OJEE 2024 B.Pharm Question Paper

Time Allowed :3 hours	**Maximum Marks :**480	**Total questions :**120

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 120 questions out of which 2 subjects with one choice-based subject (either PCM or PCB) Physics, Chemistry, Mathematics or Biology MCQs must be answered. The maximum marks are 800.
3. There are four parts in the question paper consisting of Biology, Physics, Chemistry and Mathematics.
4. Each subject will have 40 questions which will have Physics, Chemistry, and any one from Biology and Mathematics.
5. 4 marks are awarded for each correct answer and 1 mark is deducted for each wrong answer.

Physics

1. If the speed of sound in air at 0°C is 331 m/s, the speed of sound in air at 35°C is:

(A) 331.0 m/s

(B) 340.2 m/s

(C) 351.6 m/s

(D) 362.5 m/s

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2. Current I flows through a conducting wire of radius a. The magnetic field B at a distance r from the centre of the wire (where $r > a$ and μ is the permeability of free space) is:

(A) $\frac{\mu I}{2\pi a^2}$

(B) $\frac{\mu I r}{2\pi a^2}$

(C) $\frac{\mu I}{2\pi r}$

(D) $\frac{\mu I}{\pi r^2}$

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3. A concave lens forms the image of an object which is:

(A) Virtual, inverted and diminished

(B) Virtual, upright and diminished

(C) Virtual, inverted and enlarged

(D) Virtual, upright and enlarged

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4. A battery of 10 V and internal resistance 0.5 is connected in parallel with a battery of 12 V and internal resistance 0.8 . The terminals are connected by an external resistance of 20 . The current flowing through the 20 resistance is:

(A) 0.75 A

(B) 1.74 A

(C) 0.53 A

(D) 1.21 A

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5. Two coherent monochromatic light beams of intensity I and $4I$ are superimposed. The maximum and minimum possible intensities in the resulting beam are:

(A) 5I and I

(B) 5I and 3I

(C) 9I and I

(D) 9I and 3I

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6. Complete the following nuclear equation: ${}^{30}_{15}Si + ? \rightarrow ? + 1e^0$

(A) $+1e^0$

(B) $0 + 1e^0$

(C) $0 - 1e^0$

(D) None

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7. The deviation produced by an equilateral prism, when a ray of light is incident on it, does not depend on:

(A) Angle of prism

(B) Colour of light

(C) Material of the prism

(D) Size of the prism

---

8. A triode valve has an anode resistance of 20,000 and an amplification factor of 20. The mutual conductance is:

(A) 10^{-2} mho

(B) 10^{-3} mho

(C) 10^3 mho

(D) 10^2 mho

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9. A parallel-plate capacitor has plates of dimensions 2.0 cm by 3.0 cm separated by a 1.0 mm thickness of paper. The relative dielectric constant of paper is 3.7. Find its capacitance.

(A) 20 pF

(B) 20 nF

(C) 200 pF

(D) 20 micro F

---

10. If a copper wire carries a current of 80.0 mA, how many electrons flow past a given cross-section of the wire in 10.0 minutes?

(A) 0.3×10^{20} electrons

(B) 3.0×10^{16} electrons

(C) 9.0×10^{18} electrons

(D) 3.0×10^{20} electrons

---

11. A coil has resistance 20 ■ and inductance 0.35 H. Compute its impedance to an alternating current of 25 cycles/s.

(A) 50.5 ■

(B) 48.5 ■

(C) 58.5 ■

(D) 68.5 ■

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12. What back emf is induced in a coil of self-inductance 0.008 H when the current in the coil is changing at the rate of 110 A/s?

(A) 0.88V

(B) 0.78V

(C) 0.98V

(D) None

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16. To generate energy, nuclear reactors use the principle of:

(A) Fusion

(B) Fission

(C) Alpha decay

(D) Beta decay

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17. The source of energy in the Sun is:

(A) Conversion of hydrogen into helium in nuclear fusion reaction.

(B) Uranium fission.

(C) Beta decay of uranium.

(D) Reaction of hydrogen with uranium.

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18. Calculate the number density of free carriers in silver, assuming that each atom contributes one carrier. The density of silver is 10.5×10^3 kg/m^3 and the atomic weight is 107.8.

