Bridging Booklet

ANSWERS in BOOKLET

KEEP CALM AND STUDY CHEMISTRY

Task 1

Ionic or Covalently bonded

a) Covalent
b) ionic
c) covalent
d) covalent
e) ionic

Task 2

Drawing out

Dot/ Cross diagram **Atoms to Ions**

1) Aluminium Oxide

2) Lithium Oxide

3) Barium Nitride

Task 3 (HINT Use Appendix I to help)

Put the final answer in the box provided

1) Silver chloride

Ag+ Cl-

AgCl

2) Lithium sulphate

Li+ SO_4^{2-}

Li_2SO_4

3) Ammonium Hydroxide

NH_4^+ OH-

NH_4OH

4) Potassium Dichromate

K+ $Cr_2O_7^{2-}$

$K_2Cr_2O_7$

5) Iron (II) Nitrate

Fe^{3+} NO_3 -

$Fe(NO_3)_3$

Task 4

Elements in compounds

1) $AgNO_3$

1 Ag

1N

3 O

2) $PbCO_3$

1Pb

1C

3 O

3) $SnCl_2$

1 Sn

2 Cl

4) $Mg(OH)_2$

1 Mg

2O

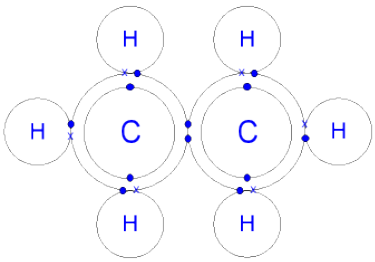
2H

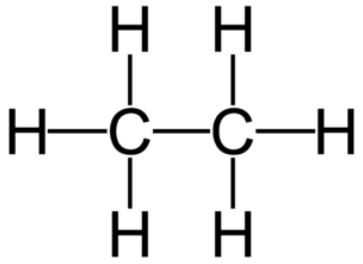
Task 5

Dot / Cross

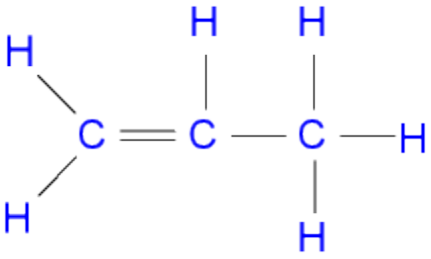
Line diagrams

1) Ethane C_2H_6

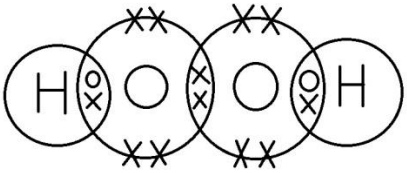


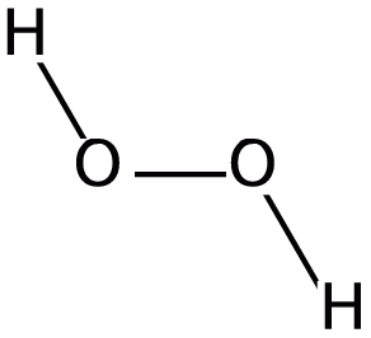


2) Propene C_3H_6

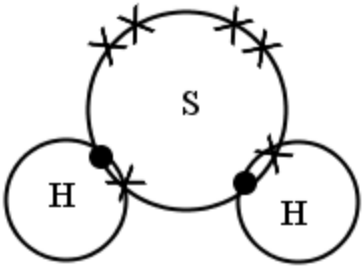


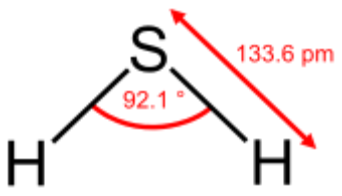
3) Hydrogen Peroxide H_2O_2





4) Hydrogen Sulphide H_2S





Don't worry about the length of the bond or bond angle shown in red

Task 6

Research on melting points Na-Mg-Al

Sodium, magnesium and aluminium are all **metals**.

They have **metallic bonding**,

in which positive metal ions are attracted to delocalised electrons.

Going from sodium to aluminium:

- the charge on the metal ions increases from +1 to +3 (with magnesium at +2) ...
- the number of delocalised electrons increases ...
- so the strength of the metallic bonding increases and ...
- the melting points and boiling points increase.

