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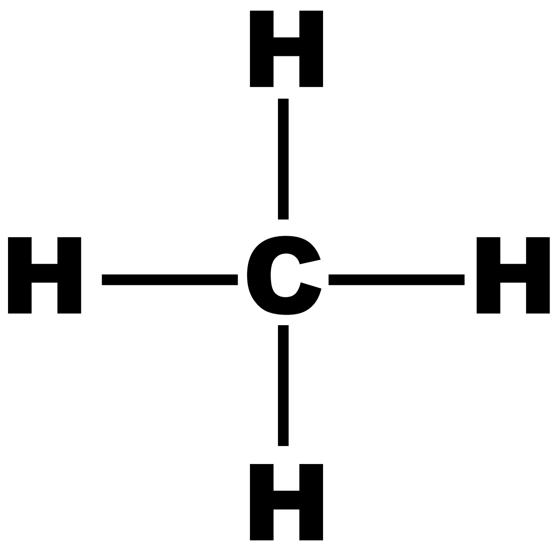
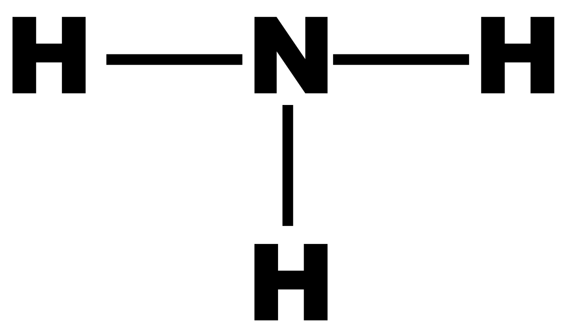
DRAWING MOLECULES 1