(A) 0.585×10^{28} carriers/m^3

(B) 58.5×10^{26} carriers/m^3

(C) 585.0×10^{27} carriers/m^3

(D) 5.85×10^{28} carriers/m^3

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19. Sodium atoms emit a spectral line with a wavelength in the yellow, 589.6 nm. What is the difference in energy between the two energy levels involved in the emission of this spectral line?

(A) 2.6 eV

(B) 2.9 eV

(C) 2.1 eV

(D) None

---

20. The speed v of a wave on a string depends on the tension F in the string and the mass per unit length m/L of the string. If it is known that [F] = [ML][T]–2, the values of the constants a and b in the following equation for the speed of a wave on a string are:

$$v = (\text{constant}) F^a \left(\frac{m}{L}\right)^b$$

(A) $a = \frac{1}{2}, b = \frac{1}{2}$

(B) $a = 2, b = -1$

(C) $a = \frac{1}{2}, b = -1$

(D) $a = 1, b = \frac{1}{2}$

---

21. A stone is dropped from the top of a tower. The height through which it falls in the first 3 seconds of its motion equals the height through which it falls in the last second of its motion. To reach the ground, the stone takes time equal to (g = 10 m/s^2):

(A) 4 s

(B) 5 s

(C) 6 s

(D) 7 s

---

22. A particle executes SHM with a period of 6 s and amplitude of 3 cm. Its maximum speed in cm/s is:

(A) π

(B) 2π

(C) 3π

(D) 3

---

23. A body of mass m moves along the X-axis such that at time t, its position is $x(t) = \alpha t^4 - \beta t^3 + \gamma t$, where α, β, and γ are constants. The acceleration of the body is:

(A) $24\alpha t^3 - 6\beta t$

(B) $\alpha t^2 - 6\beta t$

(C) $6\alpha t^2 - 6\beta t$

(D) $6\alpha t^3 - 6\beta t$

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24. A 7 kg object is subjected to two forces, $F_1 = 20i + 30j$ N and $F_2 = 8i - 50j$ N. Find the acceleration of the object.

(A) $4i - 7j$ m/s^2

(B) $8i - 7j$ m/s^2

(C) $2i - 7j$ m/s^2

(D) $4i - 7j$ m/s^2

---

25. The motion of a particle in the XY plane is given by $x(t) = 25 + 6t^2$ m; $y(t) = -50 - 20t + 8t^2$ m. The magnitude of the initial velocity of the particle, v_0, is given by:

(A) 30 m/s

(B) 40 m/s

(C) 50 m/s

(D) 20 m/s

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26. Rain, pouring down at an angle α with the vertical, has a constant speed of 10 m/s. A woman runs against the rain with a speed of 8 m/s and sees that the rain makes an angle β with the vertical. The relation between α and β is given by:

(A) $\tan\beta = \frac{8+10\sin\alpha}{10+8\cos\alpha}$

(B) $\tan\beta = \frac{8\cos\alpha}{10+8\sin\alpha}$

(C) $\tan\beta = \frac{8+10\cos\alpha}{10\sin\alpha}$

(D) $\tan\beta = \frac{8+10\sin\alpha}{10\cos\alpha}$

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27. A car goes around a curve of radius 48 m. If the road is banked at an angle of 15° with the horizontal, the maximum speed in kilometers per hour at which the car can travel if there is to be no tendency to skid even on very slippery pavement (tan 15° = 0.27 approximately) is:

(A) 30.6 km/h

(B) 40.6 km/h

(C) 20.6 km/h

(D) None

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28. An electrical appliance is rated 1500 W, 250 V. This appliance is connected to a 250 V supply mains. The current drawn by the appliance (assuming unity power factor) is:

(A) 6 A

(B) 10 A

(C) 15 A

(D) 12 A

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29. Two identical coins of mass 8 g are 50 cm apart on a tabletop. How many times larger is the weight of one coin than the gravitational attraction of the other coin for it? (G = 6.67×10^{-11} **Nm^2/kg^2, g = 9.81 m/s^2):**

(A) 4.6×10^{12}

(B) 4.6×10^{10}

(C) 4.6×10^{14}

(D) None

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30. A straight rod of length L extends from $x = a$ to $x = L + a$. Find the gravitational force it exerts on a point mass m at $x = 0$ if the mass per unit length of the rod is $\mu = A + Bx^2$:

(A) $F = GmA\left[\frac{1}{a} - \frac{1}{a+L}\right] + BL$

(B) $F = Gm\left[A\left(\frac{1}{a} - \frac{1}{a+L}\right) + BL\right]$

(C) $F = Gm\left[A\left(\frac{1}{a} - \frac{1}{a+L}\right) + BL\right]$

(D) None

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33. A block falls from a table 0.6 m high. It lands on an ideal, mass-less, vertical spring with a force constant of 2.4 kN/m. The spring is initially 25 cm high, but it is compressed to a minimum height of 10 cm before the block is stopped. Find the mass of the block (g = 9.81 m/s^2):

(A) 55.51 kg

(B) 5.51 kg

(C) 0.51 kg

(D) None

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34. An engine pumps water continuously through a hose. If the speed with which the water passes through the hose nozzle is v, and if k is the mass per unit length of the water jet as it leaves the nozzle, what is the rate at which kinetic energy is being imparted to the water?

(A) $2kv^2$

(B) $2kv^3$

(C) $2kv^4$

(D) None

---

35. n identical light bulbs, each designed to draw power P from a certain voltage supply are joined in series across that supply. The total power which they will draw is:

(A) nP

(B) P

(C) $\frac{P}{n}$

(D) Pn^{-2}

---

36. One mole of an ideal gas is at temperature T K. The γ value of this gas is $\frac{5}{3}$. Now the gas does 12R Joules of work adiabatically (R is the universal gas constant). Then the final temperature of the gas will be:

(A) $T - 8\,\mathrm{K}$

(B) $T + 4\,\mathrm{K}$

(C) $T - 4.4\,\mathrm{K}$

(D) $T - 6\,\mathrm{K}$

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37. A light ladder is supported on a rough floor and leans against a smooth wall, touching the wall at height h above the floor. A man climbs up the ladder until the base of the ladder is on the verge of slipping. The coefficient of static friction between the foot of the ladder and the floor is μ. The horizontal distance moved by the man is:

(A) $\mu^2 h$

(B) $\frac{\mu}{h}$

(C) μh

(D) $\mu^2 h^2$

---

38. A disk of 10 cm radius has a moment of inertia of 0.02 kg.m^2. A force of 15 N is applied tangentially to the periphery of the disk to give it an angular acceleration α of magnitude:

(A) 25 rad/s^2

(B) 35 rad/s^2

(C) 45 rad/s^2

(D) 75 rad/s^2

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39. A uniform hollow cylinder has a density ρ, a length L, an inner radius a, and an outer radius b. Its moment of inertia about the axis of the cylinder is (Mass of the cylinder is M):

(A) $M(b^2 + a^2)$

(B) $2M(b^2 + a^2)$

(C) $\frac{M}{2}(b^2 + a^2)$

(D) $\frac{3}{4}M(b^2 + a^2)$

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40. The two wires A and B of the same material have their lengths in the ratio 1 : 2 and their diameters in the ratio 2 : 1. If they are stretched with the same force, the ratio of the increase in the length of A to that of B will be:

(A) 1 : 2

(B) 4 : 1

(C) 1 : 8

(D) 1 : 4

---

41. The velocity of a particular mass m is $\vec{v} = 5\hat{i} + 4\hat{j} + 6\hat{k}$ when at $\vec{r} = -2\hat{i} + 4\hat{j} + 6\hat{k}$. The angular momentum of the particle about the origin is:

(A) $m(42\hat{i} - 28\hat{k})$

(B) $m(42\hat{j} - 28\hat{k})$

(C) $m(42\hat{i} + 28\hat{j} + 28\hat{k})$

(D) $m(42\hat{i} + 28\hat{j} + 28\hat{k})$

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42. The increase in pressure required to decrease the volume of 200 L of water by 0.004 percent is (Bulk modulus of water is 2.1×10^9 N/m^2):

(A) 8.4×10^4 N/m^2

(B) 8.4×10^3 N/m^2

(C) 8.4×10^5 N/m^2

(D) 8.4×10^6 N/m^2

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43. Water is flowing through a tube of radius r with a speed v. If this tube is joined to another tube of radius $r/2$, the speed of water in the second tube is:

