Part ①

KEY ①

1. a) 7.3×10^{1}
   b) 2.3×10^{-2}
   c) 6.59×10^{3}
   d) 1.78×10^{2}
   e) 4.58212×10^{5}
   f) 8.43×10^{5}
   g) 5.68×10^{-3}
   h) 4.165×10^{5}
   i) 2.156×10^{6}
   j) 5.87×10^{-1}

2. a) 0.00000063
   b) 5000000
   c) 0.00056
   d) 0.0000004455
   e) 756.8
   f) 0.007558
   g) 2 001 000 000
   h) 26600
   i) 0.85
   j) 0.02556

3. a) $8.79 \times 10^{-1}\ cm^3$
   b) $5.68 \times 10^{2}\ cm$
   c) $1.17 \times 10^{-1}\ g$
   d) $7.8 \times 10^{-3}\ kg$
   e) $1.013 \times 10^{-4}\ m^3$
   f) $1.56 \times 10^{-6}\ g$
   g) $2.5 \times 10^{3}\ mL$
   h) $6.72 \times 10^{-1}\ mg$
   i) $5.36 \times 10^{-3}\ L$
   j) $7.362 \times 10^{-7}\ m$.

4. a) 8.7×10^{-1}
   b) 1.0×10^{4}
   c) 1.7×10^{1}
   d) -8.05×10^{0}
   e) 8.56×10^{-1}
   f) -5.17×10^{1}
   g) -7.69×10^{-4}
   h) 6.0260×10^{-9}
   i) 4.0742×10^{0}
   j) 1.0×10^{3}

5. a) 3
   b) 1
   c) ∞
   d) 4
   e) 4
   f) 10
   g) 2
   h) 4
   i) 1
   j) 2

6. $5790\ cm^3$ of H_2O (= 5790 mL = 6.97 L = 6 L) $\boxed{6 \times 10^{3}\ cm^3}$

7. $\boxed{2.37 \times 10^{4}\ cm^3}$

8. $\frac{60s}{min} \times \frac{60min}{hr} \times \frac{24hr}{d} \times \frac{366d}{leap\ yr} = \boxed{3.16 \times 10^{7}\ \frac{seconds}{leap\ year}}$

9. $\frac{0.050\ g}{hr} \times \frac{24hr}{d} \times \frac{365d}{yr} \times \frac{1min}{60s} = \boxed{7.3\ minutes}$

10. $\frac{23.7mg}{mL} \times \frac{1\ g}{1000mg} \times \frac{1000mL}{1L} = \boxed{23.7\ \frac{g}{L}}$

11. $\frac{115\ km}{hr} \times \frac{1000m}{1\ km} \times \frac{1hr}{60min} \times \frac{1min}{60sec} = \boxed{31.9\ \frac{m}{s}}$

12. a) $1 \times 10^{6}\ mm^2$
    b) $1 \times 10^{-6}\ km^2$
    c) $1 \times 10^{-2}\ cm^2$

13. $\frac{125\mu g}{day} \times 30d \times \frac{1mg}{1000\mu g} = \boxed{3.75\ mg}$

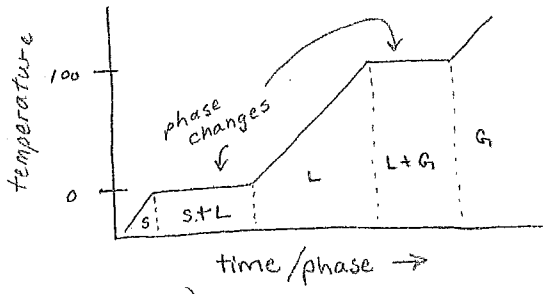
14. $\frac{30mg}{tab} \times 8\ tab \times \frac{1g}{1000mg} = 0.24g = \boxed{2 \times 10^{-1}\ g}$

KEY (2)

15. a) solid
b) vapor / liquid
c) plasma / gas
d) solid
e) gas
f) liquid

16. a) C
b) P
c) P
d) C
e) C
f) P

17. see notes



18. a) S
b) C
c) M
d) M (suspension)
e) C
f) M
g) M

19. a) ClO_4
b) Si_3N_4
c) $Fe(OH)_3$
d) $RaCO_3$
e) HBr
f) Si_2I_6
g) H_2SO_3
h) CrC_2O_4
i) H_3PO_4
j) N_2O_5
k) WBr_5
l) $Sn(HCO_3)_2$
m) typo - OMIT
n) Cu_3PO_4
o) H_2SO_4
p) BeO
q) MoI_6
r) NH_3

