Model Answers for 2019 4E Sci Chem PRELIM
Paper1 [20m]
Paper 3 Section A [45 marks]

Section A: Multiple-Choice Questions (20 marks)

Answer all the questions by writing your answers in the table provided.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
A	B	C	D	A	D	C	A	D	D
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
B	C	C	B	C	B	A	C	B	C

Section B: Structured Questions (30 marks)

Answer all the questions by writing your answers in the space provided.

1 **(a)** (i) Copper(II) carbonate or copper(II) oxide or copper(II) hydroxide can be used.[1]

(ii) The four steps:

1. Add excess solid ($CuCO_3$, CuO or $Cu(OH)_2$) to a fixed volume of dilute sulfuric acid and stir. [1]
2. Filter the mixture and collect the filtrate.[1]
3. Heat the filtrate till saturated/ to remove excess water.[1]
4. Cool the solution/filtrate to allow crystals to form. [1]

essential points/keywords are underlined.

0 marks awarded if steps 1 and 2 are missing. No mark for step 4 if step 3 is missing

(b) (i) Any Two correct: carbon dioxide; carbon monoxide; calcium silicate/slag [2]

(ii) Any Two correct :

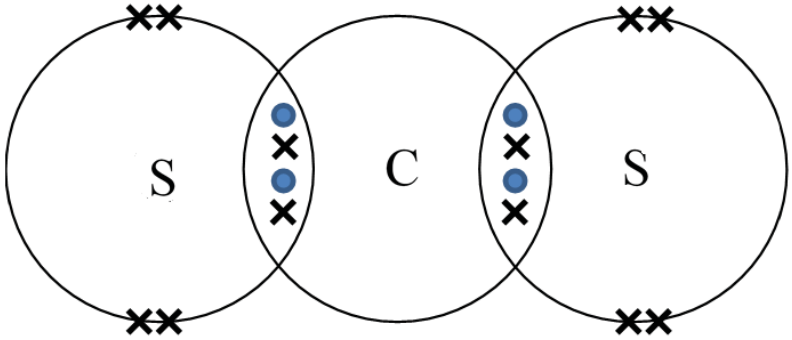
$C + O_2 \rightarrow CO_2$

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

$C + CO_2 \rightarrow 2CO$

$CaO + SiO_2 \rightarrow CaSiO_3$

2 **(a)**



double covalent bond between C and S[1]
correct no of valence electrons[1]

(b) There are weak intermolecular forces of attraction between molecules [1]
Thus need a little amount of energy to overcome these forces [1]

(c) MgS [1]

3 **(a)** Incomplete combustion of fuels in car engine.[1]

(b) **(i) The concentration is highest during 8am to 10am.[1]**
(ii) Many people are travelling to work using motor vehicles.[1]

(c) Carbon monoxide is binded to the haemoglobin, preventing oxygen from being transported around the body.[1]
This causes breathing difficulties or even death[1]

4 **(a)** W: copper(II) nitrate / $Cu(NO_3)_2$ [1]
X: ammonia/NH_3 [1]
Y: copper(II) carbonate/$CuCO_3$ [1]
Z: copper(II) hydroxide / $Cu(OH)_2$ [1]

(b) $Cu(NO_3)_2 + 2\ NaOH \rightarrow Cu(OH)_2 + 2NaNO_3$
(correct formulae-1m; correct balancing-1m)

(c) (i) Green precipitate turned black.[1]
(ii) It has been decomposed by the heat[1]

5 **(a)** Calculate the relative molecular mass of urea. [1]

$M_r[\ CON_2H_4] = 60$[1]

(b) What is the mass of ammonia required to produce 120 kg of urea? [3]

No of mole of CON_2H_4 produced = 120 000/60
= 2000[1]

Mole ratio of CON_2H_4 : NH_3 = 1: 2

Hence no of mole of NH_3 used = 2 X 2000 = 4000 [1]

Mass of ammonia required = 4000 X 17 g = 68 000 g[1]

(c) What is the volume of carbon dioxide gas needed in **(b)**? [2]

