Physics

1. The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimation of the kinetic energy obtained by measuring mass and speed

(a) 11% (b) 8%

(c) 5% (d) 1%

2. The displacement-time graph for two particles A and B are straight lines inclined at angles of 30^o and 60^o with the time axis. The ratio of velocities of $V_A : V_B$ is

(a) $1:2$ (b) $1:\sqrt{3}$

(c) $\sqrt{3}:1$ (d) $1:3$

3. A projectile thrown with a speed v at an angle θ has a range R on the surface of earth. For same v and θ, its range on the surface of moon will be

(a) $R/6$ (b) $6R$

(c) $R/36$ (d) $36R$

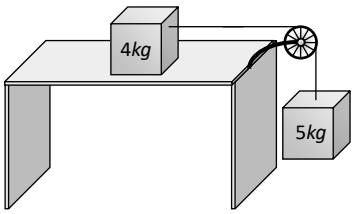
4. Two masses of 4 kg and 5 kg are connected by a string passing through a frictionless pulley and are kept on a frictionless table as shown in the figure. The acceleration of 5 kg mass is

(a) $49\ m/s^2$

(b) $5.44\ m/s^2$

(c) $19.5\ m/s^2$

(d) $2.72\ m/s^2$



5. A body of mass m is moving in a circle of radius r with a constant speed v. The force on the body is $\frac{mv^2}{r}$ and is directed towards the centre. What is the work done by this force in moving the body over half the circumference of the circle

(a) $\frac{mv^2}{r} \times \pi r$ (b) Zero

(c) $\frac{mv^2}{r^2}$ (d) $\frac{\pi r^2}{mv^2}$

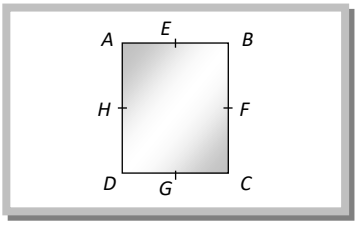
6. In a rectangle $ABCD$ $(BC = 2AB)$. The moment of inertia along which axis will be minimum

(a) BC

(b) BD

(c) HF

(d) EG



7. The escape velocity of a body on an imaginary planet which is thrice the radius of the earth and double the mass of the earth is (v_e is the escape velocity of earth)

(a) $\sqrt{2/3}\,v_e$ (b) $\sqrt{3/2}\,v_e$

(c) $\sqrt{2}/3\,v_e$ (d) $2/\sqrt{3}\,v_e$

8. A steel wire of lm long and $1\,mm^2$ cross section area is hang from rigid end. When weight of $1kg$ is hung from it then change in length will be (given $Y = 2\times10^{11}\,N/m^2$)

(a) 0.5 mm (b) 0.25 mm

(c) 0.05 mm (d) 5 mm

9. Air is streaming past a horizontal air plane wing such that its speed in 120 *m/s* over the upper surface and 90 *m/s* at the lower surface. If the density of air is 1.3 *kg* per metre^3 and the wing is 10 *m* long and has an average width of 2 *m*, then the difference of the pressure on the two sides of the wing of

(a) 4095.0 *Pascal* (b) 409.50 *Pascal*

(c) 40.950 *Pascal* (d) 4.0950 *Pascal*

10. The amount of heat required to change 1 *gm* (0°*C*) of ice into water of 100°*C*, is

(a) 716 *cal* (b) 500 *cal*

(c) 180 *cal* (d) 100 *cal*

11. Under which of the following conditions is the law $PV = RT$ obeyed most closely by a real gas

(a) High pressure and high temperature

(b) Low pressure and low temperature

(c) Low pressure and high temperature

(d) High pressure and low temperature

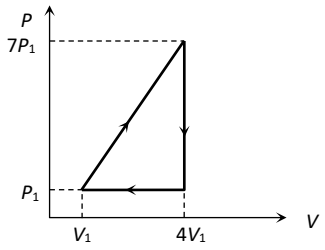
12. In the cyclic process shown in the figure, the work done by the gas in one cycle is

(a) $28\ P_1V_1$

(b) $14\ P_1V_1$

(c) $18\ P_1V_1$

(d) $9\ P_1V_1$



13. If two metallic plates of equal thicknesses and thermal conductivities K_1 and K_2 are put together face to face and a common plate is constructed, then the equivalent thermal conductivity of this plate will be