20. a) cobalt (III) fluoride
b) phosphorous pentabromide
c) potassium permanganate
d) iron (II) oxalate
e) nitric acid
f) tin (II) cyanide
g) lithium hydroxide
h) sodium monohydrogen phosphate
i) copper (II) nitrate hexahydrate
j) ammonium nitrate
k) dinitrogen pentasulphide
l) copper (II) sulphate
m) vanadium (V) oxide
n) nickel (II) phosphate octahydrate
o) phosphoric acid
p) tetrasulphur dinitride
q) carbon disulphide
r) tungsten (VI) cyanide
s) tantalum (III) chloride
t) lithium dichromate

KEY (3)

PART (2)

1. a) 383.2 g/mol
   b) 92.7 g/mol
   c) $Sn(CH_3COO)_4 \cdot 5H_2O$ = 444.7 g/mol
   d) 60.0 g/mol

2. a) 7.30×10^2 g
   b) 0.0646g
   c) 8.48g
   d) 493g

3. a) 95.1 mol
   b) 3.01×10^{-4} mol
   c) 0.0893 mol
   d) 0.18mol

4. a) 8
   b) 4.20×10^2
   c) 3.51×10^{25}
   d) 4.6×10^{23}

5. a) N = 21.2% H = 6.1% S = 24.3% O = 48.4%
   b) Cr = 33.1% P = 13.1% O = 50.8% H = 2.97%

6. a) $K_2Cr_2O_7$
   b) $C_4H_8O_3$
   c) Fe_3O_4 → typo. OMIT

7. 848 L

8. a) 42g
   b) 1.2×10^2 g
   c) 3.6g

9. 0.694 M

10. $1.750 \frac{mol}{L} \times 0.0150\,L \cdot \frac{0.0263\,mol}{0.03000\,L} = \underline{\underline{0.875M}}$

11. 135g

12. $C_1V_1 = C_2V_2$
    $(0.250M)(0.2500L) = C_2(0.2500L + 0.35L)$
    $C_2 = \underline{\underline{0.10M}}$

PART (3)

1. a) $2Li + 2H_2O \rightarrow 2LiOH + H_2 + energy$
   b) $2HCl_{(g)} + energy \rightarrow H_{2(g)} + Cl_{2(g)}$
   c) $2H_2O_{(l)} + energy \rightarrow 2H_{2(g)} + O_{2(g)}$
   d) $2FeO_{(s)} + C_{(s)} \rightarrow 2Fe_{(l)} + CO_{2(g)}$
   e) $Cl_{2(g)} + 2Na_{(s)} \rightarrow 2NaCl_{(s)} + energy$

2. a) $2Sr + O_2 \rightarrow 2SrO$ SYNTHESIS
   b) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ COMBUSTION
   c) $H_3PO_4 + 3KOH \rightarrow K_3PO_4 + 3H_2O$ NEUTRALIZATION
   d) $2H_2O \rightarrow 2H_2 + O_2$ DECOMPOSITION
   e) $2Fe(HCO_3)_3 + MgSe \rightarrow Fe_2Se_3 + Mg(HCO_3)_2$ DOUBLE REPLACEMENT
   f) $Br_2 + 2KCl \rightarrow 2KBr + Cl_2$ SINGLE REPLACEMENT

KEY (4)

3. a) $2NO_2 \rightarrow N_2 + 2O_2$ DECOMP.

b) $HCl + KOH \rightarrow KCl + H_2O$ NEUTRALIZATION

c) $Cu + Fe(NO_3)_2 \rightarrow Fe + Cu(NO_3)_2$ SINGLE REPLACEMENT

d) $MgSO_4 + BeCl_2 \rightarrow MgCl_2 + BeSO_4$ DOUBLE REPLACEMENT

4. $2Na + O_2 \rightarrow 2NaO$

$$73.2g\ Na \times \frac{1mol}{23.0g} = 3.18\ mol\ Na \times \frac{2NaO}{2Na} = 3.18\ mol\ NaO \times \frac{39.0g}{mol} = \underline{\underline{124g\ NaO}}$$

5. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

$$24.0g\ C_3H_8 \times \frac{1mol}{44.0g} = 0.545\ mol\ C_3H_8 \times \frac{5O_2}{1C_3H_8} = 2.73\ mol\ O_2 \times \frac{32.0g}{mol} = \underline{\underline{87.3g\ O_2}}$$

6. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

$$63L\ CO_2 \times \frac{1mol}{22.4L} = 2.8\ mol\ CO_2 \times \frac{6H_2O}{4CO_2} = 4.2\ mol\ H_2O \times \frac{18.0g}{mol} = \underline{\underline{76g\ H_2O}}$$

7. $2HBr \rightarrow H_2 + Br_2$

$$24.5g\ HBr \times \frac{1mol}{80.9g} = 0.303\ mol\ HBr \times \frac{1Br_2}{2HBr} = 0.151\ mol\ Br_2 \times \frac{159.8g}{mol} = \underline{\underline{24.1g\ Br_2}}$$

8. $1.25 \times 10^{-4}\ kg$

$$= 0.125g\ N_2H_4 \times \frac{1mol}{32.0g} = 4.00\ mol\ N_2H_4 \times \frac{2NH_3}{N_2H_4} = 8.00\ mol\ NH_3 \times \frac{22.4L}{mol} = \underline{\underline{179L\ NH_3}}$$

9. a) $18.0g\ Cu \times \frac{1mol}{63.5g} = 0.283\ mol\ Cu \times \frac{3CuO}{3Cu} = 0.283\ mol\ CuO \times \frac{79.5g}{mol} = \underline{\underline{22.5g\ CuO}}$

b) $\%\ yield = \frac{actual\ g}{theory\ g} \times 100 = \frac{6.5g}{18.0g} \times 100 = \underline{\underline{36\%}}$

10. a) $100.0g\ PbO \times \frac{1mol}{223.2g} = 0.448\ mol\ PbO \times \frac{2O_2}{2PbO} = 6.05\ mol\ O_2 \times \frac{22.4L}{mol} = \underline{\underline{135\ L\ O_2}}$

b) $1.00 \times 10^{-6}g\ Pb(C_2H_5)_4 \times \frac{1mol}{323.2g} = 3.09 \times 10^{-9}\ mol\ Pb(C_2H_5)_4 \times \frac{16CO_2}{2Pb(C_2H_5)_4} = 2.48 \times 10^{-8}\ mol\ CO_2 \times \frac{6.02 \times 10^{23}\ molecules}{mol}$

$$= \underline{\underline{1.49 \times 10^{16}\ molecules\ CO_2}}$$

c) 100 molecules of H_2O

d) $1.00 \times 10^{15}\ molecules\ Pb(\ )_4 \times \frac{1mol}{6.02 \times 10^{23}} = 1.66 \times 10^{-9}\ mol\ Pb(\ )_4 \times \frac{2O_2}{2Pb(\ )_4} = 2.24 \times 10^{-8}\ mol\ O_2 \times \frac{22.4L}{mol} = 5.02 \times 10^{-7}L$

$$= \underline{\underline{5.02 \times 10^{-4}\ mL}}$$

PART (4)

KEY (5)

1. Bi is bigger: more electron orbitals!

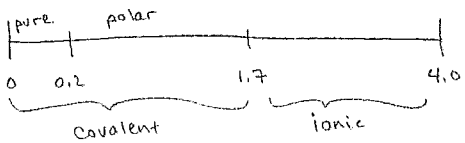
2. 19, 39, 19, 20, 18
   20, 41, 20, 21, 20
   31, 69, 31, 38, 28
   17, 37, 17, 20, 18
   8, 18, 8, 10, 8
   92, 235, 92, 143, 88

3. 107.964 amu

4. a) $[Ne]\,3s^2\,3p^3$
   b) $[Ne]\,3s^2\,3p^5$
   c) $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$
   d) $[Ne]$
   e) $[Ar]$
   f) $1s^2$

5. you know this! discuss radius, I.E., electronegativity, etc., or charge, etc.

6. Radon (Rn) because electrons are loosely held in large orbitals.

7. 

covalent = electrons shared
ionic = transfer of electrons

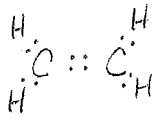
8. a) 3.0 − 0.9 = 2.1 - ionic
   b) 3.5 − 2.1 = 1.4 = polar covalent
   c) 3.5 − 3.0 = 0.5 = polar covalent
   d) 2.5 − 2.5 = 0 = pure covalent

9. Odor = gas = low boiling point (near room temp) = covalent compound
   Ionic are bonded/attracted to each others opposite charges in solid lattice (high melting/boiling point)

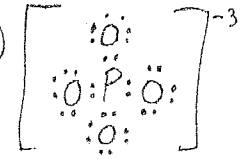
10. a) 4
    b) 8
    c) 8
    d) 8
    e) 2
    f) 5

11. ethanol: CH_3CH_2-O-H ← O = electronegativity high = creates charge separation = polar = mix with H_2O (polar)
    ether: CH_3-O-CH_3

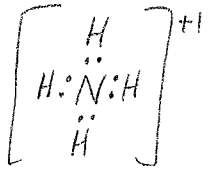
12. All about electronegativity difference; charge separation. Difference = polar.
    Like dissolves like - salt has charge (ions) - need polar solvent to dissolve salt → H_2O!