CH_4



NH_3



O_2

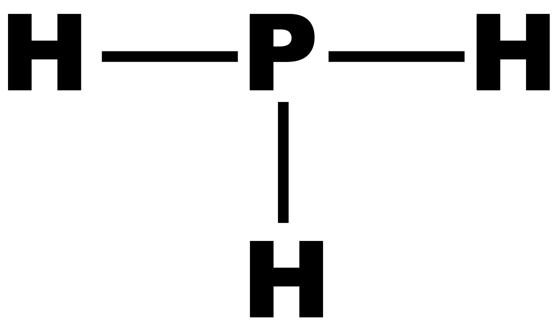
$O=O$

HCl

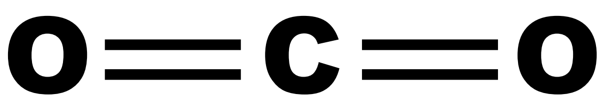
Br_2

Br — Br

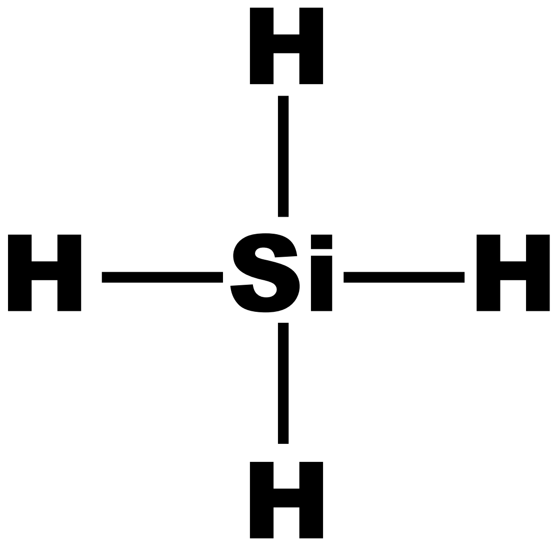
PH_3



CO_2



SiH_4



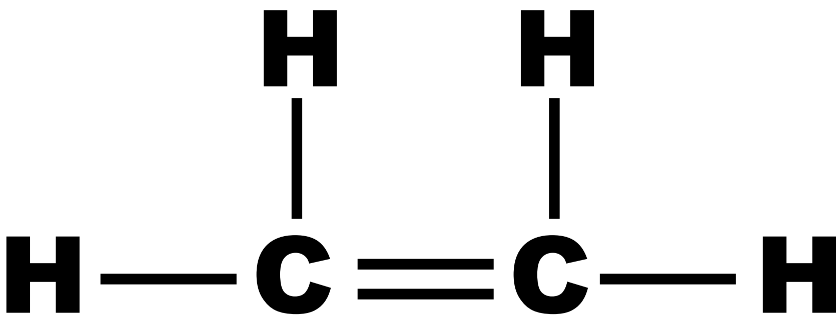
H_2O

H — O — H