Task 7

Balancing equations

1) $N_2 + H_2 \longrightarrow NH_3$

$N_2 + 3H_2 \longrightarrow 2NH_3$

2) $CH_4 + O_2 \longrightarrow CO_2 + H_2O$

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

3) $Na + H_2SO_4 \longrightarrow Na_2SO_4 + H_2$

$2Na + H_2SO_4 \longrightarrow Na_2SO_4 + H_2$

4) $SO_2 + NaOH \longrightarrow Na_2SO_3 + H_2O$

$SO_2 + 2NaOH \longrightarrow Na_2SO_3 + H_2O$

5) $C_2H_5OH + O_2 \longrightarrow CO_2 + H_2O$

$C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$

Task 8

Moles in the following:

1) 59 g of cobalt

Moles = Mass / RFM

= 59 / 59

= 1 mole

2) 4.14 g of lead

Moles = Mass / RFM

= 4.14 / 207

= 0.02 mole

3) 1.08g of gold

Moles = Mass / RFM

= 1.08 / 108

= 0.01

Task 9

Moles in these compounds:

1) 62 g of sodium Oxide Na_2O

Moles = mass / RFM

= 62 / 62

Na_2O

Na + Na + O

23 + 23 + 16 = 62

= 1 mole

2) 174 g of lithium bromide LiBr

Moles = Mass / RFM

= 174 / 87

LiBr

Li + Br

7 + 80 = 87

= 2 mole

3) 3.2 g of oxygen

Moles = Mass / RFM

= 3.2 / 32

O_2

O + O

16 + 16 = 32

= 0.1 mole

4) 1.24 g of Ammonia

Moles = Mass / RFM

= 1.24 / 17

NH_3

N + H + H + H

14 + 1 + 1 + 1 = 17

= 0.073 mole

Task 10

Calculate the mass of:

1) Mass of 2 moles of calcium metal

Mass = Moles x RFM
= 2 x 40
= 80g

2) 0.25 moles of lead carbonate $PbCO_3$

Mass = Moles x RFM
= 0.25 x 267
= 66.75g

$PbCO_3$
Pb + C + O + O + O
207 + 12 + 16 + 16 + 16 = 267

3) The formula mass of a compound which has 0.5 moles of mass 14g

RFM = Mass / Moles
= 14g / 0.5
28 RFM

Task 11

a) Moles of copper sulphate

Moles = Mass / RFM
= 160 / 160 (of the dry sample)
1 Mole of copper sulphate

$CuSO_4$
Cu + S + O + O + O + O
64 + 32 + 16 + 16 + 16 + 16 = 160

b) Mass of water lost

250 g – 160 g = 90 g of water lost

c) Moles of water lost

Moles = mass / RFM
= 90 / 18
= 5 moles of water lost

H_2O
H + H + O
1+ 1+ 16 = 18

d) Formula of hydrated copper sulphate

1 mole of $CuSO_4$.....5 moles of water
So $CuSO_4.5H_2O$

Task 12

1) Calculate the moles in 40 ml of 5M of sodium hydroxide solution

Moles = $\frac{C \times V}{1000}$

= $\frac{5 \times 40}{1000}$ = 0.2 Mol/dm^3

2) What is the concentration when you dissolve 2 moles of acid in 100ml of water

Moles = $\frac{C \times V}{1000}$

= $\frac{2 \times 100}{1000}$ = 0.2 Mol/dm^3

3) How many moles are their in 500ml of 0.1 mol/dm3 of salt solution

Moles = $\frac{C \times V}{1000}$

= $\frac{0.1 \times 500}{1000}$ = 0.05 Mol/dm^3

4) What is the concentration of 0.25 moles of alkali in 25 ml

Moles = $\frac{C \times V}{1000}$

= $\frac{0.25 \times 25}{1000}$ = 0.00625 Mol/dm^3

Task 13

1) How many grams of potassium oxide (K_2O) are needed to make 100ml of a 0.5M solution ?

Moles = $\frac{C \times V}{1000}$

= $\frac{0.5 \times 100}{1000}$

= 0.05 moles

Then

Mass = Moles x RFM

= 0.05 X 94

= 4.7 g

K_2O

K + K + O

39 + 39 + 16 = 94

2) What is the concentration of a solution when we dissolve 730g of hydrochloric acid in 350 cm^3?

