PART B - CHEMISTRY

31. **a) 0.25**

No. of moles $= \frac{5.6}{22.4} = 0.25$

32. **b) 3.011×10^{23}**

No. of moles $= \frac{\text{mass}}{\text{molar mass}}$

$= \frac{9}{18} = \frac{1}{2}$

No. of molecules $= \frac{1}{2} \times 6.022 \times 10^{23}$

$= 3.011 \times 10^{23}$

33. **a) 0.01**

$$AgNO_3 + NaCl \xrightarrow{H_2O} AgCl + NaNO_3$$

	$AgNO_3$	$NaCl$	$AgCl$	$NaNO_3$
moles	$\frac{1.7}{170}$	$\frac{0.585}{58.5}$	?	$\frac{0.85}{85}$
	0.01	0.01	?	0.01

Mass of AgCl formed (by law of mass conservation)

$1.7 + 0.585 - 0.85 = 1.435$ gram

moles of AgCl $= \frac{1.435}{143.5} = 0.01$

34. **d) 8.8 g**

1st balance equation using POAC (principle of atomic conservation)

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

$\left(\frac{\text{moles of reactant taken}}{\text{stoichiometric coefficient}}\right)$ comes out least for limiting reagent

for $CaCO_3 \Rightarrow \frac{20}{100} = 0.2$ mole

for HCl $\Rightarrow \frac{2.0}{36.5} = 0.548$

so $CaCO_3$ is limiting reagent.

1 mole $CaCO_3$ produces 1 mole CO_2, so 0.2 mole produce 0.2 mole CO_2.

mass = molar mass × moles

$= 44 \times 0.2$

$= 8.8$ gm CO_2

35. **b) 50%**

Let $CaCO_3$ be x g and SiO_2 be (4 – x) g

100 gm of $CaCO_3$ produces 44 gm of CO_2, so 0.88 g CO_2 is produced by

$\Rightarrow \frac{100}{x} = \frac{44}{0.88}$

$\Rightarrow x = \frac{100 \times 0.88}{44}$

$= 2$ gm of $CaCO_3$

so, 50% SiO_2 is present.

36. **c) 1.26×10^{24}**

1 mol $C_6H_{12}O_6$ has $6N_A$ atoms of C.

0.35 mol has $\Rightarrow 6 \times 0.35\ N_A = 2.1\ N_A$ atoms of C.

$2.1 \times 6.022 \times 10^{23} = 1.26 \times 10^{24}$

37. **c) 26,18**

Let atomic mass of P and Q be a and b respectively.

Molar mass of $P_2Q_3 = 2a + 3b$

Molar mass of $P_2Q_3 = a + 2b$

(molar mass × moles = mass)

So $(2a + 3b)\ 0.15 = 15.9$

$(a + 2b)\ 0.15 = 9.3$

a = 26, b = 18

38. **c) C_7H_8**

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

$x : \frac{y}{2} = \frac{3.08}{44} : \frac{0.72}{18}$

$= 0.07 : 0.04$

$= 7 : 4$

So, $x : y = 7 : 8$

39. **b) 2**

moles $= \frac{5.6}{22.4} = \frac{1}{4}$

molar mass $= \frac{\text{mass}}{\text{no. of moles}}$

$= \frac{16}{1/4} = 64$

$SO_x = 32 + x(16) = 64$

$\Rightarrow \quad x = 2$

40. **b)** **3.125×10^{-2}**

$Mg_3(PO_4)_2$

8 mole O atoms are in 1 mole

1 mole O atoms in $\frac{1}{8}$ mole

$\frac{1}{4}$ mole O atoms in $\frac{1}{8}\times\frac{1}{4} = \frac{1}{32}$ moles

$= 3.125 \times 10^{-2}$

41. **c)** $\mathbf{\frac{1.2}{(35)^2}\times N_A}$

mass = vol × density

$= 2\text{ ml} \times 1.2\text{ g ml}^{-1}$

$= 2.4\text{ gm}$

No. of moles in 35 drops $= \frac{2.4}{70}$

No. of moles in 1 drop $= \frac{2.4}{70}\times\frac{1}{35}$

No. of molecules in 1 drop $= \frac{2.4}{(35)^2}\times\frac{N_A}{2}$

$= \frac{1.2\times N_A}{(35)^2}$

42. **c)** **C_4H_{10}**

	% wt	At. wt.	relative no. of atoms/moles	simple ratio of atoms
C	82.8	12	82.8÷12 = 6.9	6.9÷6.9 = 1
H	17.2	1	17.2÷1=17.2	17.2÷6.9=2.5⇒5

