1. Mark the conversion factor which is not correct
(a) $1 atm = 1.01325 \times 10^5 Pa$
(b) 1 metre = 39.37 inches
(c) 1 litre $= 10^{-3} m^3$
(d) 1 inch = 3.33 cm

2. The number of oxygen present in 1 mole of oxalic acid dehydrate is.
(a) 6×10^{23} (b) 6.022×10^{34}
(c) 7.22×10^{23} (d) 36.13×10^{23}

3. Match the prefixes present in column I with their multiples in column II and mark the appropriate choice.

Column I (Prefixes)	Column II (Multiples)
(A) Pico	(i) 10^9
(B) Femto	(ii) 10^{-3}
(C) Milli	(iii) 10^{-12}
(D) Giga	(iv) 10^{-15}

(a) (A) $\to$ (i), (B) $\to$ (ii), (C) $\to$ (iii), (D) $\to$ (iv)
(b) (A) $\to$ (ii), (B) $\to$ (i), (C) $\to$ (iv), (D) $\to$ (iii)
(c) (A) $\to$ (iv), (B) $\to$ (iii), (C) $\to$ (i), (D) $\to$ (ii)
(d) (A) $\to$ (iii), (B) $\to$ (iv), (C) $\to$ (ii), (D) $\to$ (i)

4. What should be the volume of the milk $(in\, m^3)$ which measures 5 L? (L-2)
(a) $5 \times 10^{-3} m^3$ (b) $5 \times 10^3 m^3$
(c) $5 \times 10000 m^3$ (d) $5 \times 10^6 m^3$

5. 18.72 g of a substance 'X' occupies 1.81 cm^3. What will be its density measured in correct significant figures? (L-2)
(a) $10.3 g\, cm^{-3}$ (b) $10.34 g\, cm^{-3}$
(c) $10.4 g\, cm^{-3}$ (d) $10.3425 g\, cm^{-3}$

6. How many seconds are there in 3 days?
(a) 259200 s (b) 172800 s
(c) 24800 s (d) 72000 s

7. Which of the following pairs illustrates the law of multiple proportions? (L-2)
(a) PH_3, HCl (b) pbO, PbO_2
(c) H_2S, SO_2 (d) $CuCl_2, CuSO_4$

8. Given below are few statements. Mark the statement which in not correct.
(a) Gram atomic mass of an element may be defined as the mass of Avogadro's number of atoms.
(b) The molecular mass of a diatomic elementary gas is twice its atomic mass.
(c) Gay Lussac's law of chemical combination is valid for all substances.
(d) A pure compound has always a fixed proportion of masses of its constituents.

9. Atomic masses of elements are usually fractional because.
(a) These are mixtures of isotopes.
(b) They contain impurities of other atoms.
(c) They are mixtures of isobars.
(d) Atomic masses cannot be weighed accurately.

10. Which of the following gases will have least volume if 10 g of each gas is taken at same temperature and pressure?
(a) CO_2 (b) N_2 (c) CH_4 (d) HCl

11. What will be the mass of 100 atoms of hydrogen?

(a) $100\,g$ (b) 1.66×10^{-22}

(c) 6.023×10^{23} g (d) $100\times6.023\times10^{23}$ g

12. 1.4 moles of phosphorus trichloride are present in a sample. How many atoms are there in the sample?

(a) 5.6 (b) 34

(c) 2.4×10^{23} (d) 3.372×10^{24}

13. Which of the following formulae is not correctly depicted?

(a) Molar mass =

$$\frac{\text{Mass of substance}}{\text{Moles of substance}}$$

Or $M=\frac{W}{n}\,g\,mol^{-1}$

(b) Number of moles of a substance

$$=\frac{\text{Mass of substance}}{\text{Molar mass}}$$ or

$$x=\frac{w}{m}\,mol$$

(c) Number of molecules

$$=\frac{\text{Mass of the substance}}{\text{Molar mass}}\times\text{Avogadro's no}$$

Or no. of molecules $=\frac{w}{M}\times6.023\times10^{23}$ molecules

(d) Mole × Molar mass = Number of molecules or n × m = Number of molecules

14. How many number of aluminium ions are present in $0.051\,g$ of aluminium oxide?

(a) 6.023×10^{20} (b) 3 ions

(c) 6.023×10^{23} (d) 9 ions

15. I mole of water contains

(a) 6.023×10^{23} atoms (b) 6.023×10^{23} molecules

(c) $3\times6.023\times10^{23}$ molecules (d) None of these

16. A mixture having 2 g of hydrogen and 32 g of oxygen occupies how much volume at NTP?

(a) $44.8L$ (b) $22.4L$

(c) $11.2L$ (d) $67.2L$

17. What will be the molality of the solution made by dissolving 10 g of NaOH in 100 g of water?

(a) $2.5m$ (b) 5m (c) 10 m (d) $1.25m$

18. What is the concentration of copper sulphate $(\text{in } mol\,L^{-1})$ if 80 g of it is dissolved in enough water to make a final volume of L?