Mole ratio of CON_2H_4 : CO_2 = 1: 1

No of mole of CO_2 needed =2000 [1]

Volume of CO_2 =24 dm^3 X 2000 = 48 000 dm^3 [1]

6 **(a)** **(i)** It is because iodide ions are oxidised to iodine, the oxidation state of iodine has increased -1 in iodide ion to 0 in iodine **OR electrons lost when I^- is converted to I_2 [1]**

(ii) The solution turned from **colourless to brown / yellow** [1]

(b) The higher the concentration of potassium iodide used, the shorter the time taken **OR the faster the reaction**[1]

(c) the concentration of H+ ions does not affect the rate of reaction[1]. It is because the amount of products produced remained constant at 0.00017 mol/dm^3 when its concentration changes from 0.1 mol/dm^3 to 0.3 mol/dm^3[1]

(d) It can be done by reducing the temperature of the solution [1]. When the kinetic energy of the reactant molecules is lowered[1], they will move slower[1] and will reduce the frequency of effective collision to result in reaction[1]

7 **(a)** Functional groups present:

- C=C (carbon-carbon double bond)[1]
- □ COOH (carboxyl group)[1]

(b) (i) Test with aqueous bromine or bromine solution[1]

(ii) Observation with fatty acid **P** : reddish-brown bromine solution decolourised / turns colourless.[1]

Observation with fatty acid **Q** : bromine solution remains reddish-brown[1]

8 **(a)** (i) Beaker A – No visible reaction[1]

Beaker B – Effervescence is seen OR Mg dissolved in acid to form a colourless solution. [1]

(ii) In beaker A, HCl in methylbenzene does not dissociate into H^+ ions and is not acidic. [1]

In beaker B, the presence of water causes HCl to dissociate to form H^+ ions which react with magnesium to form hydrogen gas. [1]

(iii) $Mg + 2HCl \rightarrow MgCl_2 + H_2$ [1]

(b) (i) fractional distillation [1]

(ii) The 2 liquids must have different boiling points which are close together. [1]

(iii) the water will cool down the hot vapour and changes/ condenses it into liquid[1]

(iv)Decane will give a smokier flame. [1]

It has a higher percentage by mass of carbon[1], hence will be less likely to be completely burnt in oxygen [1]

9 **(a)** **(i)**

- Add a small piece of lithium into a beaker of water. [1]

- Effervescence was observed and metal darts and float on the water.[1]
- The experiment was repeated using different metals and the observation was recorded.[1]
- The reaction which produces most gas / reaction being the most vigorously will be the most reactive metal[1]

(ii) Potassium > sodium>lithium[1]

(ii) The reaction will be more vigorous when a piece of francium is used as compared to sodium [1].
Francium is more reactive than sodium[1]

(b) **(i)** All of them have seven valence electrons [1]

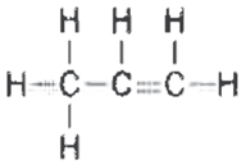
(ii) Observations: **the colourless solution** turned into a yellow/ brown solution [1]
Explanation: Bromine is more reactive than iodine and displaces it from its aqueous solution[1]

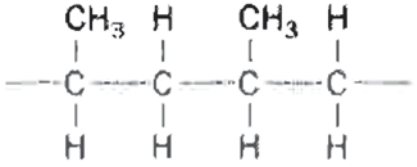
10 **(a)**

- In the furnace, petroleum is heated and turned into vapour (vapourised)[1]
- The hot vapour rises up the column, it begins to cool and condense.[1]
- Lighter fractions have lower boiling points will be condensed and collected at the top of the fractionating column as gases.[1]
- Heavier fractions have higher boiling point will be condensed and collected at the lower sections of the column.[1]

One of the useful substance is **bitumen[1]**. It is **used to surface road[1]**
(Accept any of the correct fraction and its use from the column.)

(b) (i) C_nH_{2n} [1]

(ii)  [1]

(iii)  [2]
All bonds correct [1] no of C and H atoms correct[1]