(a) $\frac{K_1K_2}{K_1+K_2}$ (b) $\frac{2K_1K_2}{K_1+K_2}$

(c) $\frac{(K_1^2+K_2^2)^{3/2}}{K_1K_2}$ (d) $\frac{(K_1^2+K_2^2)^{3/2}}{2K_1K_2}$

14. The period of oscillation of a simple pendulum of constant length at earth surface is *T*. Its period inside a mine is

(a) Greater than *T* (b) Less than *T*

(c) Equal to *T* (d)Cannot be compared

15. Equation of a progressive wave is given by

$$y = 4\sin\left\{\pi\left(\frac{t}{5}-\frac{x}{9}\right)+\frac{\pi}{6}\right\}$$

Then which of the following is correct

(a) $v = 5\,m/\sec$ (b) $\lambda = 18\,m$

(c) $a = 0.04\,m$ (d) $n = 50\,Hz$

16. The ratio of the forces between two small spheres with constant charge (a) in air (b) in a medium of dielectric constant *K* is

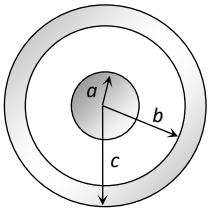
(a) $1:K$ (b) $K:1$

(c) $1:K^2$ (d) $K^2:1$

17. A solid conducting sphere of radius *a* has a net positive charge 2*Q*. A conducting spherical shell of inner radius *b* and outer radius *c* is concentric with the solid sphere and has a net charge – *Q*. The surface charge density on the inner and outer surfaces of the spherical shell will be

(a) $-\frac{2Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$

(b) $-\frac{Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$



(c) $0, \frac{Q}{4\pi c^2}$

(d) None of the above

18. There is an electric field E in X-direction. If the work done on moving a charge $0.2\,C$ through a distance of $2\,m$ along a line making an angle $60°$ with the X-axis is 4.0, what is the value of E

(a) $\sqrt{3}\ N/C$ (b) $4\ N/C$

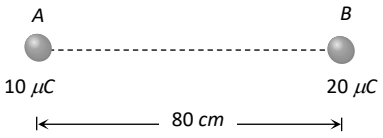
(c) $5\ N/C$ (d) None of these

19. Ten electrons are equally spaced and fixed around a circle of radius R. Relative to $V = 0$ at infinity, the electrostatic potential V and the electric field E at the centre C are

(a) $V \neq 0$ and $\vec{E} \neq 0$ (b) $V \neq 0$ and $\vec{E} = 0$

(c) $V = 0$ and $\vec{E} = 0$ (d) $V = 0$ and $\vec{E} \neq 0$

20. In the given figure distance of the point from A where the electric field is zero is



(a) 20 *cm* (b) 10 *cm*

(c) 33 *cm* (d) None of these

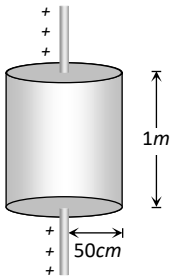
21. Electric charge is uniformly distributed along a long straight wire of radius 1*mm*. The charge per *cm* length of the wire is Q *coulomb*. Another cylindrical surface of radius 50 *cm* and length 1*m* symmetrically encloses the wire as shown in the figure. The total electric flux passing through the cylindrical surface is

(a) $\frac{Q}{\varepsilon_0}$

(b) $\frac{100\,Q}{\varepsilon_0}$

(c) $\frac{10\,Q}{(\pi\varepsilon_0)}$

(d) $\frac{100\,Q}{(\pi\varepsilon_0)}$



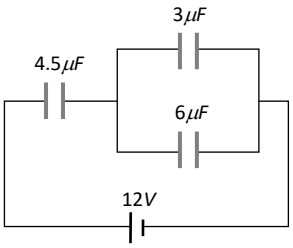
22. In the circuit shown in the figure, the potential difference across the $4.5\mu F$ capacitor is

(a) $\frac{8}{3}$ *volts*

(b) 4 *volts*

(c) 6 *volts*

(d) 8 *volts*



23. There is a current of 40 *ampere* in a wire of $10^{-6}\,m^2$ area of cross-section. If the number of free electron per m^3 is 10^{29}, then the drift velocity will be