N_2

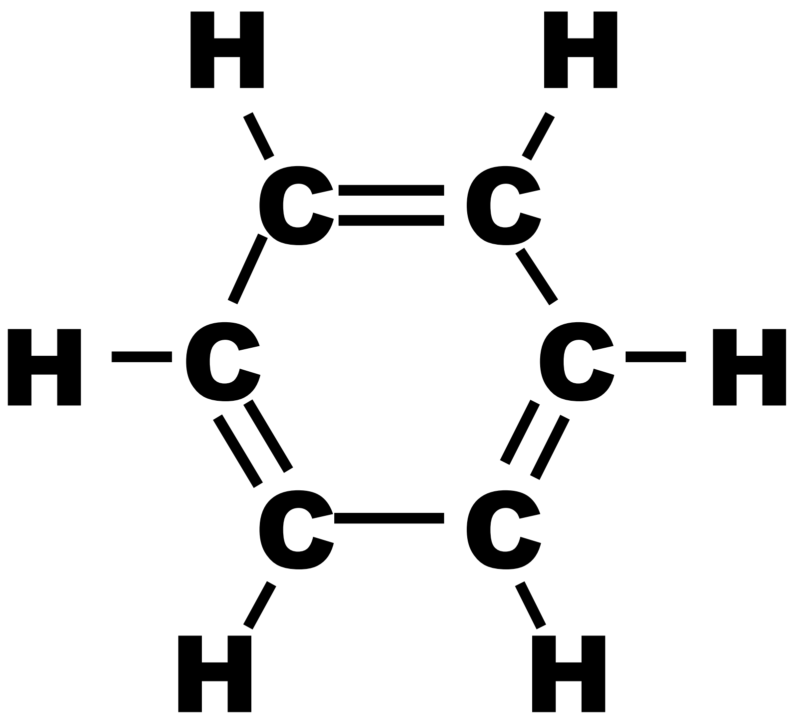
$$N \equiv N$$

C_2H_4

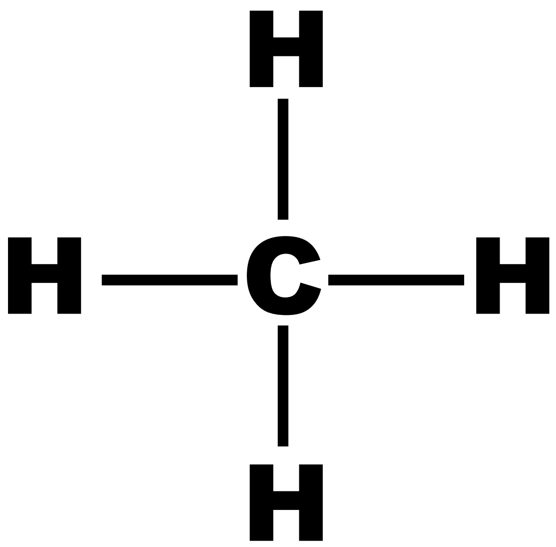


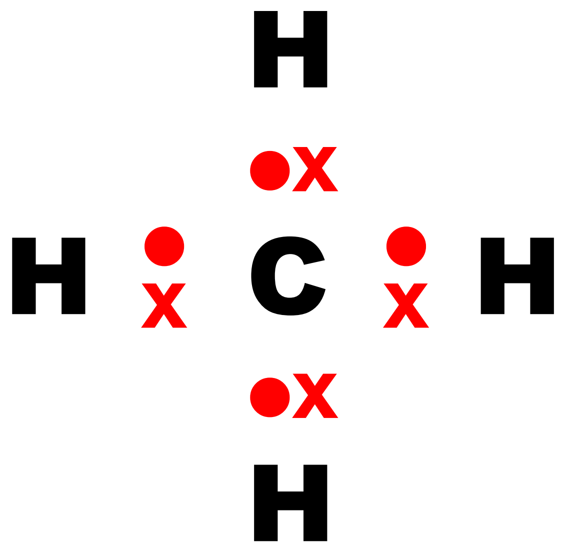
C_2H_2

C_6H_6

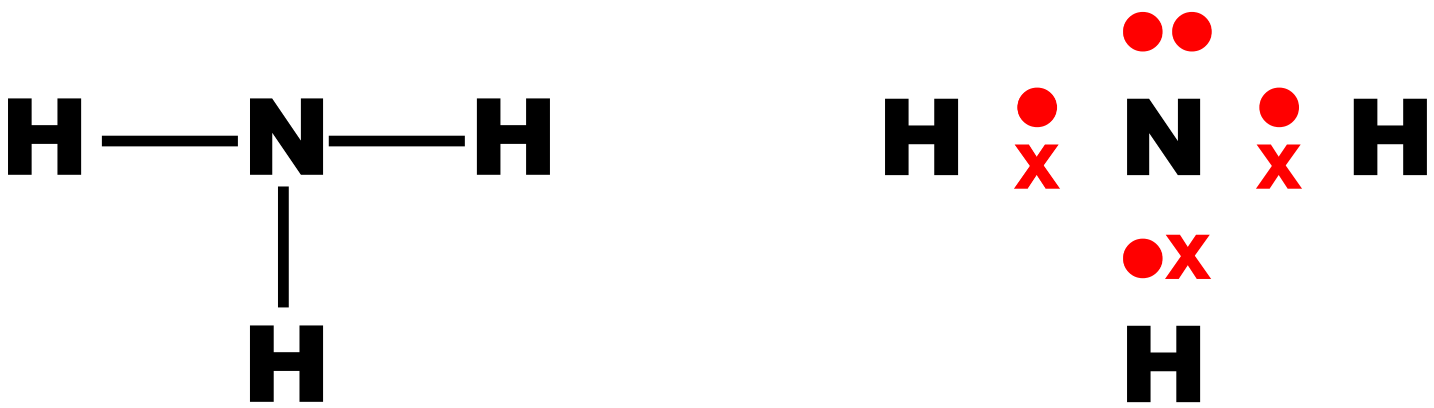


CH_4



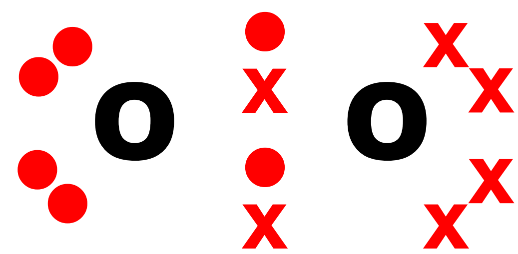


