1. Three blocks of masses 2 kg, 3 kg and 5 kg are connected to each other with light string and are then placed on a frictionless surface as shown in the figure. The system is pulled by a force $F=10$ N, then tension $T_1$ is:

- a) 1 N   b) 5 N   c) 8 N   d) 10 N

2. Two masses $m_1$ and $m_2$ are attached to a string which passes over a frictionless smooth pulley. When $m_1=10$ kg, $m_2=6$ kg, the acceleration of masses is:

- a) 20 m/s$^2$   b) 5 m/s$^2$   c) 2.5 m/s$^2$   d) 10 m/s$^2$

3. An object is moving through the liquid. The viscous damping force acting on it is proportional to the velocity. Then dimension of constant of proportionality is:

- a) $[ML^{-1}T^{-1}]$   b) $[MLT^{-1}]$   c) $[MLT^{-1}]$   d) $[MLT^{-1}]$
4. Magnetic meridian is a:
   a) Point  b) horizontal plane
   c) Vertical plane  d) Line along N-S

5. The unit of L/R is where L = inductance and R = resistance:
   a) Sec  b) sec⁻¹
   c) volt  d) ampere

6. If the current is doubled, the deflection is also doubled in:
   a) a tangent galvanometer  b) a moving coil galvanometer
   c) both a) and b)  d) none of the above

7. The permeability of a paramagnetic substance is:
   a) Slightly more than vacuum  b) slightly less than vacuum
   c) much more than vacuum  d) none of the above

8. When particles will have minimum frequency of revolution when projected with the same velocity perpendicular to magnetic field?
   a) Li⁺  b) Electron
   c) Proton  d) He⁺

9. A body of mass \( M_1 \) collides elastically with another mass \( M_2 \) at rest. There is maximum transfer of energy when:
   a) \( M_1 > M_2 \)  b) \( M_1 = M_2 \)
   c) \( M_1 > M_2 \)  d) same of all values of \( M_1 \) and \( M_2 \)

10. Minimum energy required to fake out the only one electron from ground state of He⁺ is:
    a) 13.6 eV  b) 54.4 eV
    c) 27.2 eV  d) 6.8 eV
11. Photons of 5.5 eV energy fall on the surface of the metal emitting photoclectrons of maximum kinetic energy 4.0 eV. The stopping voltage required for these electrons is:
   a) 5.5 V  b) 1.5 V  
   c) 9.5 V  d) 4.0 V

12. Which is different from others by units?
   a) Phase different  b) Mechanical equivalent  
   c) Loudness of sound  d) Poission's ratio

13. The velocity of a body of rest mass \( m_0 \) is \( \sqrt{\frac{3}{2}} \) where \( c \) is the velocity of light in vaccum. Then mass of this body is:
   a) \( \sqrt{\frac{3}{2}} m_0 \)  b) \( \frac{1}{2} m_0 \)  
   c) \( 2m_0 \)  d) \( 2/\sqrt{3}m_0 \)

14. A ball is dropped from top of a tower of 100m height. Simultaneously another ball was thrown upward from bottom of the tower with a speed of 50 m/s. They will cross each other after: \( g = 10 \text{ m/s}^2 \)
   a) 1 sec  b) 2 sec  
   c) 3 sec  d) 4 sec

15. The driver of a car moving towards a rocket launching pad with a speed of 6 m/s observes that the rocket is moving with speed of 10 m/s. The upward speed of the rocket as seen by the stationary observer is:
   a) 4 m/s  b) 6 m/s  
   c) 8 m/s  d) 11 m/s

16. A satellite revolves very near to the earth surface. Its speed should be around:
   a) 5 km/s  b) 8 km/s  
   c) 2 km/s  d) 11 km/s

17. If the density of the earth is doubled keeping its radius constant, then aclearation due to gravity \( g \) is:
   a) 20 m/s\(^2\)  b) 10 m/s \(^2\)
c) 5 m/s²  d) 2.5 m/s²

