2021 SNGS Prelim MARKING SCHEME

PAPER 1

1	B	11	D	21	A	31	C
2	D	12	D	22	B	32	C
3	B	13	D	23	D	33	D
4	B	14	D	24	C	34	A
5	C	15	A	25	C	35	D
6	D	16	A	26	C	36	C
7	C	17	B	27	A	37	B
8	A	18	B	28	C	38	A
9	B	19	B	29	C	39	B
10	C	20	B	30	B	40	C

PAPER 2

A1 **(a)** **(i)** B has Weak intermolecular force of attraction [0.5] between simple molecules[0.5] [3]
Little amount of energy required to overcome forces of attraction[0.5]

A has strong covalent bonds between the atoms [0.5]which extends throughout the vast network[0.5]
A lot of energy required[0.5]

(ii) Giant metallic structure [0.5] [3]
E has strong electrostatic forces of attraction between cations and sea of delocalised electrons.[0.5]
Mobile electrons[0.5]

Giant ionic structure [0.5]
solid D has opposite charged ions held fixed in position in solid state[0.5]
no mobile ions.[0.5]

(b) Any group I [1]

(c) iron [1]

A2 **(a)** Filter the mixture [0.5] to obtain residue[0.5] [2]

Wash residue with distilled water[0.5], completely dry the residue with sheets of filter paper[0.5]

(b) The universal indicator will turn blue[1] [1]

(c) Silver ion has lower Ar/Mr than dichromate ion [3]

Silver ion diffuse faster than dichromate ion [1]

Red solid formed nearer to ammonium dichromate[1]

$2Ag^{+} + Cr_2O_7^{2-} \rightarrow Ag_2Cr_2O_7$ [1]

(d) White solid [0.5] , silver chloride [0.5] occurs near to silver nitrate than ammonium chloride[0.5] [2]

Silver ion has higher Ar than chloride ion [0.5]

A3 **(a)** liquid hydroxypropanoic acid does not dissociate [0.5] [1]
to form mobile ions.[0.5]

OR

liquid hydroxypropanoic acid exists as simple molecules. Molecules are electrically neutral [0.5]
No mobile ion[0.5]

(b) hydroxypropanoic acid : Universal indicator turns from green to orange/yellow.[0.5] [3]
hydroxypropanoic acid is weak acid. hydroxypropanoic acid partially dissociate to form H^{+}[1]
sulphuric acid : Universal indicator turns from green to red. [0.5]
sulfuric acid is strong acid. sulfuric acid completely dissociate to form H+[1]

(c) Mole of NaOH= Mole of acid = 0.0232 x 0.1 = 0.00232 mol [1] [2]
Mr of acid = 0.172/0.00232 = 74.1 [1]

A4 **(a)** carbon dioxide[0.5], carbon monoxide[0.5]. [1]

(b) Iron more reactive than hydrogen[1] [2]
hydrogen ions are preferentially discharge/reduced than iron (III) ion[1]

(c) Anode : $2O^{2-} \rightarrow O_2 + 4e$ [1] [2]
Cathode : $Fe^{3+} + 3e \rightarrow Fe$ [1]

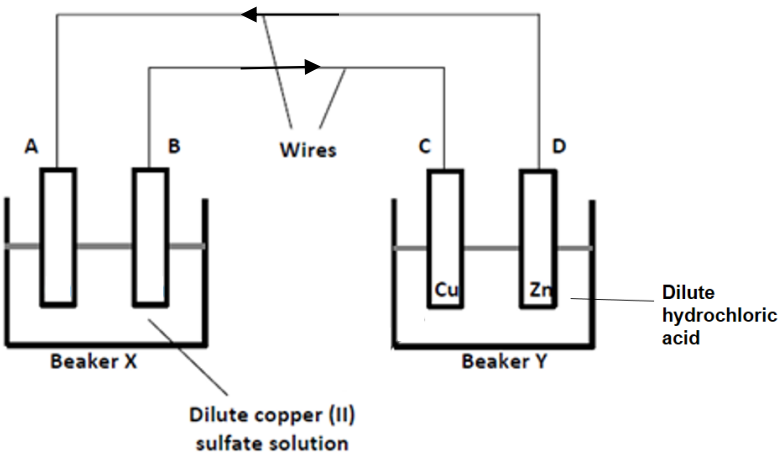
(d) $2Fe_2O_3 \rightarrow$ $4Fe + 3O_2$ [3]
Mole of Fe_2O_3 = $10x\ 10^6/160$= 62500 mol [1]
Mole of Fe = 62500 x 2 =125000 mol[1]
Mass of Fe = 125000x 56 = 7 tonnes.[1]

(e) Aluminium oxide is very stable.[1] [2]
Alumium oxide cannot be reduced by carbon/hydrogen/carbon monoxide[1]

A5 **(a)** Beaker Y as the electrodes are metal of different reactivity[1] [2]

Metals are connected in an electrolyte[1]

(b) [2]



(c) Electrode B : Effervescence, colourless and odourless gas at the anode.[1] [2]
Electrode A: Cathode become bigger/ reddish brown solid coated on the cathode[1]

(d) The electrode B become smaller/no gas evolved [2]

Electrode B oxidise to form copper (II)ions [1]as it is a reactive electrode.