NH_3

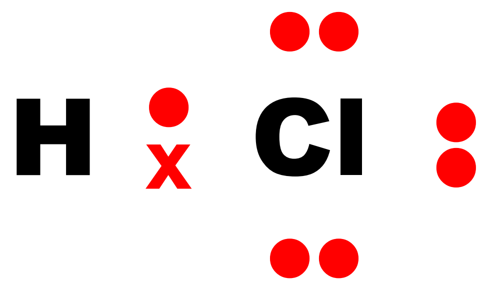


O_2

$O=O$

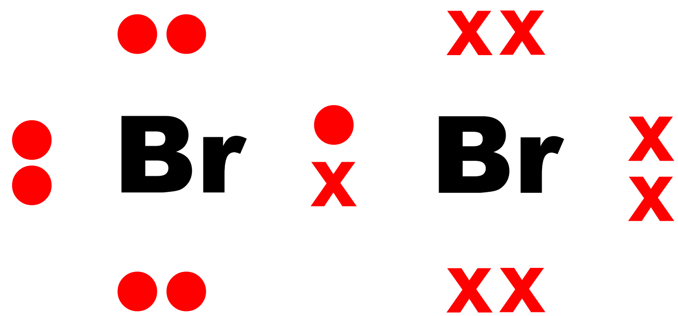


HCl

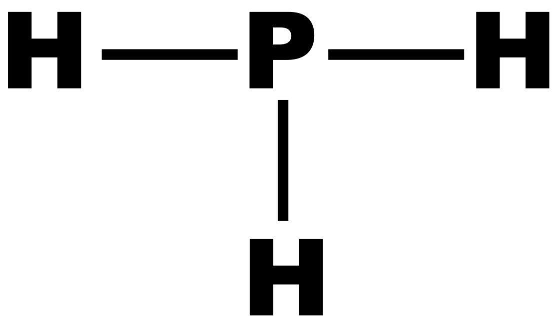


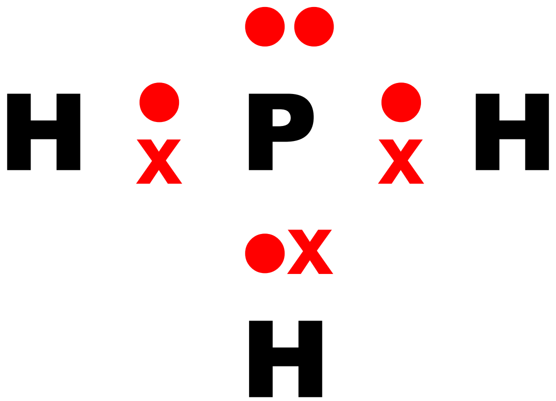
Br_2

Br — Br



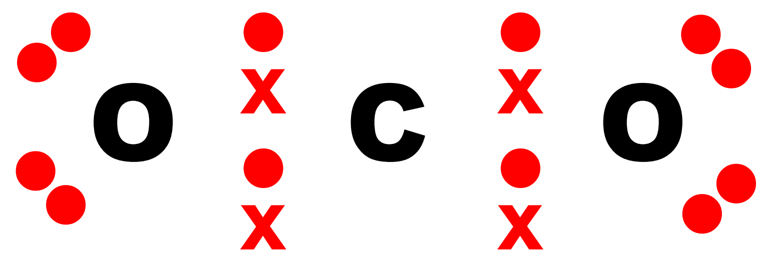