Mass of solid added

Moles = mass / RFM

= 730 / 36.5

= 20 moles of HCl

HCl

H + Cl

1+ 35.5 = 36.5

Concentration

$C = \frac{Moles \times 1000}{v}$

$= \frac{20 \times 1000}{350}$

$= 57.14\ mol/dm^3$

3) What is the mass of calcium oxide, CaO needed to make a 250 ml volume of 0.5 M solution?

Moles = C x V / 1000

= 0.5 x 250 / 1000

= 0.125 moles

Then

Mass = Moles x RFM

= 0.125 X 46

= 5.75 g

CaO

Ca + O

40 + 16 = 56

Task 14

1) Calcium cyanamide $CaCN_2$ reacts with water to form calcium carbonate and ammonia

$$CaCN_2 + 3H_2O \longrightarrow CaCO_3 + NH_3$$

What mass of calcium carbonate is formed if 20g of the $CaCN_2$ is reacted with excess water.

$CaCN_2$

Ca + C + N + N

40 + 12 + 14 + 14

=80

20g

Moles = Mass / RFM

= 20 / 80

= 0.25

$CaCO_3$

Ca + C + O+O+O

40 + 12 + 16 + 16+16

=100

0.25 moles formed

Mass = Moles x RFM

Mass= 0.25 x 100

Mass = 25g

2) Magnesium burns in air to make magnesium oxide

$$2Mg + O_2 \longrightarrow 2MgO$$

What mass of magnesium would you need to create 0.8g of magnesium oxide powder.

0.8 g created

Moles = Mass / RFM

= 0.8 / 40

=0.02 moles formed

MgO

Mg + O

24 + 16

=40

Mg

24

= 0.02

Mass = Moles x RFM

Mass= 0.02 x 24

Mass = 0.48 g

3) Iron reacts with water to form iron oxide and hydrogen

$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

If the student starts with 1.68g of iron and it undergoes a complete reaction

i) Number of moles of iron started with?

ii) Moles of tri Iron oxide formed

iii) Mass of tri iron oxide formed

iv) The concentration of this solution if we had 500ml of water in the reaction?

Moles of Iron

i) Moles $= \frac{\text{Mass}}{\text{RFM}}$

$= \frac{1,68}{56}$

$= \underline{0.03}$

ii) Mole formed

3 : 4 ⟶ 1 4 Molar ratio

0.03 0.01 moles

iii) Mass of Tri iron oxide

Mass = Moles x RFM

= 0.01 x 232

= 2.32g

Fe_3O_4

Fe + Fe +Fe + O + O+ O + O

56 + 56+56+16+16+16+16

=232

iii) Concentration

$C = \frac{\text{Moles} \times 1000}{V}$

$= \frac{0.01 \times 1000}{500}$

$= \underline{0.02}$

Task 15

Imaginary story! You are CH_4

Use as much technical language as you can and **HIGHLIGHT** these key words

Key ideas to include:

As part of all the molecules in the mixture of crude oil

All heated up before going into the column

You turn into Gas, most other molecules do as well (although some do stay as liquids)

As go into column begin to cool down

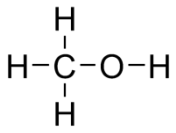
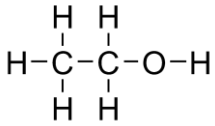
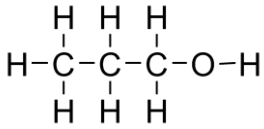
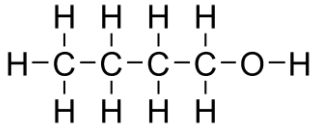
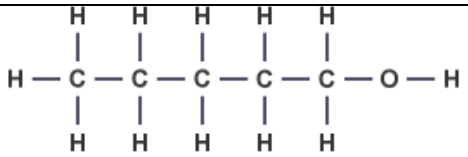
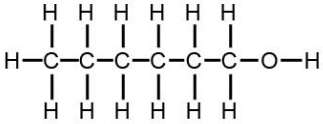
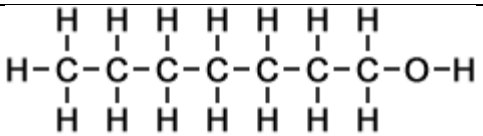
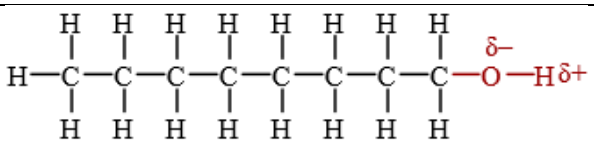
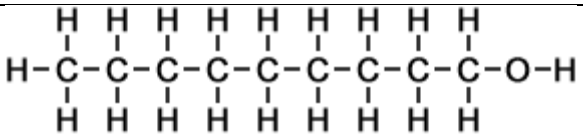
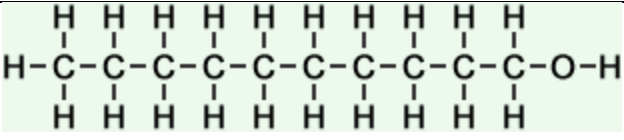
Some cool enough to condense and turn back into liquid and get piped of