(a) $1.25 \times 10^3\ m/s$ (b) $2.50 \times 10^{-3}\ m/s$

(c) $25.0 \times 10^{-3}\ m/s$ (d) $250 \times 10^{-3}\ m/s$

24. The electric field E, current density J and conductivity σ of a conductor are related as

(a) $\sigma = E/j$ (b) $\sigma = j/E$

(c) $\sigma = jE$ (d) $\sigma = 1/jE$

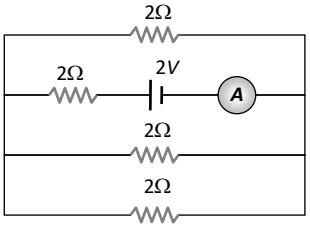
25. The reading of the ammeter as per figure shown is

(a) $\frac{1}{8}\,A$

(b) $\frac{3}{4}\,A$

(c) $\frac{1}{2}\,A$

(d) 2 A



26. Kirchhoff's second law is based on the law of conservation of

(a) Charge

(b) Energy

(c) Momentum

(d) Sum of mass and energy

27. A cell whose e.m.f. is 2 V and internal resistance is 0.1Ω, is connected with a resistance of 3.9Ω. The voltage across the cell terminal will be

(a) $0.50\ V$ (b) $1.90\ V$

(c) $1.95\ V$ (d) $2.00\ V$

28. The n rows each containing m cells in series are joined in parallel. Maximum current is taken from this combination across an external resistance of 3Ω resistance. If the total number of cells used are 24 and internal resistance of each cell is 0.5 Ω then

(a) $m=8, n=3$ (b) $m=6, n=4$

(c) $m=12, n=2$ (d) $m=2, n=12$

29. The resistance of a wire of iron is 10 *ohms* and temp. coefficient of resistivity is $5\times10^{-3}/°C$. At $20°C$ it carries 30 *milliamperes* of current. Keeping constant potential difference between its ends, the temperature of the wire is raised to $120°C$. The current in *milliamperes* that flows in the wire is

(a) 20 (b) 15

(c) 10 (d) 40

30. A helium nucleus makes a full rotation in a circle of radius 0.8 *metre* in two seconds. The value of the magnetic field B at the centre of the circle will be

(a) $\frac{10^{-19}}{\mu_0}$ (b) $10^{-19}\mu_0$

(c) $2\times10^{-10}\mu_0$ (d) $\frac{2\times10^{-10}}{\mu_0}$

31. A battery is connected between two points A and B on the circumference of a uniform conducting ring of radius r and resistance R. One of the arcs AB of the ring subtends an angle θ at the centre. The value of the magnetic induction at the centre due to the current in the ring is

(a) Proportional to $2(180°-\theta)$

(b) Inversely proportional to r

(c) Zero, only if $\theta=180°$

(d) Zero for all values of θ

32. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns per *cm* is halved, the new value of the magnetic field is

(a) B (b) 2 B

(c) 4 B (d) $B/2$

33. A proton is moving along Z-axis in a magnetic field. The magnetic field is along X-axis. The proton will experience a force along

(a) X-axis (b) Y-axis

(c) Z-axis (d) Negative Z-axis

34. A galvanometer coil of resistance 50 Ω, show full deflection of $100\,\mu A$. The shunt resistance to be added to the galvanometer, to work as an ammeter of range 10 *mA* is

(a) 5 Ω in parallel (b) 0.5 Ω in series

(c) 5 Ω in series (d) 0.5 Ω in parallel

35. A magnetic needle is kept in a non-uniform magnetic field. It experiences

(a) A force and a torque

(b) A force but not a torque

(c) A torque but not a force

(d) Neither a torque nor a force

36. Two identical thin bar magnets each of length *l* and pole strength *m* are placed at right angle to each other with north pole of one touching south pole of the other. Magnetic moment of the system is