PH_3





CO_2

O=C=O



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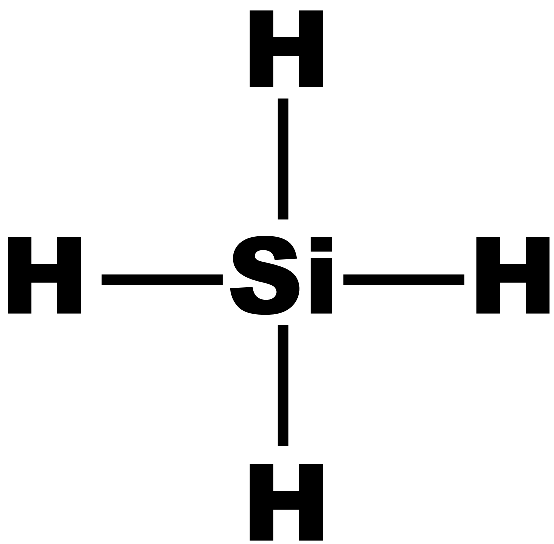
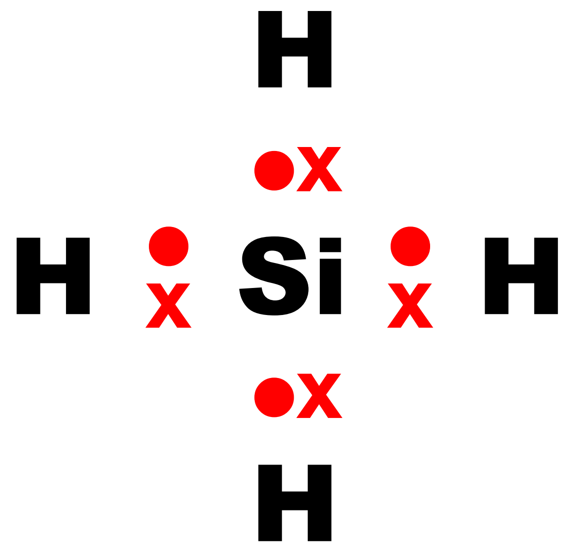
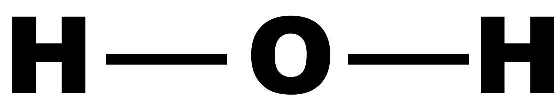
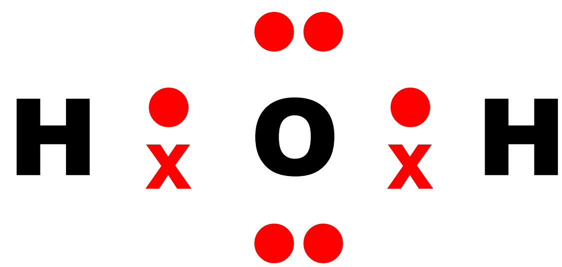
SiH_4





