Physics

1. If a force F is applied on a body and it moves with a velocity v, the power will be-
   (1) F v
   (2) F / v
   (3) F/v^2
   (4) F/v^2

2. In an experiment, the percentage of error occurred in the measurement of physical quantities. A, B, C and D are $1\%, 2\%, 3\%$ and 4% respectively. Then the maximum percentage of error in the measurement X, where $X = \frac{A^2 B^{1/2}}{C^{1/3} D^3}$, will be
   (1) 10%
   (2) (3/13) %
   (3) 16%
   (4) −10%

3. The range of a particle when launched at an angle of 15° with the horizontal is 150 m. What is the range of projectile when launched at an angle of 45° to the horizontal?
   (1) 150 m
   (2) 300 m
   (3) 450 m
   (4) 60 m

4. The moment of inertia of two spheres of equal masses about their diameters are equal. If one of them is solid and other is hollow, the ratio of their radii is.
   (1) $\sqrt{3}:\sqrt{5}$
   (2) 3:5
   (3) $\sqrt{5}:\sqrt{3}$
   (4) 5:3

5. The relation between escape velocity v_e from the surface of the earth and the orbital velocity v_0 is.
   (1) $\sqrt{2}v_e = v_0$
   (2) $v_e = \sqrt{2}v_0$
   (3) $v_e = 2v_0$
   (4) $4v_e = 3v_0$

6. If electric flux coming out of a closed surface is zero, the electric field at the surface will be-
   (1) Zero
   (2) Same at all places
   (3) Dependent upon the location of charges
   (4) Infinite

7. A particle performing SHM starts from equilibrium position and its time period is 16 second. After 2 seconds its velocity is $\pi m/s$. Amplitude of oscillation is $(\cos 45° = \frac{1}{\sqrt{2}})$.
   (1) $a2\sqrt{m}$
   (2) $4\sqrt{2}\ m$
   (3) $6\sqrt{2}m$
   (4) $8\sqrt{2}m$

8. The resistance of the bulb filament is $100\ \Omega$ at a temperature of 100℃. If its temperature coefficient of resistance be $0.005\ per\ °C$, its resistance will become 200Ω at a temperature
   (1) $400°C$
   (2) $200°C$
   (3) $300°C$
   (4) $500°C$

9. A circular coil of n turns and radius R has a magnetic induction of strength at its centre is
   (1) $B = \frac{\mu_0 nI}{2R}$
   (2) $B = \frac{\mu_0 nR}{\sqrt{2}\ R}$
   (3) $B = \frac{\mu_0 nI}{R}$
   (4) $\sqrt{\frac{2}{3}} \frac{\mu_0 nI}{R}$

10. The nuclei of which one of the following pairs of nuclei are isotones: -
    (1) $_{34}Se^{74}$, $_{31}Ga^{71}$
    (2) $_{38}Sr^{84}$, $_{38}Sr^{86}$
    (3) $_{42}Mo^{92}$, $_{40}Zr^{92}$
    (4) $_{20}Ca^{40}$, $_{16}S^{32}$

11. Two slits in Young's experiment have widths in the ratio 1:25. The ratio of intensity at the maxima and minima in the interference pattern, $\frac{I_{max}}{I_{min}}$ is.
    (1) $\frac{49}{121}$
    (2) $\frac{4}{9}$
    (3) $\frac{9}{4}$
    (4) $\frac{121}{49}$

12. Consider the earth to be a homogeneous sphere. Scientist 'A' goes deep down in a mine and scientist 'B' goes high up in a balloon. The gravitational field measured by:
    (1) A goes on decreasing and that by B goes on increasing.
    (2) B goes on decreasing and that by A goes on increasing
    (3) Each remains unchanged
    (4) Each goes on decreasing

13. In a series LCR circuit, resistance R = 10 Ω and the impedance $Z = 20\Omega$. The phase difference between the current and the voltage is.
    (1) 30°
    (2) 45°
    (3) 60°
    (4) 90°