18. A simple pendulum oscillates in a vertical plane. When it passes through the mean position, the tension in the string is 3 times the weight of the pendulum bob. What is the maximum displacement of the pendulum of the string with respect to the vertical?
   a) 30°  b) 45°  c) 60°  d) 90°

19. A body is massed 8 kg is moved by a force F = 3 x N, where x is the distance covered. Initial position is x = 2 m and the final position is x = 10 m. The initial speed is zero. The final speed is:
   a) 6 m/s  b) 12 m/s  c) 18 m/s  d) 14 m/s

20. Which of the following statement is true?
   a) Velocity of light is constant in all media.  b) Velocity of light in vacuum is maximum.
   c) Velocity of light is same in all reference frames.  d) Laws of nature have identical form in all reference frames.

21. Find the equivalent resistance across AB:

   ![Diagram of a network of resistors]

   a) 1 Ω  b) 2 Ω  c) 3 Ω  d) 4 Ω

22. The nuclear reaction $^1\text{H}^1 + ^1\text{H}^1 \rightarrow ^2\text{He}^4$ mass of deuteron = 2.0141 amu and of He = 4.0024 amu is:
   a) Fusion reaction releasing 24 MeV energy
   b) Fusion reaction absorbing 24 MeV energy
   c) Fission reaction releasing 0.0258 MeV energy
   d) Fission reaction absorbing 0.0258 MeV energy

23. In Thomson experiment of finding e/m for electrons, beam of electron is replaced by that of mouns particle with same charge as of electrons but mass 208 times that of electrons. No deflection condition in this case satisfy if:
24. A thin metal plate P is inserted half way between the plates of a parallel plate capacitor of capacitance C in such a way that it is parallel of the two plates. The capacitance now becomes:
   a) C    b) \( \frac{C}{2} \)
   c) 4C    d) none of these

25. An inclined plane makes an angle 30° with horizontal. A solid sphere rolling down this inclined plane has a linear acceleration of:
   a) \( \frac{5g}{3} \)    b) \( \frac{2g}{3} \)
   c) \( \frac{g}{3} \)    d) \( \frac{5g}{7} \)

26. A bullet of mass 10 g is fired from a gun of mass 1 kg. If the recoil velocity vis 5 m/s, the velocity of the muzzle is:
   a) 0.05 m/s    b) 5 m/s
   c) 50 m/s    d) 500 m/s

27. A particular moves with constant speed \( \upsilon \) along circular path of radius \( r \) and completes the circle in time T. The acceleration of the particle is:
   a) \( \frac{2\upsilon^2}{T} \)    b) \( \frac{2\upsilon}{T} \)
   c) \( \frac{2\upsilon^2}{r} \)    d) \( \frac{2\upsilon^2}{T} \)

28. The separation between C and O-atoms in CO is 1.2 \( \text{Å} \). The distance of carbon atom from the centre of mass is:
   a) 0.3 \( \text{Å} \)    b) 0.7 \( \text{Å} \)
   c) 0.5 \( \text{Å} \)    d) 0.9 \( \text{Å} \)

29. A body moves a distance of 10 m under the action of force \( F = 10 \text{ N} \). If the work done by 25 J, the angle which the force makes with the direction of motion is:
   a) 0°    b) 30°
   c) 60°    d) none of these
30. When a spring is stretched by 2 cm, it stores 100 J of energy. If it is stretched further by 2 cm, the stored energy will be increased by:
   a) 100 J  b) 200 J  c) 300 J  d) 400 J

31. Two wires A and B are of same materials. Their lengths are in the ratio 1:2 and diameters are in the ratio 2:1. When stretched by force $F_A$ and $F_B$ respectively they got equal increase in their lengths.