(A) $4v$

(B) $\frac{v}{4}$

(C) $\frac{v}{2}$

(D) $2v$

---

44. The volume of an air bubble is doubled as it rises from the bottom of a lake to its surface. The atmospheric pressure is 75 cm of mercury and the ratio of the density of mercury to that of lake water is 40/3. The depth of the lake is:

(A) 15 m

(B) 10 m

(C) 20 m

(D) 25 m

---

45. A hole of area 1 mm^2 opens in the pipe near the lower end of a large water storage tank, and a stream of water shoots from it. If the top of the water in the tank is 20 m above the point of the leak, the amount of water escapes in 1 s is:

(A) 87.5 cm^3/s

(B) 43.1 cm^3/s

(C) 27.5 cm^3/s

(D) 19.8 cm^3/s

---

46. The temperatures of two bodies differ by 1°C. How much will they differ on Fahrenheit scale?

(A) 1°F

(B) 1.2°F

(C) 2.4°F

(D) 1.8°F

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47. Same quantity of ice is filled in each of the two identical metal containers P and Q having the same size and shape but of different materials. In P ice melts completely in time t_1, whereas in Q the time taken is t_2. Then the ratio of conductivities of P and Q is:

(A) $\frac{t_2}{t_1}$

(B) $\sqrt{\frac{t_1}{t_2}}$

(C) $\frac{t_2}{t_1^2}$

(D) $\frac{t_2}{t_2^2}$

---

48. From the measurement made on the Earth, it is known that the Sun has a surface area of 6.1×10^{18} m^2 and radiates energy at the rate of 3.9×10^{26} W. Assuming that the emissivity of the Sun's surface is 1, the temperature of the Sun's surface is:

(A) 2600 K

(B) 3600 K

(C) 4500 K

(D) 5800 K

---

49. In a diesel engine, the cylinder compresses air from approximately standard pressure and temperature to about one-sixteenth the original volume and a pressure of about 50 atm. The temperature of the compressed air is:

(A) 225 K

(B) 853 K

(C) 970 K

(D) 1043 K

---

50. A charge q is placed at the centre of the line joining two equal charges Q. The system of the three charges will be in equilibrium if q is equal to:

(A) $-\frac{Q}{2}$

(B) $-\frac{Q}{4}$

(C) $\frac{Q}{2}$

(D) $\frac{Q}{4}$

---

51. One mole of helium gas, initially at STP (p = 1 atm, T = 0°C), undergoes an isovolumetric process in which its pressure falls to half its initial value. The work done by the gas is:

(A) 101 J

(B) 51 J

(C) 23 J

(D) 0 J

---

52. 100 Vernier scale divisions match with 99 main scale divisions of a slide caliper. If the value of each main scale division is 1 mm, then the Vernier constant is:

(A) 1 mm

(B) 100 μm

(C) 10 μm

(D) 1 μm

---

53. The amount of moisture that must evaporate from a 5.0 kg body to reduce its temperature by 2°C is m g. The heat of vaporization for water at body temperature is

about 580 cal/g. The specific heat capacity for the body is 0.83 cal/g°C. The value of m is:

(A) 14.3 g

(B) 19.5 g

(C) 25.4 g

(D) 35.2 g

---

54. A sphere of 3 cm radius acts like a black body. It is in equilibrium with its surrounding and absorbs 30 kW of power radiated to it from surroundings. The temperature of the sphere is $\sigma = 5.67 \times 10^{-8}$ W/m^{2}K^4. What is the temperature of the sphere?

(A) 5600 K

(B) 4600 K

(C) 3600 K

(D) 2600 K

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55. A glass bulb of volume 400 cm^3 is connected to another bulb of volume 200 cm^3 by means of a tube of negligible volume. The bulbs contain dry air. They are both at a common temperature and pressure of 20°C and 1.000 atm. The larger bulb is immersed in steam at 100°C; the smaller, in melting ice at 0°C. The final common pressure is:

(A) 2.31 atm

(B) 1.13 atm

(C) 0.53 atm

(D) 0.04 atm

---

56. At temperature 'T', the 'effective' speed of gaseous hydrogen molecules (molecular weight = 2) is equal to that of oxygen molecules (molecular weight = 32) at 47°C. The value of 'T' is:

(A) 60 K

(B) 40 K

(C) 20 K

(D) 0 K

---

57. A drop of water of radius 0.01 m is falling through a medium whose density is 1.21 kg/m^3 and co-efficient of viscosity $\eta = 1.8 \times 10^{-5}$ Ns/m^2. Then the terminal velocity of the drop is:

(A) 120.0×10^{-2} m/s

(B) 0.012 m/s

(C) 1.2 m/s

(D) 1.2×10^{-2} m/s

---

58. A wave along a string has the following equation $y = 0.02 \sin[30t – 4.0x]$ m. The speed of the wave is:

(A) 4.0 m/s

(B) 30 m/s

(C) 7.5 m/s

(D) 10 m/s

---

59. How far should an object be from a concave spherical mirror of radius 36 cm to form a real image one-ninth its size?

(A) 170 cm

(B) 180 cm

(C) 190 cm

(D) None

---

60. A wire 0.5 m long and with a mass per unit length of 0.0001 kg/m vibrates under a tension of 4 N. The fundamental frequency is:

(A) 100 Hz

(B) 200 Hz

(C) 300 Hz

(D) 400 Hz

Chemistry

1. Solutions are classified into aqueous and non-aqueous solutions, based on:

a) Nature of solute particles

b) Nature of solvent

c) Size of the particles

d) Thickness of solvent

---

2. The solvent used to prepare aqueous solutions is:

a) Water

b) Benzene

c) Kerosene

d) Petrol

---

3. A true solution does not show Tyndall effect, because of the:

a) Nature of solvent

b) Amount of solute

c) Size of the particles

d) Nature of solute

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4. Tyndall effect is exhibited by:

a) True solutions

b) Suspensions

c) Colloidal solutions

d) Crystals

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5. Tyndall effect is produced by:

a) True solutions of light

b) Scattering of light

c) Refraction of light

d) Movement of particles

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6. The particle size in a colloidal solution is:

a) 1 Å – 10 Å

b) 10 Å – 2000 Å

c) More than 2000 Å

d) Less than 1 Å

---

7. The particle size in a suspension is:

a) 1 Å – 10 Å

b) 10 Å – 2000 Å

c) More than 2000 Å

d) Less than 1 Å

---

8. A solution which has more of solute, at a given temperature than that of saturated solution is called a:

a) Super saturated solution

b) Unsaturated solution

c) Colloidal solution

d) Suspension

---

9. Chalk powder in water is an example of:

a) Saturated solution

b) Unsaturated solution

c) Suspension

d) Colloidal solution

---

10. The particle size of the solute in true solution is:

a) 1 Å – 10 Å

b) 10 Å – 100 Å

c) 100 Å – 1000 Å

d) More than 1000 Å

---

11. Milk is a:

a) True solution

b) Colloidal solution

c) Suspension

d) Saturated solution

---

12. Nitrogen in soil is an example for:

a) True solution

b) Saturated

c) Super saturated

d) Unsaturated

---

13. Fog is a solution of:

a) Liquid in gas

b) Gas in liquid

c) Solid in gas

d) Gas in gas

---

14. Soda water is a solution of:

a) Liquid in gas

b) Gas in liquid

c) Solid in gas

d) Gas in gas

---

15. Blood is an example of:

a) True solution

b) Colloidal solution

c) Saturated solution

d) Suspension

---

16. The dispersed phase in a colloidal solution is:

a) Solute

b) Solution

c) Suspension

d) Mixture

---

17. Sugar and Salt solutions are:

a) Heterogeneous mixtures

b) True solutions

c) Colloidal solutions

d) Suspensions

---

18. Brownian movement explains the *property of colloidal solutions*:

a) Optical

b) Electrical

c) Kinetic

d) Mechanical

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19. In aqueous solutions, the solvent used is:

a) Benzene

b) Ether

c) Alcohol

d) Water

---

20. The solution in which saturation is not achieved is called:

a) Super saturated

b) Unsaturated

c) Saturated

d) Suspended

---

21. Cheese is a colloidal solution of:

a) Solid in solid

b) Liquid in solid

c) Solid in liquid

d) Gas in solid

---

22. Cork is a colloid of:

a) Solid in solid

b) Liquid in solid

c) Solid in liquid

d) Gas in solid

---

23. Smoke is a colloid of:

a) Solid in solid

b) Liquid in solid

c) Solid in liquid

d) Solid in gas

---

24. The saturation temperature for 20.7g of $CuSO_4$ soluble in water is:

a) 100°C

b) 1000°C

c) 200°C

d) 300°C

---

25. The solubility level of an aqueous solution of NaCl at 25°C is:

a) 20g

b) 36g

c) 95g

d) 8g

---

26. The increase in the solubility of Sodium halides, in water at 25°C is:

a) NaCl ¿ NaBr ¿ NaI

b) NaBr ¿ NaI ¿ NaCl

c) NaI ¿ NaBr ¿ NaCl

d) NaCl = NaBr ¿ NaI

---

27. Solubility of CaO in water is:

a) Chermic

b) Endothermic

c) Exothermic

d) Hypothermic

---

28. According to Henry's Law, in gases, an increase in pressure increases:

a) Solubility

b) Saturation

c) Volume

d) Viscosity

---

29. Deep sea divers use a mixture of:

a) Helium - Oxygen

b) Nitrogen - Oxygen

c) Hydrogen - Nitrogen

d) Helium - Nitrogen

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30. The continuous random motion of colloidal particles is called:

a) Brownian movement

b) Zig zag movement

c) Continuous movement

d) Tyndall effect

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31. On increasing the temperature, the solubility of the solute in the solvent:

a) Increase

b) Decrease

c) Change

d) Does not change

---

32. Which law relates solubility of solvents with pressure?

a) Hess' law

b) Henry's law

c) Charles' Law

d) Boyle's law

---

33. When sunlight passes through the window of your house, the dust particles scatter the light making the path of the light visible. This phenomenon is called as:

a) Brownian motion

b) Tyndall effect

c) Raman effect

d) Uniform motion

---

34. The Greek term 'atomos' means:

a) divisible

b) indivisible

c) macro molecule

d) soft sphere

---

35. Isotopes are the atoms of the same element, with the same atomic number, but with different:

a) Atomic number

b) Mass number

c) Number of electrons

d) Chemical nature

---

36. C^{126} and C^{14} are:

a) Isotopes

b) Isobars

c) Isomers

d) Molecules

---

37. Atoms of different elements possessing the same atomic mass are called:

a) Isotopes

b) Isobars

c) Isomers

d) Molecules

---

38. Atoms of different elements with the same number of neutrons are called:

a) Isotopes

b) Isomers

c) Isobars

d) Isotones

---

39. Atomicity of oxygen in ozone molecule is:

a) 1

b) 2

c) 3

d) 4

---

40. Atomicity of primary gases is:

a) 1

b) 2

c) 3

d) 4

---

41. In the beginning of the 20th century, the matter wave concept was introduced by:

a) Broglie

b) Avogadro

c) Heisenberg

d) Einstein

---

42. The Principle of Uncertainty was introduced by:

a) Broglie

b) Avogadro

c) Heisenberg

d) Einstein

---

43. Ar_{40}^{18} and Ca_{20}^{40} are considered as:

a) Isotopes

b) Isomers

c) Isobars

d) Isotones

---

44. The compound which does not show a simple ratio of atoms is:

a) Benzene

b) Acetylene

c) Hydrogen

d) Sucrose

---

45. Avogadro's hypothesis relates volume of gases and:

a) mass

b) temperature

c) pressure

d) number of molecules

---

46. Atomicity of an element is:

a) Valency of an element

b) Atomic mass

c) Number of atoms in one molecule of an element

d) Isotope of an element

---

47. Atomicity is given by:

a) Mass/molecular mass

b) Mass of the element

c) Molecular mass X atomic mass

d) Molecular mass / atomic mass

---

48. The atoms of $^{6}C^{13}$ and $^{7}N^{14}$ are considered as:

a) Isotopes

b) Isomers

c) Isobars

d) Isotones

---

49. Isotones are the atoms of different elements having:

a) Same mass number

b) Same atomic number

c) Same number of neutrons

d) Same number of electrons

---

50. Atomicity of Phosphorus is:

a) 2

b) 3

c) 4

d) 5