$C_2H_5 \Rightarrow$ empirical formula mass = 29

n = 2

$n(C_2H_5) \Rightarrow C_4H_{10}$

43. **b)** **72 litre**

On balancing the equation

$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

Volume ratio = molar ratio

$\frac{90}{x} = \frac{5}{4} = x = 72$

44. **c)** **11.2 kg**

Mass of pure $Fe_2O_3 = \frac{80}{100}\times 20$

$= 16\text{kg}$

$Fe_2O_3 \rightarrow 2Fe$

1 mol produces 2 mol

160g produces 112g

16kg produces $\frac{112}{160}\times 16 = 11.2\text{kg}$

45. **d)** **60%**

$\%\text{ yield} = \frac{\text{actual yield}}{\text{theoretical yield}}\times 100$

$C_6H_6 + HNO_3 \rightarrow C_6H_5NO_2 + H_2O$

$\frac{26}{78} = \frac{2}{6} = \frac{1}{3}\text{mol} \qquad \frac{1}{3}\times 123 = 41\text{g}$

$\%\text{ yield} = \frac{24.6}{41}\times 100 = 60\%$

46. **d)** **10**

$Na_2CO_3 \cdot xH_2O \xrightarrow{\Delta} Na_2CO_3 + xH_2O$

1 mol $\qquad$ 1mol

$\Rightarrow \frac{2.574}{(106+18x)} = \frac{0.954}{106}$

$= 9 \times 10^{-3}$

On solving $x = 10$

47. **b)** **H – F > H – O > H – N > H – Cl**

Decreasing electronegativity.

48. **c)** **solubility in water ($BaSO_4 > Na_2SO_4$)**

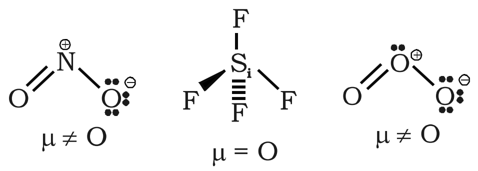
$BaSO_4$ has more covalent character.

49. **b)** **$Na_2O_2 > KO_2 > O_2$**

$\xrightarrow{O_2 - O_2^- - O_2^{-2}}$ Bond order

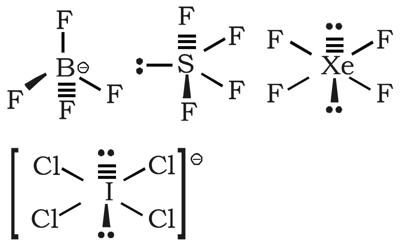
Bond order decreases.

50. **c)** **NO_2 and O_3**

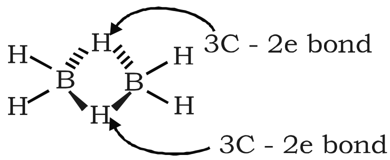


O = C = O
$\mu = O$

51. **a)** **$BF_4^{\ominus}$**



52. **d)** **four 2C – 2e bonds and two 3C – 2e bonds**



53. **d)** **CN^- and NO^+**
can be solved by both lewis concept and MOT

$:\overset{\ominus}{C} \equiv N:$ and $:N \equiv \overset{\oplus}{O}:$ (B.O = 3)

$$\text{MOT, B.O} = \frac{\text{No of el in BMO} - \text{No of el in ABMO}}{2}$$

$$= \frac{10-4}{2} = 3$$

54. **a)** **40**

$$\frac{16}{40} \times 100 = 40\%$$

55. **c)** **112 g**
88g CO_2 contain 64 g oxygen
28g CO contain 16 g oxygen
for 64 g of O, 112 g of CO in needed.

56. **d)** **168**

$$C_5H_{10} + \frac{15}{2}O_2 \rightarrow 5CO_2 + 5H_2O$$

$$\frac{15}{2}\text{ mole} \Rightarrow \frac{15}{2} \times 22.4 = 168 \text{ litre}$$

57. **a)** **X is the limiting reagent**
$3x + 4y \rightarrow X_3Y_4$

$$\frac{6}{3} \quad \left[\frac{6}{4}\right] \rightarrow \text{minimum so y in LR}$$

58. **c)** **both a and b**
1 amu = 1.66×10^{-24}g

59. **d)** **96500 Coloumbs**
1.6×10^{-19}coloumb $\times 6.022 \times 10^{23}$
$\cong$ 96500 coloumb/mol.

60. **d)** **both a and b are incorrect**
No of atoms on each side remains conserved (always)
Limiting reagent is decided by both stoichiometric coefficients of balanced chemical reaction and moles taken.