14. The rms velocity of hydrogen gas molecules at NTP is V ms^{-1}. The gas is heated at constant volume till the pressure becomes four times. The final rms velocity is.
    (1) V/2
    (2) V
    (3) 2V
    (4) 4V

15. A system of three polarizers $P_1, P_2 P_3$ is set up such that the pass axis of P_3 is crossed with respect to that of P_1. The pass axis of P_2 is inclined at 60° to the pass axis of P_3. When a beam of unpolarized light of intensity I_0 is incident on P_1, the intensity of light transmitted by the three polarizers is I. The ratio (I_0/I) equals (nearly):
    (1) 10.67
    (2) 5.33
    (3) 1.80
    (4) 16.00

16. The thermodynamic process on an ideal gas is given in column – I while the corresponding change in internal energy (dU), heat transfer (dQ) and work done are (dW) given in column – II.

	Column-I		Column-II
(i)	Isothermal process	p.	Pressure= constant
(ii)	Adiabatic process	q.	dW=−dU
(iii)	Isochoric process	r.	dU=0
(iv)	Isobaric process	s.	dQ=dU

Now, match the given columns and select the correct option from the codes given below.
    (1) $i - p, ii - q, iii - r, iv - s$
    (2) $i - r, ii - q, iii - s, iv - p$
    (3) $i - s, ii - p, iii - q, iv - r$
    (4) $i - q, ii - s, iii - p, iv - r$

17. If the current through a coil change from 1 A to 3 A in 0.02 s to produce an emf of 6 V, then the self-inductance of the coil is.
    (1) 0.12 H
    (2) 0.06 H
    (3) 0.02 H
    (4) 0.01 H

18. Escape velocity for a projectile at earth's surface is v_e. A body is projected from earth's surface with velocity $2v_e$. The velocity of the body when it is at infinite distance from the center of the earth is-
    (1) v_e
    (2) $2v_e$

(3) $\sqrt{2}v_e$

(4) $\sqrt{3}v_e$

19. A body is projected at an angle of 30° with the horizontal and with a speed of $30ms^{-1}$. What is the angle with the horizontal after 1.5 seconds? ($g = 10\ ms^{-2}$).
    (1) 0°
    (2) 30°
    (3) 60°
    (4) 90°

20. If a magnetic needle is made to vibrate in uniform field H, then its time period is T. If it vibrates in the field of intensity 4H, its time period will be:
    (1) 2T
    (2) T/2
    (3) 2/T
    (4) T

21. If $\alpha-$ particle of mass m_α are accelerated through potential V, the wavelength of associated matter wave will be –
    (1) $h/\sqrt{m_\alpha eV}$
    (2) $h/\sqrt{2m_\alpha eV}$
    (3) $h/\sqrt{8m_\alpha eV}$
    (4) $h/2\sqrt{m_\alpha eV}$

22. An alpha particle is accelerated through a potential difference of 10^6 volt. Its kinetic energy will be.
    (1) 1 MeV
    (2) 2 MeV
    (3) 4 MeV
    (4) 8 MeV

23. The length of a potentiometer wire is 10 m and a potential difference of 2 volt is applied to its ends. If the length of its wire is increased by 1 m, the value of potential gradient in volt/m will be-
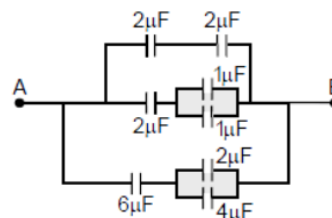
(1) 0.18
(2) 0.22
(3) 1.3
(4) 0.9

24. In the arrangement shown, find the equivalent capacitance between A and B:

(1) $5\mu F$
(2) $\frac{25}{2}\mu F$
(3) $10\mu F$
(4) $\frac{25}{3}\mu F$

25. A cricket ball of mass 250 g collides with a bat with velocity 10 m/s and returns with the same velocity within 0.01 second. The force acted on bat is.
    (1) 25 N
    (2) 50 N
    (3) 250 N
    (4) 500 N

26. Two particles A and B initially at rest. Move towards each other under a mutual force of attraction. At the instant, when the speed of A is v and the speed of B is $2v$ the velocity of center of the system is.
    (1) 0
    (2) v
    (3) $1.5\ v$
    (4) $3\ v$

27. **Assertion:** Work function of a metal is. 8 eV. Two photons each having energy 5 eV can't eject the electron from the metal.
    Reason: More than one photon can't collide simultaneously with an electron.
    (1) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
    (2) If both Assertion and Reason are true but the Reason is not correct explanation of the Assertion.