(a) 0.0167 (b) 0.167

(c) 1.067 (d) 10.67

19. What volume of 5M Na_2SO_4 must be added to 25 mL of 1 M $BaCl_2$ to produce 10 g of $BaSO_4$?

(a) $8.58\,mL$ (b) $7.2\,mL$ (c) 10 mL (d) 12 Ml

20. How much mass of silver nitrate will react with 5.85 g of sodium chloride to produce 14.35 g of silver chloride and 8.5 g of sodium nitrate if law of conservation of mass is followed?

(a) $22.85\,g$ (b) 108 g (c) 17.0 g (d) $28.70\,g$

21. Calcium carbonate decomposes on heating to give calcium oxide and carbon dioxide. How much volume of CO_2 will be obtained by thermal decomposition of 50 g of $CaCO_3$?

(a) 1 L (b) $11.2\,L$ (c) $44\,L$ (d) $22.4\,L$

22. Chlorine gas is prepared by reaction of H_2SO_4 with MnO_2 and NaCl. What volume of Cl_2 will be produced at STP if 50 g NaCl is taken in the reaction?

(a) $1.915\,L$ (b) $22.4\,L$ (c) $11.2\,L$ (d) $9.57\,L$

23. Oxygen occurs in nature as a mixture of isotopes $^{16}O, ^{17}O$ and ^{18}O having atomic masses of 15.995 u 16.999 u and 17.999 U and relative abundance of $99.763\%, 0.037\%$ and 0.200% respectively.

What is the average atomic mass of oxygen?

(a) $15.999\,u$ (b) $16.999\,u$

(c) $17.999\,u$ (d) $18.999\,u$

24. Match the mass of elements given in column I with the no. of moles given in column II and mark the appropriate choice.

Column -I	Column -II
(A) 28 g of He	(i) 2 moles
(B) 46 g of Na	(ii) 7 moles
(C) 60 g of Ca	(iii) 1 mole
(D) 27 g of Al	(iv) 1.5 moles

(a) (A)$\rightarrow$ (iv), (B)$\rightarrow$ (iii), (C)$\rightarrow$ (ii), (D)$\rightarrow$ (i)

(b) (A)$\rightarrow$ (i), (B)$\rightarrow$ (iii), (C)$\rightarrow$ (ii), (D)$\rightarrow$ (iv)

© (A)$\rightarrow$ (iii), (B)$\rightarrow$ (ii), (C)$\rightarrow$(i), (D)$\rightarrow$ (iv)

(d) (A)$\rightarrow$ (ii), (B)$\rightarrow$ (i), (C)$\rightarrow$ (iv), (D)$\rightarrow$ (iii)

25. Which of the following correctly represents 180 g of water?

(i) 5 moles of water

(ii) 10 moles of water

(iii) 6.023×10^{23} molecules of water

(iv) 6.023×10^{24} molecules of water

(a) (i) and (ii) (b) (i) and (iv)

(b) (ii) and (iv) (d) (ii) and (iii)

26. 0.48 g of a sample of a compound containing boron and oxygen contains 0.192 g of boron and 0.288 g of oxygen. What will be the percentage composition of the compound?

(a) 60% and 40% B and O respectively

(b) 40% and 60% B and O respectively

(c) 30% and 70% B and O respectively

(d) 70% and 30% B and O respectively

27. Molarity equation of a mixture of solutions of same substance is given by

(a) $M_1 + V_1 \times M_2 + V_2 \times M_3 + V_3 + ... = M_1 + M_2 + M_3$

(b) $M_1V_1 + M_2V_2 + M_3V_3 + ... = M(V_1 + V_2 + V_3)$

(c) $\frac{M_1}{V_1} + \frac{M_2}{V_2} + \frac{M_3}{V_3} + ...M\left(\frac{1}{V_1} + \frac{1}{V_2} + \frac{1}{V_3}\right)$

(d) $\frac{M_1}{V_1} \times \frac{M_2}{V_2} \times \frac{M_3}{V_3} + ... = M_1\left(\frac{1}{V_1} \times \frac{1}{V_2} \times \frac{1}{V_3}\right)$

28. The final molarity of a solution made by mixing 50 mL of $0.5\,M$ HCl, 150 mL of $0.25\,M$ HCl and water to make the volume 250 mL is

(a) $0.5\,M$ (b) 1 M (c) $0.75\,M$ (d) $0.25\,M$

29. A solution is prepared by adding 5 g of a solute 'X' to 45 g solvent 'Y' what is the mass per cent of the solute 'X'?
(a) 10% (b) 11.1% (c) 90% (d) 75%

30. $4.28\,g$ of NaOH is dissolved in water and the solution is made to 250 cc. what will be the molarity of the solution?