(a) *ml* (b) 2*ml*

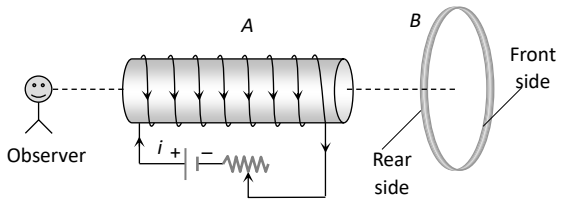
(c) $\sqrt{2}ml$ (d) $\frac{1}{2}ml$

37. The magnetic field in a coil of 100 turns and 40 *square cm* area is increased from 1 *Tesla* to 6 *Tesla* in 2 *second.* The magnetic field is perpendicular to the coil. The e.m.f. generated in it is

(a) $10^4\ V$ (b) 1.2 *V*

(c) 1.0 *V* (d) $10^{-2}\ V$

38. An aluminium ring *B* faces an electromagnet *A*. The current *I* through *A* can be altered



(a) Whether *I* increases or decreases, *B* will not experience any force

(b) If *I* decrease, *A* will repel *B*

(c) If *I* increases, *A* will attract *B*

(d) If *I* increases, *A* will repel *B*

39. Two coils *A* and *B* having turns 300 and 600 respectively are placed near each other, on passing a current of 3.0 *ampere* in *A*, the flux linked with *A* is $1.2\times10^{-4}\ weber$ and with *B* it is $9.0\times10^{-5}\ weber$. The mutual inductance of the system is

(a) 2×10^{-5} *henry* (b) 3×10^{-5} *henry*

(c) 4×10^{-5} *henry* (d) 6×10^{-5} *henry*

40. If a current *I* given by $I_0\sin\left(\omega t-\frac{\pi}{2}\right)$ flows in an ac circuit across which an ac potential of $E=E_0\sin\omega t$ has been applied, then the power consumption *P* in the circuit will be

(a) $P=\frac{E_0I_0}{\sqrt{2}}$ (b) $P=\sqrt{2}E_0I_0$

(c) $P=\frac{E_0I_0}{2}$ (d) $P=0$

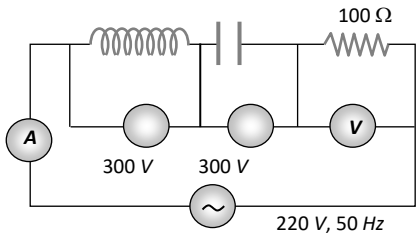
41. An alternating voltage $E=200\sqrt{2}\sin(100\,t)$ is connected to a 1 *microfarad* capacitor through an ac

ammeter. The reading of the ammeter shall be

(a) 10 mA (b) 20 mA

(c) 40 mA (d) 80 mA

42. In the circuit shown below, what will be the readings of the voltmeter and ammeter



(a) 800 V, 2A (b) 300 V, 2A

(c) 220 V, 2.2 A (d) 100 V, 2A

43. An electromagnetic wave travels along z-axis. Which of the following pairs of space and time varying fields would generate such a wave

(a) E_x, B_y (b) E_y, B_x

(c) E_z, B_x (d) E_y, B_z

44. The field of view is maximum for

(a) Plane mirror (b) Concave mirror

(c) Convex mirror (d)Cylindrical mirror

45. If light travels a distance x in t_1 sec in air and 10 x distance in t_2 sec in a medium, the critical angle of the medium will be

(a) $\tan^{-1}\left(\frac{t_1}{t_2}\right)$ (b) $\sin^{-1}\left(\frac{t_1}{t_2}\right)$

(c) $\sin^{-1}\left(\frac{10t_1}{t_2}\right)$ (d) $\tan^{-1}\left(\frac{10t_1}{t_2}\right)$

46. A thin equiconvex lens is made of glass of refractive index 1.5 and its focal length is 0.2 m, if it acts as a concave lens of 0.5 m focal length when dipped in a liquid, the refractive index of the liquid is

(a) $\frac{17}{8}$ (b) $\frac{15}{8}$

(c) $\frac{13}{8}$ (d) $\frac{9}{8}$

47. Angle of a prism is 30° and its refractive index is $\sqrt{2}$ and one of the surface is silvered. At what angle of incidence, a ray should be incident on one surface so that after reflection from the silvered surface, it retraces its path

(a) 30° (b) 60°

(c) 45° (d) $\sin^{-1}\sqrt{1.5}$

48. Two waves having intensity in the ratio 25 : 4 produce interference. The ratio of the maximum to the minimum intensity is