13. a) 

    b) H:H

    c) 

    d) H:C:::N:

    e) 

KEY (6)

14. $60.0\,g\ BaCl_2 \times \frac{1\,mol}{208.3\,g} = \frac{0.288\,mol}{0.6000\,L} = 0.480\,M\ BaCl_2 \times \frac{2\,Cl^-}{1\,BaCl_2} = \underline{\underline{0.960\,M\ Cl^{-1}}}$

15. $35.0\,g\ V(NO_3)_5 \times \frac{1\,mol}{360.9\,g} = 0.0970\,mol\ V(NO_3)_5 \times \frac{5\,NO_3^{-1}}{1\,V(NO_3)_5} = \frac{0.485\,mol\ NO_3^{-1}}{1.0\,L} = \underline{\underline{0.485\,M\ NO_3^{-1}}}$

16. $5.2\,M \times 4.9\,L = 25.48\,mol\ NaBr \times \frac{102.9\,g}{mol} = 2.6\times10^3\,g\ NaBr$

17. $KCl \rightarrow K^{+1} + Cl^{-1}$

$1.9\,M\ KCl \times 0.7000\,L = 1.33\,mol\ KCl = 1.33\,mol\ Cl^{-1}$

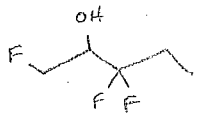
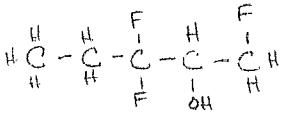
$MgCl_2 \rightarrow Mg^{+2} + 2Cl^{-1}$

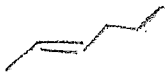
$0.750\,M\ MgCl_2 \times 1.05\,L = 0.788\,mol\ MgCl_2 \times \frac{2Cl^-}{1\,MgCl_2} = 1.58\,mol\ Cl^-$

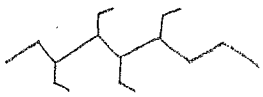
$\frac{1.33\,mol\ Cl^- + 1.58\,mol\ Cl^-}{0.7000\,L + 1.05\,L} = \underline{\underline{1.66\,M\ Cl^{-1}}}$

PART (5)

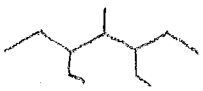
1. methane, ethane, propane, butane, pentane, hexane, heptane, octane, nonane, decane

2. a)  OR 

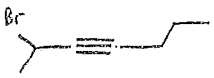
b) 

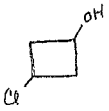
c) 

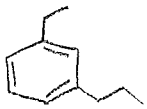
d) 

e) 

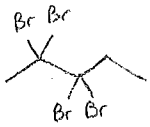
f) 

g) 

h) 

i) 

j) 

k) 

l) 

KEY (7)

3. C_5H_{10} isomers:


cyclopentane

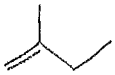

methyl cyclobutane

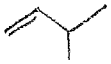

ethyl cyclopropane


1,2-dimethyl cyclopropane (cis- and trans-)


1-pentene


2-pentene (cis- & trans-)


2-methyl-1-butene


3-methyl-1-butene


2-methyl-2-butene

4. a) pentane

b) 2,3-dimethyl-butane

c) cis-2,3-dibromo-2-butene

d) 3-bromo-2-methyl-1-propene

e) 1,3-cyclopentadiene

f) 1,4-dimethyl-benzene

g) 1-propanol

h) 3-cyclopropyl-1-butanol

i) 2-octyne

j) 2,2,6-trifluoro-octane

k) 1,1-dichloro-2,2-difluoro-propane

l) 1,2,3-trichloro-1,3-butadiene

m) propyne

n) trans-2,3-dichloro-2-butene

o) 1,4-dichloro-benzene ≅ para-dichloro-benzene