H_2O

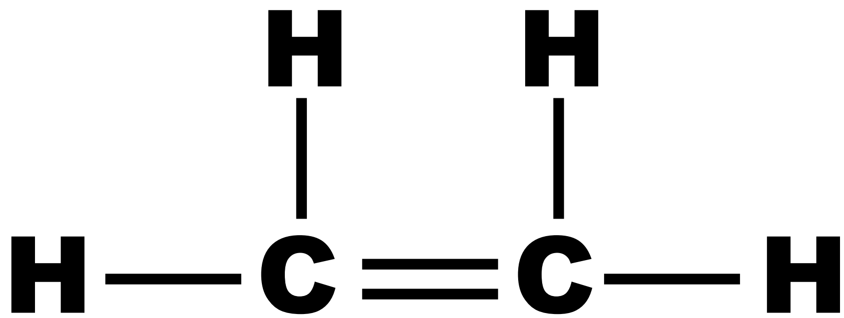


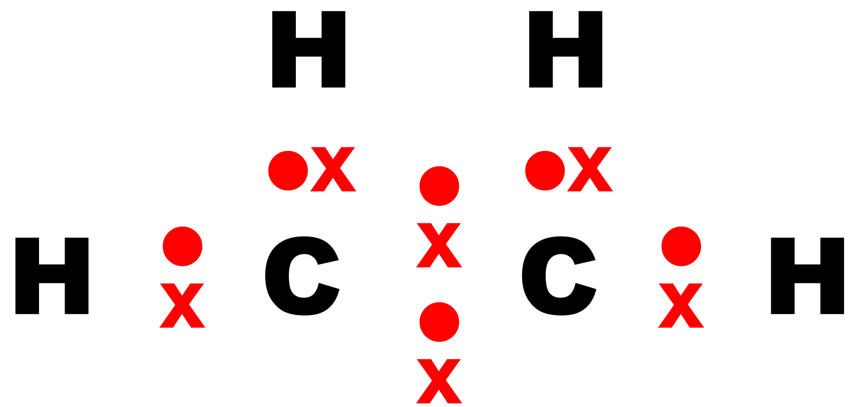


N_2

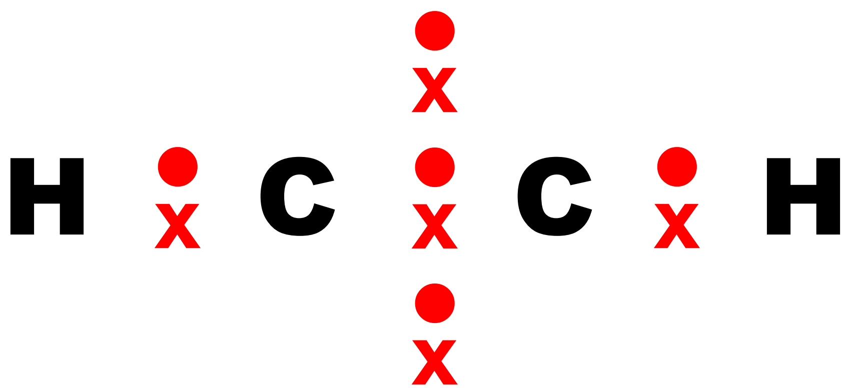
$$N \equiv N$$

C_2H_4

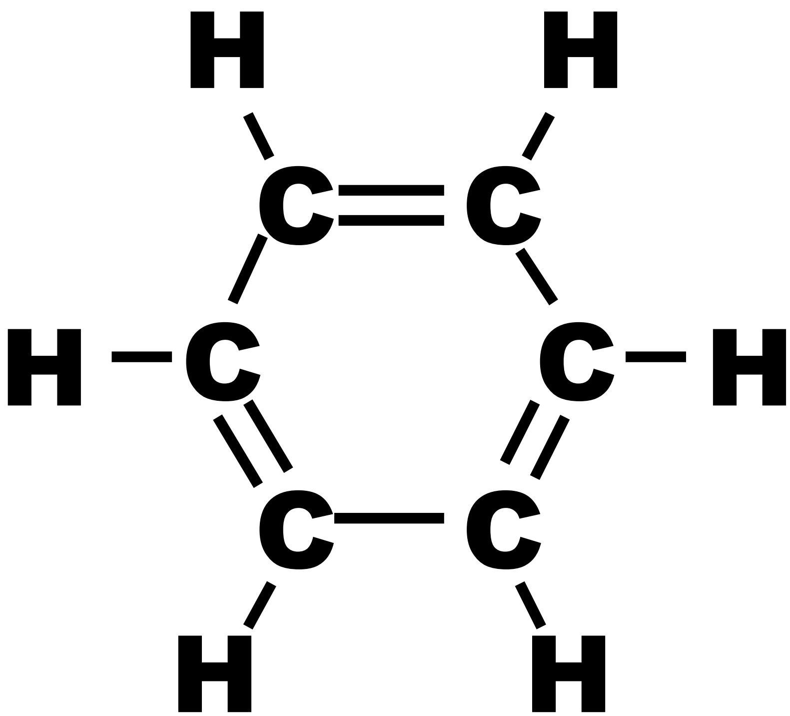


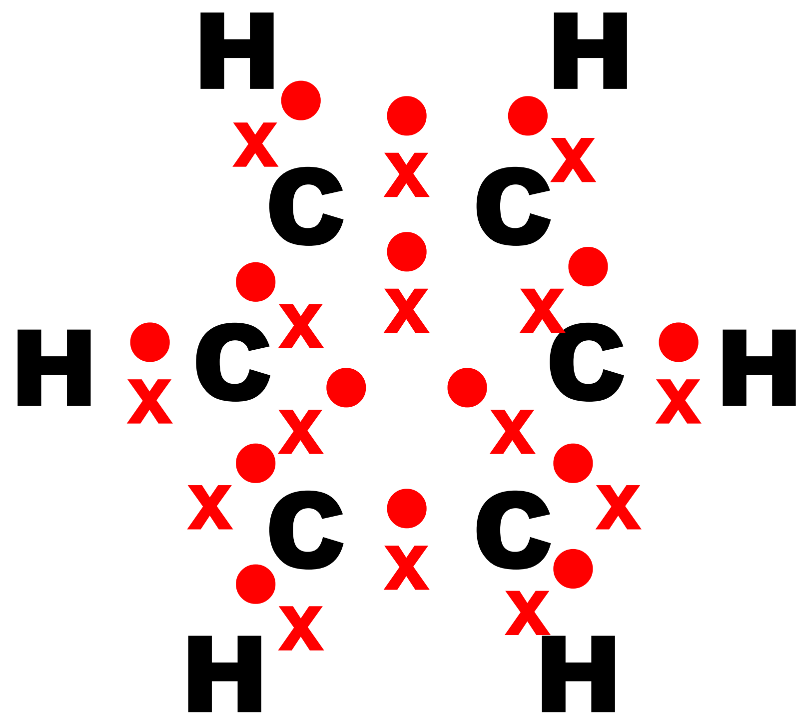


C_2H_2



C_6H_6





CALCULATIONS MIXTURE 1

1) Sodium reacts with oxygen as shown: $4Na + O_2 \rightarrow 2Na_2O$

Find the M_r of the following substances involved in this reaction.