   Then the ratio $F_A:F_B$ should be:
   a) 1:2  b) 1:1  c) 2:1  d) 8:1

32. Mixed He$^+$ and O$^{2+}$ ions mass of He$^+$ = 4 amu and that of O$^{2+}$ = 16 amu beam passes a region of constant perpendicular magnetic field. If kinetic energy of all the ions is same then:

   a) He$^+$ ions will be deflected more than those of O$^{2+}$
   b) He$^+$ ions will be deflected less than those of O$^{2+}$
   c) all the ions will be deflected equally
   d) no ions will be deflected

33. In young double slit experiment the wavelength of light was changed from 7000 Å to 3500 Å. While doubling the separation between the slits which of the following is not true for the experiment?

   a) The width of the fringes changes
   b) The colour of bright fringes changes
   c) The separation between successive bright fringes changes
   d) The separation between successive dark fringes remains unchanged

34. The coherence of two light sources means that the light waves emitted have:

   a) same frequency  b) same intensity  c) constant phase difference  d) same velocity

35. The valence band and conduction band of a solid overlap at low temperature, the solid may be:

   a) a metal  b) a semiconductor  c) an insulator  d) none of these
36. The dominant contribution to current comes from holes in case of:
   a) metals       b) intrinsic semiconductor
   c) p-type extrinsic semiconductors    d) n-type extrinsic semiconductors

37. The ratio of thermionic currents $I/I_0$ for a metal when the temperature is slowly increased $T_0$ to $T$ as shown in figure. $I$ and $I_0$ are currents at $T$ and $T_0$ respectively. Then which one is correct?

   ![Diagram](image)

   a) A       b) B
   c) C       d) D

38. A point object $0$ is placed in front of a glass rod having spherical end of radius of curvature $30$ cm. The image would be formed at:

   ![Diagram](image)

   a) $30$ cm left    b) infinity
   c) $1$ cm to the right    d) $18$ cm to the left

39. In the information of a rainbow light from the sun on water droplets undergoes:

   a) dispersion only    b) only total internal reflection
   c) dispersion and total internal reflection    d) none of the above

40. The angular magnification of a simple microscope can be increased by increasing:

   a) focal length of lens    b) size of object
   d) aperture of lens    d) power of lens

41. If no external voltage is applied across p-n junction, there would be:
a) no electric field across the junction
b) an electric field pointing from n-type to p-type side across the junction
c) an electric field pointing from p-type to n-type side across the junction
d) a temporary electric field during formation of p-n junction that would subsequently disappear

42. Light travelling from a transparent medium to air undergoes total internal reflection at an angle of incidence of 45°. Then refractive index of the medium may be:
   a) 1.5    b) 1.3
   c) 1.1    d) 1.2

43. Plate voltage of a triode is increased from 200 V to 225 V. To maintain the plate current, change in grid voltage from 5 V to 5.75 V is needed. The amplification factor is:
   a) 40    b) 45
   c) 33.3  d) 25

44. Binding energy per nucleon plot against the mass number for stable nuclei is shown in the figure. Which curve is correct?

   a) A    b) B
   c) C    d) D

45. A light ray from air is incident as shown in figure at one end of a glass fiber refractive index, \( \mu = 1.5 \) making an incidence angle of 60° on the lateral surface, so that it undergoes a total internal reflection. How much time would it take to traverse the straight fiber of length 1 km?

   a) 3.33 µs  b) 6.67 µs  c) 5.77 µs  d) 3.85 µs
46. A thermodynamic system is taken through the cycle PQRSP process. The network done by the system is:

![Network Diagram]

a) 20 J  

b) -20 J  

c) 400 J  
d) -374 J

47. Consider four circuits shown in the figure below. In which circuit dissipating is greatest?

Neglect the internal resistance of the power supply.