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(3) If Assertion is true but the Reason is false.

(4) If Assertion & Reason are false.

28. **Assertion:** Net electric field insider conductor is zero.
    Reason: Total positive charge equals to total negative charge in a charged conductor.
    (1) If both assertion and reason are true and reason is the correct explanation of assertion.
    (2) If both assertion and reason are true but reason is not the correct explanation of assertion.
    (3) If assertion is true but reason is false.
    (4) If both assertion and reason are false.

29. **Assertion:** Work done in moving a body over a closed loop is zero for every force in nature.
    Reason: Work done does not depend on nature of force.
    (1) If both assertion and reason are true and reason is the correct explanation of assertion.
    (2) If both assertion and reason are true but reason is not the correct explanation of assertion.
    (3) If assertion is true but reason is false.
    (4) If both assertion and reason are false.

30. The electric field associated with an e. m. wave in vacuum is given by $\vec{E} = \hat{i}40\cos(kz - 6 \times 10^8 t)$, where E, z and t are in vol/m, meter and seconds respectively. The value of wave vector k is:
    (1) $6\ m^{-1}$
    (2) $3\ m^{-1}$
    (3) $2\ m^{-1}$
    (4) $0.5\ m^{-1}$

31. **Assertion:** Force is the product of mass and square of acceleration.
    Reason: In every case, net force is parallel to acceleration.
    (1) Both (Assertion) and (Reason) are correct and (Reason) is not the correct explanation of (Assertion).
    (2) (Assertion) is correct but (Reason) is not correct.
    (3) (Assertion) is not correct but (Reason) is correct.
    (4) Both (Assertion) and (Reason) are correct and (Reason) is the correct explanation of (Assertion).

32. Radius of the second Bohr orbit of singly ionised helium atom is.
    (1) 0.53 Å
    (2) 1.06 Å
    (3) 0.265 Å
    (4) 0.132 Å

33. The center of mass of a non-uniform rod of length L whose mass per unit length λ varies as $\lambda = \frac{k.x^2}{L}$ where k is a constant and x is the distance of any point on rod from its one end, is (from the same end).
    (1) $\frac{3}{4}L$
    (2) $\frac{1}{4}L$
    (3) $\frac{k}{L}$
    (4) $\frac{3k}{L}$

34. For a radioactive substance disintegrating. Which of the following is correct at $t = 1.09\ \tau$.
    (1) About 1/3 of substance disintegrate
    (2) About 2/3 of substance disintegrate
    (3) About 90% of the substance disintegrate
    (4) Almost all the substance disintegrates

35. Two waves of same frequency and amplitude travelling in opposite directions in a medium super impose

over each other. Then which event is observed.
(1) Beats
(2) Resonance
(3) Stationary waves
(4) Harmonic nodes

SECTION – B

36. **Statement I:** The angle of contact of a liquid decrease with increase in temperature.
Statement II: According to Bernoulli's theorem, as velocity increases pressure decreases and vice versa.
Choose the correct option.
(1) Both statement I and II are correct.
(2) Both statement I and II are incorrect.
(3) Statement I is correct but statement II is incorrect.
(4) Statement II is correct but statement I is incorrect

37. The magnetic susceptibility of a paramagnetic substance at $-73°C$ is 0.0075, then its value at $-173°C$ will be?
(1) 0.0030
(2) 0.0150
(3) 0.0180
(4) 0.0045

