jm^{-2} - s^{-1} - K^{-4}$)

a) 1.7×10^3 J b) 2.5×10^2 J

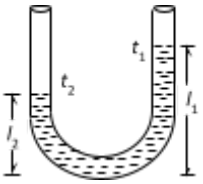
c) 8×10^3 J d) 3×10^4 J

16. A thin square steel plate with each side equal to $10\ cm$ is heated by a blacksmith. The rate of radiated energy by the heated plate is $1134\ W$. The temperature of the hot steel plate is (Stefan's constant $\sigma = 5.67\times10^{-8} watt\ m^{-2}K^{-4}$, emissivity of the plate = 1)

a) $1000\ K$ b) $1189\ K$

c) $2000\ K$ d) $2378\ K$

17. In a vertical U-tube containing a liquid, the two arms are maintained at different temperatures t_1 and t_2. The liquid columns in the two arms have heights l_1 and l_2 respectively. The coefficient of volume expansion of the liquid is equal to



a) $\frac{l_1-l_2}{l_2t_1-l_1t_2}$ b) $\frac{l_1-l_2}{l_1t_1-l_2t_2}$

c) $\frac{l_1+l_2}{l_2t_1+l_1t_2}$ d) $\frac{l_1+l_2}{l_1t_1+l_2t_2}$

18. The end A of a rod AB of length 1 m is maintained at 100°C and the end B at 10°C. The temperature at a distance of 60 cm from the end B is

a) 64°C b) 36°C

c) 46°C d) 72°C

19. $1\ g$ of a steam at 100°C melts how much ice at 0°C? (Latent heat of ice $= 80\ cal/gm$ and latent heat of steam $= 540\ cal/gm$)

a) $1\ gm$ b) $2\ gm$

c) $4\ gm$ d) $8\ gm$

20. The ratio of specific heat of a gas at constant pressure to that at constant volume is γ. The change in internal energy of one mole of gas when volume change from V to $2V$ at constant pressure p is

a) $R/(\gamma - 1)$ b) pV

c) $pV/(\gamma - 1)$ d) $\frac{\gamma V}{\gamma-1}$

21. In the certain process, 400 cal of heat are supplied to a system and at the same time 105 J of mechanical work was done on the system. The increase in its internal energy is

a) 20 cal b) 303 cal

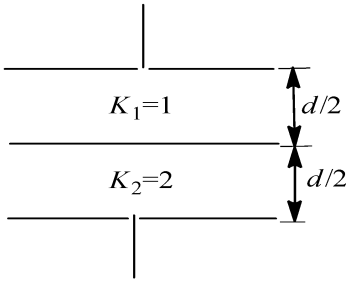
c) 404 cal d) 425 cal

22. The latent heat of vaporization of water is $2240\ J/g$. If the work done in the process of expansion of $1\ g$ is $168\ J$, then increase in internal energy is

a) $2408\ J$ b) $2240\ J$

c) $2072\ J$ d) $1904\ J$

23. Two parallel plates of area A are separated by two different dielectric as shown in figure. The net capacitance is



a) $\frac{\varepsilon_0 A}{2d}$ b) $\frac{\varepsilon_0 A}{d}$

c) $\frac{3\varepsilon_0 A}{d}$ d) $\frac{4\varepsilon_0 A}{3d}$

24. Two identical capacitors have the same capacitance$C$. One of them is charged to potential V_1 and the other toV_2. The negative ends of the capacitors are connected together. When the positive ends are also connected, the decrease in energy of the system is

a) $\frac{1}{4}C(V_1^2 - V_2^2)$ b) $\frac{1}{4}C(V_1^2 + V_2^2)$

c) $\frac{1}{4}C\left(V_1 - V_2\right)^2$ d) $\frac{1}{4}C\left(V_1 + V_2\right)^2$

25. Three capacitors of capacitance $1\ \mu F,\ 2\ \mu F\ and\ 4\mu F$ are connected first in a series combination, and then in a parallel combination. The ratio of their equivalent capacitance will be

a) 2 : 49 b) 49 :2

c) 4 : 49 d) 49 : 4

26. Two spheres of radii R_1 and R_2 joined by a fine wire are raised to a potential V. Let the surface charge densities at these two spheres be σ_1 and σ_2 respectively. Then the ratio $\frac{\sigma_2}{\sigma_1}$ has a value

a) $\frac{R_1}{R_2}$ b) $\frac{R_2}{R_1}$

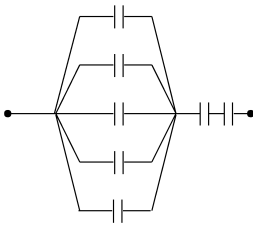
c) 1 d) $\left(\frac{R_2}{R_1}\right)^2$

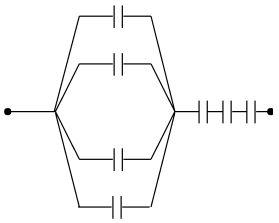
27. A small conducting sphere of radius r is lying concentrically inside a bigger hollow conducting sphere of radius R. The bigger and smaller spheres are charged with Q and $q\ (Q > q)$ and are insulated from each other. The potential difference between the spheres will be

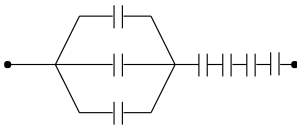
a) $\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r} - \frac{q}{R}\right)$ b) $\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{R} - \frac{Q}{r}\right)$

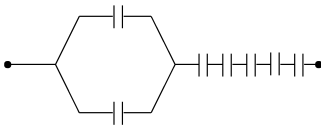
c) $\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r} - \frac{Q}{R}\right)$ d) $\frac{1}{4\pi\varepsilon_0}\left(\frac{Q}{R} - \frac{q}{r}\right)$

28. Seven capacitors each of the capacitance $2\mu F$ are be connected in a configuration to obtain an effective capacitance of $\frac{10}{11}\mu\ F$. Which of the combination (S) shown in figure will achieve the desired result?

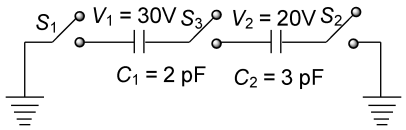
a) 

b) 

c) 

d) 

29. For the circuit shown figure, which of the following statements is true?



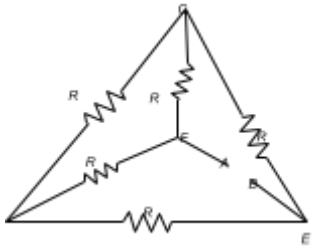
a) With S_1 closed, $V_1 = 15$ V, $V_2 = 20$ V

b) With S_3 closed, $V_1 = V_2 = 20\ V$

c) With S_1 and, $S_3\ closed,\ V_1 = V_2 = 0$

d) With S_1 and S_3 closed, $V_1 = 30$ V , $V_2 = 20$ V

30. Five equal resistances, each of resistance R,are connected as shown in figure below. A bettery of V volt is connected between $A\ and\ B$. The current flowing in FC will be



a) $\frac{3V}{R}$

b) $\frac{V}{R}$

c) $\frac{V}{2R}$

d) $\frac{2V}{R}$