(a) $0.615\,mol\,L^{-1}$ (b) $0.428\,mol\,L^{-1}$

(c) $0.99\,mol\,L^{-1}$ (d) $0.301\,mol\,L^{-1}$

1. (d)
No. of unpaired electron = 2

2. (c)
Cl : $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$
Six electrons ($1s^2, 2s^2, 3s^2$) have $l = 0$.

3. (d)
For Li^{2+}, $E_n = -13.6 \times \frac{Z^2}{n^2} = -13.6 \times \frac{9}{n^2}$ eV

For n = 2, $E_2 = -13.6 \times \frac{9}{4} = -30.6$ eV

For n = 3, $E_3 = -13.6 \times \frac{9}{9} = -13.6$ eV

For n = 6, $E_6 = -13.6 \times \frac{9}{36} = -3.4$ eV

4. (d)
$\psi = 0$ if $\cos^2\theta = 1/3$

$\Rightarrow \cos\theta = \pm \frac{1}{\sqrt{3}}$

So there are two angular nodes for this orbital hence
$\ell = 2$ i.e. orbital should be $3d_z^2$

5. (b)
$\Delta x \times \Delta P \geq \frac{h}{4\pi}$

$\Rightarrow \frac{\lambda}{4\pi} \times m \times \Delta v \geq \frac{h}{4\pi}$

$\Rightarrow \frac{h}{mv} \times m \times \Delta v \geq h$

$\Rightarrow \Delta v = v$

6. (b)
Radio wave

7. (c)
$n_1 + n_2 = 4$ & $n_2 - n_1 = 2$; { $n_1 = 1$ & $n_2 = 3$ }
$\frac{1}{\lambda} = R_H \times z^2 \times \left(\frac{1}{1^2} - \frac{1}{3^2}\right)$

$= 109678 \times 9 \times \frac{8}{9}$ cm^{-1}

$\lambda = 1.14 \times 10^{-6}$ cm^{-1}

8. (d)
$\lambda = \frac{c}{\nu}$

9. (c)
Apply $E = \frac{nhc}{\lambda}$

10. (b)
from KE = $h(\nu - \nu_0)$

$$\frac{KE_1}{KE_2} = \frac{\nu_1 - \nu_0}{\nu_2 - \nu_0}$$

Given $\nu_1 = 1.5 \times 10^{15}\ s^{-1}$

$\nu_2 = 2.0 \times 10^{15}\ s^{-1}$

$\nu_0 = 10^{15}\ s^{-1}$

11. (a)
Factual

12. (d)
Factual

13. (c)
When a body carrying charge equal to that of electron is accelerated by a potential difference of 1 volt, its kinetic energy is equal to 1 eV

14. (b)
Orbital angular momentum = $\sqrt{\ell(\ell+1)}\,\hbar$

for p-electron, $\ell = 1$

15. (a)
The total lines obtained due to the splitting of a spectral line in the presence of magnetic effect is $(2l + 1)$ as the presence of orbitals which have specific orientation in the presence of external field take up certain new orientation. The number of orbitals are equal to $(2l + 1)$ and for each orbital one splitting takes place.

(B) As we move away from the nucleus the difference in the energy levels become lesser and lesser hence.

For 1st line of Lyman $\Delta E = E_1\left[\frac{1}{n_1^2} - \frac{1}{n_n^2}\right]$

$\Delta E_1 = E_1\left[\frac{3}{4}\right]$ – 1st line; $\Delta E_2 = E_1\left[\frac{8}{9}\right]$ –2nd line

$\Delta E_3 = E_1\left[\frac{15}{16}\right]$ –34rd line ; $\Delta E_4 = E_1\left[\frac{24}{25}\right]$ – 4th line;

$\Delta E_5 = E_1\left[\frac{35}{36}\right]$ – 5th line;

$$\Delta E_2 - \Delta E_1 = E_1\left[\frac{8}{9} - \frac{3}{4}\right] = E_1\left[\frac{5}{36}\right]$$

$$\Delta E_3 - \Delta E_2 = E_1\left[\frac{15}{16} - \frac{8}{9}\right] =$$

$$E_1\left[\frac{135-128}{144}\right] = E_1\left[\frac{7}{144}\right]$$

$$\Delta E_4 - \Delta E_3 = E_1\left[\frac{24}{25} - \frac{15}{16}\right]$$

$$= E_1\left[\frac{16\times24 - 15\times25}{25\times16}\right] = E_1\left[\frac{9}{400}\right]$$

We find that $(\Delta E_2 - \Delta E_1) > (\Delta E_3 - \Delta E_2)$

$> (\Delta E_4 - \Delta E_3)$

Hence the distance also become lesser and lesser.