You stay as Gas as so small and have low boiling point

Eventually you go to very top of column and get pumped out as gas.

You are used as a fuel like most of the other molecules

Task 16

	Name	Molecular	Structural/displayed
1	Methanol	CH_4O	
2	Ethanol	C_2H_6O	
3	Propanol	C_3H_8O	
4	Butanol	$C_4H_{10}O$	
5	Pentanol	$C_5H_{12}O$	
6	Hexanol	$C_6H_{14}O$	
7	Heptanol	$C_7H_{16}O$	
8	octanol	$C_8H_{18}O$	
9	Nonanol	$C_9H_{20}O$	
10	Decanol	$C_{10}H_{22}O$	

Task 17

1) Hydrogen is used in synthesising ammonia and is made on a large scale from reacting methane with water

methane + water ==> hydrogen + carbon monoxide

$CH_4 + H_2O$ ==> $3H_2$ + CO

3 x(2)

Mass of compounds **16 : 18 : 6 : 28**

CH_4	**CO**
12 + 4 x 1	**12 + 16**
= 16	**=28**
H_2O	H_2
1 + 1 + 16	1 + 1
= 18	= 2

Atom economy = Mass of useful product x 100

Mass of all reactants

$= \frac{6}{34} \times 100$

$= 17.6\%$

2) In the blast furnace where we form Iron .

$Fe_2O_{3(s)} + 3CO_{(g)}$ ===> $2Fe_{(l)} + 3CO_{2(g)}$

160 : 3 x 28 2 x56 : 3 x44

160 : 84 112 : 132

Fe_2O_3	**CO**
56 x2 + 16 x 3	**12 + 16**
= 160	**= 28**
Fe	CO_2
56	12 + 16 +16
	= 44

Atom economy = Mass of useful product x 100

Mass of all reactants

$= \frac{112}{244} \times 100$

$= 45.9\%$

Task 18

1) When 5.00 g of $KClO_3$ is heated it decomposes according to the equation:
$2KClO_3 \rightarrow 2KCl + 3O_2$

a) Calculate the theoretical yield of oxygen.
b) Give the % yield if 1.78 g of O_2 is produced.
c) How much O_2 would be produced if the percentage yield was 78.5%?

a) $2KClO_3 \rightarrow 2KCl + 3O_2$

5g

Moles = Mass / RFM

= 5 / 122.5

= 0.04

$KClO_3$	O_2
K + Cl + 3 xO	2 x O
39 + 35.5 + 3 x16	2 x 16
= 122.5	= 32

Molar ratio 2 : 3

so 0.04 : 0.06

Mass = Moles x RFM

Mass = 0.06 x 32

Mass = 1.92 g

b) yield

$$\frac{\text{Actual}}{\text{Theoretical}} \times 100$$

$$\frac{1.78}{1.92} \times 100$$

$$= 92.7\%$$

c) If 78.5%

$$\text{Actual} = \frac{\text{Yield}}{100} \times \text{Theoretical}$$

$$= \frac{78.5\ \%}{100} \times 1.92$$

$$= 1.51\text{g}$$

2) The electrolysis of water forms H_2 and O_2.

$2H_2O \rightarrow 2H_2 + O_2$

What is the % yield of O_2 if 12.3 g of O_2 is produced from the decomposition of 14.0 g H_2O?

$2H_2O \rightarrow 2H_2 + O_2$

14g

Moles = Mass / RFM

= 14 / 18

= 0.78

H_2O	O_2
H + H + O	O + O
1 + 1+ 16	16 + 16
= 18	= 32

H_2

1+1

= 2

Ratio

2 → 2 : 1

0.78 → 0.39 moles

Mass = Moles x RFM

Mass = 0.39 x 32

= 12.48g

Yield = Actual / Theoretical x 100

= 12.3 / 12.48 x 100

= 98.6%