a) sodium **Na** **23**

b) oxygen **O_2** **2(16) = 32**

c) sodium oxide **Na_2O** **2(23) + 16 = 62**

2) a) How many moles in the following:

i) 21.3 g of chlorine, Cl_2 $\frac{mass}{M_r} = \frac{21.3}{71}$ = **0.3 mol**

ii) 5.34 kg of aluminium bromide, $AlBr_3$ $\frac{mass}{M_r} = \frac{5340}{267}$ = **20 mol**

b) What is the mass of 0.25 moles of sulfur dioxide, SO_2? **M_r x moles = 64 x 0.25 = 16 g**

3) What mass of bromine reacts with 2.3 g of sodium to form sodium bromide? $2Na + Br_2 \rightarrow 2NaBr$

moles Na = $\frac{mass}{M_r} = \frac{2.3}{23}$ = 0.1 mol

moles Br_2 = $\frac{0.1}{2}$ = 0.05 mol

mass Br_2 = M_r x moles = 160 x 0.05 = 8.0 g

4) What mass of oxygen reacts with 280 g of iron to form iron oxide? $2Fe + 3O_2 \rightarrow 2Fe_2O_3$

moles Fe = $\frac{mass}{M_r} = \frac{280}{56}$ = 5 mol

moles O_2 = 5 x $\frac{3}{2}$ = 7.5 mol

mass O_2 = M_r x moles = 32 x 7.5 = 240 g

5) What is the percentage atom economy to make tungsten (W) from tungsten oxide in this reaction? $WO_3 + 3H_2 \rightarrow W + 3H_2O$

	WO_3 +	$3H_2$ →	W +	$3H_2O$
M_r	232	2	184	
Mass	232 g	3(2) g	184g	

% atom economy = $\frac{mass\ of\ desired\ product}{total\ mass\ of\ all\ reactants}$ x 100 = $\frac{184}{232+3(2)}$ x 100 = 77.3%

6) a) What is the maximum mass of calcium hydroxide that can be formed by reaction of 2.8 g of calcium oxide with water?

$CaO + H_2O \rightarrow Ca(OH)_2$

moles CaO = $\frac{mass}{M_r}$ = $\frac{2.8}{56}$ = 0.05 mol

moles $Ca(OH)_2$ = 0.05 mol

mass $Ca(OH)_2$ = M_r x moles = 74 x 0.05 = 3.7 g

b) In a reaction, 2.6 g of calcium hydroxide was formed from 2.8 g of calcium oxide. Calculate the percentage yield.

% yield = $\frac{mass\ formed}{maximum\ mass\ possible}$ x 100 = $\frac{2.6}{3.7}$ x 100 = 70.3%

7) 1.95 g of potassium is reacted with 5.08 g of iodine. Work out which is the limiting reagent and then calculate the mass of potassium iodide formed.

$2K + I_2 \rightarrow 2KI$

moles K = $\frac{mass}{M_r}$ = $\frac{1.95}{39}$ = 0.05 mol

moles I_2 = $\frac{mass}{M_r}$ = $\frac{5.08}{254}$ = 0.02 mol

$2K + I_2 \rightarrow 2KI$

0.05 moles of K needs 0.025 moles of I_2 for all the K to react, but we don't have this much I_2

therefore I_2 is the limiting reagent (so the K is in excess and does not all react)

therefore only 0.04 moles of K reacts with the 0.02 moles of I_2, and forms 0.04 moles of KI

mass KI = M_r x moles = 166 x 0.04 = 6.64 g

8) 1.20 g of hydrated tin chloride decompose to form 1.01 g of anhydrous tin chloride on heating. Calculate the value of *x*.