(C) The distance from the nucleus for maximum probability of finding electrons is 0.53 Å. This is not on the circumference of the orbital but is in the vicinity of the circumference.

16. (a)

$$\Delta\times.\Delta v=\frac{h}{4\pi m}\quad \Delta v=\frac{6.6\times10^{-34}}{4\times3.14\times25\times10^{-5}}$$

$\therefore \quad \Delta v=2.1\times10^{-18}\,ms^{-1}$.

17. (b)

The value of ℓ (azimuthal quantum number) for s -electron is equal to zero.

Orbital angular momentum $=\sqrt{\ell(\ell+1)}.\frac{h}{2\pi}$

Substituting the value of l for s-electron $\sqrt{0(0+1)}.\frac{h}{2\pi}=0$

18. (c)

According to Heisenberg's uncertainity principle

$$\Delta x\times\Delta p=\frac{h}{4\pi}$$

$$\Delta x\times(m.\Delta v)=\frac{h}{4\pi}\ \Delta x=\frac{h}{4\pi m.\Delta v}$$

$$;\Delta v=\frac{0.001}{100}\times300=3\times10^{-3}\,ms^{-1}$$

$$\therefore \quad \Delta x=\frac{6.63\times10^{-34}}{4\times3.14\times9.1\times10^{-31}\times10^{-3}}=1.29\times10^{-2}\,m.$$

19. (a)

Hydrogen atom contains 1 proton, 1 electron and no neutrons.

20. (a)

I.E. of one sodium atom $=\frac{hC}{\lambda}$

& I.E. of one mole Na atom

$$=\frac{hC}{\lambda}N_A=\frac{6.62\times10^{34}\times3\times10^{8}\times6.02\times10^{23}}{242\times10^{-9}}=494.65\text{ kJ. mol.}$$

21. (b)

Radius = 0.529 $\frac{n^2}{Z}$ Å $=10\times10^{-9}\,m$

So, $n^2=189$ or, $n\approx14$

22. (a)

V = 2.188 × $10^6\,\frac{Z}{n}$ m/s

Now, $V\propto\frac{Z}{n}$

so, $\frac{V_{Li^{2+}}}{V_H}=\frac{Z_1/n_1}{Z_2/n_2}$

$=\frac{3/3}{1/1}=1$ or, $V_{Li^{2+}}=V_H$

23. (b)

When electron falls from n to 1, total possible number of lines = n – 1.

24. (d)

$$\frac{\lambda_1}{\lambda_1} = \sqrt{\frac{V_2}{V_1}} = \sqrt{\frac{200}{50}} = \frac{2}{1}$$

25. (d)

Spin quantum number does not comes from Schrodinger equation.

s = + $\frac{1}{2}$ and – $\frac{1}{2}$ have been assigned arbitrarily.

26. (c)

$$\left.\begin{matrix} n_1 + n_2 = 4 \\ n_1 + n_2 = 2 \end{matrix}\right\}$$ so $n_1 = 3$ and $n_2 = 1$.

$$\bar{v} = R(3)^2\left\{\frac{1}{(1)^2} - \frac{1}{(3)^2}\right\} = 8R.$$

27. (d)

$$\frac{T_1}{T_2} = \frac{n_1^3}{n_2^3} = \frac{1^3}{2^3} = \frac{1}{8}.$$

$$\therefore \quad \left(T = \frac{2\pi r}{V}\right) \text{so, } T \propto \frac{n^3}{Z^2}$$

28. (c)

Visible lines $\Rightarrow$ Balmer series $\Rightarrow$ 3 lines. (5 $\rightarrow$ 2, 4 $\rightarrow$ 2, 3 $\rightarrow$ 2).

29. (d)

$$\frac{hc}{\lambda} = E_1 - E_2 = KE_2 - KE_1$$

$$\therefore \lambda = \frac{h}{mV} \qquad (mV)^2 = \left(\frac{h}{\lambda}\right)^2; \qquad \frac{1}{2}mV^2 = \frac{1}{2m}\frac{h^2}{\lambda^2} \therefore \quad \frac{hc}{\lambda} = \frac{h^2}{2m\lambda_2^2} - \frac{h^2}{2m\lambda_1^2} \quad \therefore \quad \lambda = \frac{2mc}{h}\left\{\frac{\lambda_1^2\lambda_2^2}{\lambda_1^2 - \lambda_2^2}\right\}$$

30. (a)

$$\frac{\lambda_\rho}{\lambda\alpha} = \sqrt{\frac{m_\alpha KE_\alpha}{m_p KE_p}} = \sqrt{\frac{4m_p \times 325}{m_p \times 50}} = \sqrt{26} \approx 5.$$