(a) 5 : 2 (b) 7 : 3

(c) 49 : 9 (d) 9 : 49

49. In a Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen when light of wavelength 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is given by

(a) 12 (b) 18

(c) 24 (d) 30

50. When an unpolarized light of intensity I_0 is incident on a polarizing sheet, the intensity of the light which does not get transmitted is

(a) Zero (b) I_0

(c) $\frac{1}{2}I_0$ (c) $\frac{1}{4}I_0$

51. The de-Broglie wavelength of a neutron at 27^oC is λ. What will be its wavelength at 927^oC

(a) $\lambda / 2$ (b) $\lambda / 3$

(c) $\lambda / 4$ (d) $\lambda / 9$

52. The minimum intensity of light to be detected by human eye is $10^{-10} W/m^2$. The number of photons of wavelength $5.6\times10^{-7} m$ entering the eye, with pupil area $10^{-6} m^2$, per second for vision will be nearly

(a) 100 (b) 200

(c) 300 (d) 400

53. An electron jumps from the 4th orbit to the 2nd orbit of hydrogen atom. Given the Rydberg's constant $R = 10^5 cm^{-1}$. The frequency in *Hz* of the emitted radiation will be

(a) $\frac{3}{16}\times10^5$ (b) $\frac{3}{16}\times10^{15}$

(c) $\frac{9}{16}\times10^{15}$ (d) $\frac{3}{4}\times10^{15}$

54. The energy of electron in first excited state of H-atom is $-3.4\ eV$ its kinetic energy is

(a) $-3.4\ eV$ (b) $+3.4eV$

(c) $-6.8eV$ (d) $6.8Ev$

55. Atomic weight of boron is 10.81 and it has two isotopes ${}_5B^{10}$ and ${}_5B^{11}$. Then ratio of ${}_5B^{10} :{}_5 B^{11}$ in nature would be

(a) 19 : 81 (b) 10 : 11

(c) 15 : 16 (d) 81 : 19

56. The masses of neutron and proton are 1.0087 *a.m.u.* and 1.0073 *a.m.u.* respectively. If the neutrons and protons combine to form a helium nucleus (alpha particles) of mass 4.0015 *a.m.u.* The binding energy of the helium nucleus will be (1 *a.m.u.*= 931 *MeV*)

(a) 28.4 *MeV* (b) 20.8 *MeV*

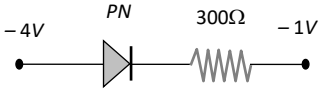
(c) 27.3 *MeV* (d) 14.2 *MeV*

57. A *Ge* specimen is doped with *Al*. The concentration of acceptor atoms is ~10^{21} *atoms*/m^3. Given that the intrinsic concentration of electron hole pairs is ~ $10^{19}/m^3$, the concentration of electrons in the specimen is

(a) $10^{17}/m^3$ (b) $10^{15}/m^3$

(c) $10^4/m^3$ (d) $10^2/m^3$

58. What is the current in the circuit shown below



(a) 0 *amp* (b) 10^{-2} *amp*

(c) 1 *amp* (d) 0.10 *amp*

59. In a *PN*-junction diode not connected to any circuit

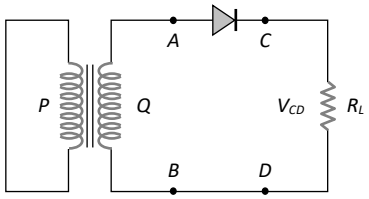
(a) The potential is the same everywhere

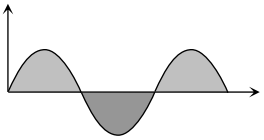
(b) The *P*-type is a higher potential than the *N*-type side

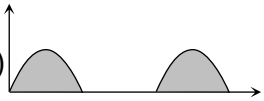
(c) There is an electric field at the junction directed from the *N*- type side to the *P*- type side

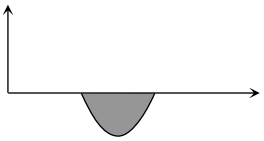
(d) There is an electric field at the junction directed from the *P*-type side to the *N*-type side

60. In the half-wave rectifier circuit shown. Which one of the following wave forms is true for V_{CD}, the output across *C* and *D*?



(a) 

(b) 

(c) 

(d)