![Circuit Diagrams]

48. Two capacitors $C_1$ and $C_2 = 2C_1$ are connected in a circuit with a switch between them as shown in the figure. Initially the switch is open and $C_1$ holds charge $Q$. The switch is closed. At steady state, the charge on each capacitor will be:

![Capacitor Diagram]

49. A particle is moving in a vertical circle. The tensions in the string when passing through two positions at angles $30^\circ$ and $60^\circ$ from vertical lowest positions are $T_1$ and $T_2$ respectively then:

a) $T_1 = T_2$  
b) $T_1 > T_2$
c) T > T2, d) tension in the string always remains the same

50. A coil of 100 turns carries a current of 5 mA and creates a magnetic flux of \(10^{-5}\) weber. The inductance is:
   a) 0.2 mH  b) 2.0 mH  
   c) 0.02 mH  d) none of these

51. The starter motor of a car draws a current \(I = 300\) A from the battery of voltage 12 V. If the car starts only after 2 minutes, what is the energy drawn from the battery?
   a) 3 kJ  b) 30 kJ  
   c) 7.2 kJ  d) 432 kJ

52. Surface of the lake is at 2°C and depth of the lake is 20 m. Find the temperature of the bottom of the lake:
   a) 2°C  b) 3°C  
   c) 4°C  d) none of these

53. \(y_1 = 4 \sin \omega t + kx, y_2 = -4 \cos \omega t + kx\), the phase difference is:
   a) \(\pi/2\)  b) 3 \(\pi/2\)  
   c) \(\pi\)  d) zero

54. Gauss's law should be invalid if:
   a) there were magnetic monopoles  
   b) the inverse square law were not exactly true  
   c) the velocity of light were not a universal constant  
   d) none of the above

55. A changed particle of mass 0.003g is held stationary in space by placing it in a downward direction of electric field of \(6 \times 10^4\) N/C. Then the magnitude of the charge is:
   a) \(5 \times 10^{-4}\) C  b) \(5 \times 10^{-8}\) C  
   c) \(-18 \times 10^{-6}\) C  d) \(-5 \times 10^{-8}\) C

56. A parallel plate capacitor has an electric field of \(10^3\) V/m between the plates. If the charge on the capacitor plate is \(1 \mu\)C, the force on each capacitor plate is:
57. An elementary of particle of mass \( m \) and charge \( +e \) is projected with velocity \( v \) at a much more massive particle of charge \( Z\varepsilon \), where \( Z>0 \). What is the closed possible approach of the incident particle?

\[ a) \frac{Z\varepsilon}{4\pi\varepsilon_0 m v^2} \quad b) \frac{Z\varepsilon}{4\pi\varepsilon_0 r_n} \quad c) \frac{Z\varepsilon}{8\pi\varepsilon_0 r_n} \quad d) -\frac{Z\varepsilon}{8\pi\varepsilon_0 r_n} \]

58. 1 g of water at atmospheric pressure has volume of 1 cc and when boiled it becomes 1681 cc of steam. The heat of vaporization of water is 540 cal/g. Then the changes in its internal energy in this process is:

\[ a) 540 \text{ cal} \quad b) 500 \text{ cal} \quad c) 1681 \text{ cal} \quad d) \text{ none of these} \]

59. A physicist works in a laboratory where the magnetic field is 2 T. She wears a necklace enclosing an area 0.01 m\(^2\) in such a way that the plane of the necklace is normal to the field and has a resistance \( R = 0.01 \Omega \). Because of power failure, the field decays to 1 T in time 10\(^{-3}\) sec. Then what is the total heat produced in her necklace?

\[ a) 10 \text{ J} \quad b) 20 \text{ J} \quad c) 20 \text{ J} \quad d) 40 \text{ J} \]

60. The temperature coefficient of resistance of a wire is 0.00125 C\(^{-1}\). At 300 K, resistance is 1 \( \Omega \). At what temperature the resistance of the wire will be 2 \( \Omega \)?

\[ a) 800 \text{ K} \quad b) 1100 \text{ K} \quad c) 600 \text{ K} \quad d) \text{ none of these} \]