38. **Assertion:** When number of turns in a coil doubled, coefficient of self-inductance of the coil becomes four times.
Reason: Coefficient of self-inductance is proportional of the square of number of turns.
(1) If both the assertion and the reason are true and the reason is a correct explanation of the assertion
(2) If both the assertion and reason are true but the reason is not a correct explanation of the assertion
(3) If the assertion is true but the reason is false
(4) If both the assertion and reason are false

39. A two-input NAND gate is followed by a single-input NOR gate. This logic circuit will function as.
(1) an AND gate
(2) an OR gate
(3) a NOT gate
(4) a NOR gate

40. One mole of an ideal diatomic gas is heated at a constant pressure of one atmosphere from $0°C$ to $100°C$. Then the change in the internal energy is.
(1) $20.80 \times 10^2 J$
(2) $12.48 \times 510^2 J$
(3) $832 \times 10^2 J$
(4) $6.25 \times 10^2 J$

41. M_P denotes the mass of a proton and M_n that of a neutron. A given nucleus, of binding energy B, contains Z protons and N neutrons. The mass. $M(N, Z)$ of the nucleus is given by (c is velocity of light)
(1) $M(N, Z) = NM_n + ZM_P + Bc^2$
(2) $M(N, Z) = NM_n + ZM_P - B/c^2$
(3) $M(N, Z) = NM_n + ZM_P + B/c^2$
(4) $M(N, Z) = NM_n + ZM_P - Bc^2$

42. Probability of survival of a radioactive nucleus in one mean life is.
(1) $\frac{1}{2}$
(2) $\frac{1}{e}$
(3) $\frac{1}{4}$
(4) $\frac{1}{5}$

43. The correct measure of magnetic hardness of a material is.
(1) Remnant magnetism
(2) Hysteresis loss
(3) Coercivity
(4) Curie temperature

44. If the angle of dip at two places are 30° and 45° respectively, then the ratio of horizontal component of earth's magnetic field at two places assuming

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magnitude of total magnetic field of earth is same, will be.

45. Two parallel wires in free space are 10 cm apart and each carries a current of 10 A in the same direction. The magnetic force per unit length of each wire is.
    (1) $2 \times 10^{-4} \, N$, attractive
    (2) $2 \times 10^{-4} \, N$, repulsive
    (3) $2 \times 10^{-7} \, N$, attractive
    (4) $2 \times 10^{-7} \, N$, repulsive

46. What is the voltage gain in a common emitter amplifier where input resistance is $3 \, \Omega$ and load resitacne is $24 \, \Omega$ and current gain $\beta = 6$?
    (1) 2.2
    (2) 1.2
    (3) 4.8
    (4) 48

47. A person of mass m is standing on one end of a plank of mass M and length L floating in water. The person moves from one end to another and stops. The displacement of the plank is-
    (1) $\frac{Lm}{(m+M)}$
    (2) $Lm(M + m)$
    (3) $\frac{(M+m)}{Lm}$
    (4) $\frac{LM}{(m+M)}$

48. **Assertion:** When height of a tube is less than liquid rise in the capillary tube, the liquid does not overflow.

Reason: Product of radius of meniscus and height of liquid in the capillary tube always one.
    (1) If both the assertion and the reason are true and the reason is a correct explanation of the assertion
    (2) If both the assertion and reason are true but the reason is not a correct explanation of the assertion
    (3) If the assertion is true but the reason is false
    (4) If both the assertion and reason are false

49. The amplitude of particles executing S.H..M with frequency of 60 Hz is 0.01 m. Then the maximum value of the acceleration of particle is.
    (1) $144\pi^2 m/sec^2$
    (2) $144 \, m/sec^2$
    (3) $\frac{144}{\pi^2} m/sec^2$
    (4) $288\pi^2 m/sec^2$

50. A force F is needed to break a copper wire having radius R. Then the force needed to break a copper wire of radius $2R$ will be.
    (1) $F/2$
    (2) $2F$
    (3) $4F$
    (4) $F/4$