$SnCl_2.xH_2O \rightarrow SnCl_2 + xH_2O$

moles $SnCl_2$ = $\frac{1.01}{190}$ = 0.005316 mol

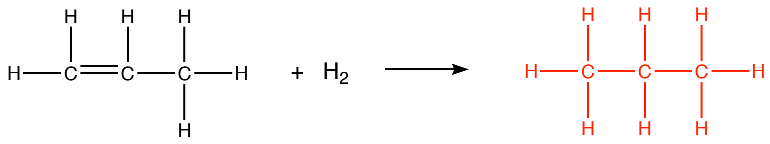
mass H_2O = 1.20 – 1.01 = 0.19 g

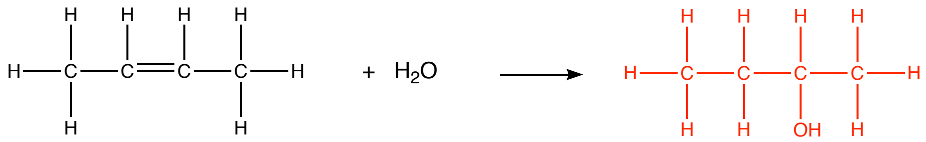
moles H_2O = $\frac{0.19}{18}$ = 0.01056 mol

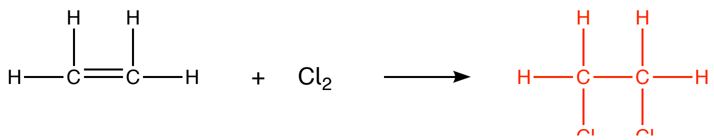
Ratio of moles $SnCl_2 : H_2O$ = 0.005316 : 0.01056 = $\frac{0.005316}{0.005316}$ $\frac{0.01056}{0.005316}$ = 1 : 2

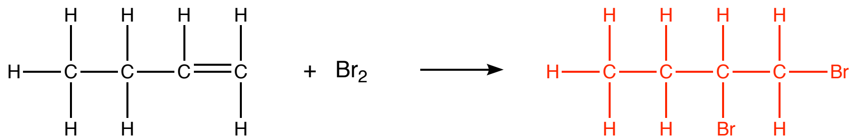
∴ x = 2 (nearest whole number)

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can convert units			Use equation to find reacting moles		
Shows suitable working			Which numbers are part of formula			Can work out % atom economy		
Does not round too much			Can work out M_r			Can work out % yield		
Can use sig figs			Work out moles from mass			Understands limiting reagents		
Gives units			Can work out mass from moles			Water of crystallisation calculations		

1) a) 

b) 

c) 

d) 

2) a) hexene = C_6H_{12}, hexane = C_6H_{14}

b) test = bromine water, hexene = goes colourless, hexane = stays yellow-orange

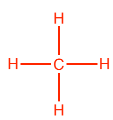
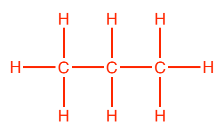
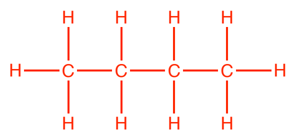
c) hexane is saturated as it contains only single bonds / no double bonds

3) a) $C_{10}H_{22} \rightarrow C_5H_{12} + C_3H_6 + C_2H_4$

b) vaporise alkanes, pass over hot catalyst; or mix with steam, heat to high temperature

c) creates valuable products, alkenes used to make polymers, shorter alkanes to use as fuels

4) a)

name	methane	propane	butane
molecular formula	CH_4	C_3H_8	C_4H_{10}
structure			

b) i) butane

ii) methane

iii) methane

iv) methane

5) vaporise oil

pass into tower/column that is hot at bottom and cool at top

molecules cool and condense at different heights

as molecules have different boiling points

smaller molecules are collected higher up tower/column

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Understands bromine water test			Knows why cracking is done		
Good SPG			Understands saturated			Can draw alkanes		
Write equations for alkene addition			Can write equations for cracking			Compare properties of alkanes		
Can write molecular formulas			Knows how cracking is done			Fractional distillation of crude oil		