OR

the electrolyte remain blue. [1]

concentration of Cu^{2+} remain the same.[1]

A6 **(a)** A,C,D,B [1]

(b) Carbonate of Metal A. A is the least reactive metal. [1] [2]
Its carbonate has the lowest thermal stability.[1]

(c) (i) Metal A: No visible change/reaction [1] [2]
Metal D: pale green solution becomes colourless [0.5] and grey solid produced.[0.5]

(ii) Add excess iron/iron(II)oxide/iron(II) hydroxide /iron(II) carbonate to dilute sulfuric acid [1] [3]
Filter the mixture to obtain the filtrate[0.5]
Heat to saturation and cool [0.5]Filter mixture to obtain residue[0.5]
Wash residue with a small amount of distilled water[0.5], completely dry the residue with sheets of filter paper[0.5]

(d) It will not rust. [2]
D is more reactive than iron/ D loses electron more readily than iron[1]
It corrode in place of iron.[1]

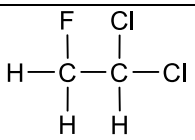
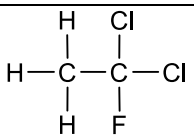
Section B

B7 **(a)** Structural formula of CF_3CF_3 [1]

(b) HFCs do not contain chlorine atoms, which deplete the ozone layer [1]. [1]

(c) Two fluorine atoms [1]

(d) [2]

HCFC-141a	HCFC-141b
	

(e) (i) UV light [1]

(ii) $CH_4 + F_2 \rightarrow CH_3F + HF$[1] [2]

$CH_3F + F_2 \rightarrow CH_2F_2 + HF$[1]

(iii) Fluorine has a smaller atomic radius than bromine/valence electrons are closer from the nucleus [0.5] [2]

Electrostatic forces of attraction between the nucleus and valence electrons are stronger [0.5].

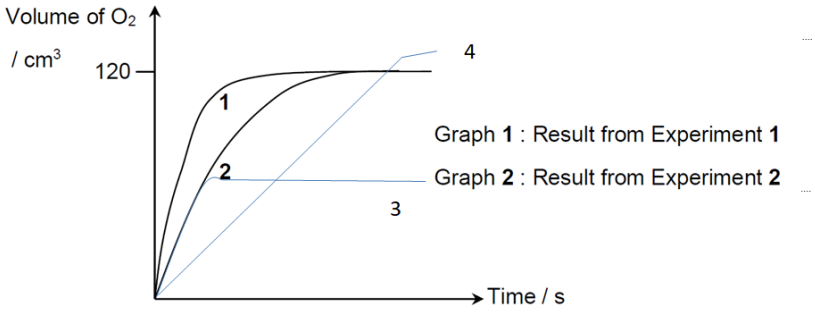
valence electrons are more easily gain [0.5]

Fluorine will react more vigorously than bromine.[0.5]

B8 **(a)** Manganese(IV) oxide is a better catalyst because graph **1** has a steeper gradient [1] [1]

(b) From the graph, volume of O_2 gas = 120 cm^3 [2]
No. of mol of O_2 = 120/24000 = 0.005 mol [1]
Hence, from the equation, no. of mol of H_2O_2 = 0.005X2 = 0.01 mol[0.5]
Concentration = 0.01/ 50 X 1000 = 0.200 mol/dm^3[0.5]

(c) [2]



(d) Increase temperature of hydrogen peroxide [1]
OR used powdered catalyst

(e) The energy absorbed to break bonds in 2 mole of H_2O_2 is lesser than [1] [2]
the energy released to form bonds in 2 moles of water and 1 mole of oxygen.[1]

(f) Hydrogen peroxide is a reducing agent. Hydrogen peroxide is oxidised.[1] [2]
Oxidation state of oxygen increases from -1 in H_2O_2 to 0 in O_2.[1]

E **(a)** Reduction. [0.5]Nitrogen gain electron to form ammonium ion[0.5] [1]

B9

(b) $2\ NO_3^- + 12\ H^+ + 10\ e^- \rightarrow N_2 + 6\ H_2O$ [1]

(c) Add aqueous sodium hydroxide and warm, test with moist red litmus paper. If red litmus paper turns blue, ammonium ion present.[1] [2]
If moist red litmus paper turns blue only when Al added, nitrate ion is present. [1]

(d) **(i)** The sudden increase in volume occurs because the number of moles of gas produced is 1.5 times that of the reactant. Volume goes up by 1.5 times.[1] [3]

Rate of combustion increases as oxygen is liberated by the process.[1]
Concentration of oxygen increases. [1]

(ii) nitrogen dioxide dissolves in rain water and is oxidized by atmospheric oxygen to form acid rain [1]
Acid rain will corrode buildings made of cement, reactive metals and limestone.[1] [2]

(iii) $2CO + 2NO \rightarrow N_2 + 2CO_2$ [1]

O B9 **(a)** (i) $4x410 + 2x\ 460 – 3x436 –y = 206$ [1]
$y = 1640 +920 -1308 -206= 1046$ kJ/mol[1] [2]

(ii) Triple bond [1]

(iii) Mole of $H_2 = 1000/24=41.667$ mol [1]
Energy change = 206/3 x 41.667
= + 2860kJ[1] [2]

(b) **(i)** $2H_2 \rightarrow 4H^+ + 4e$ [1]

(ii) Hydrogen is oxidized in a redox reaction by losing electrons to oxygen. [1]The electrons given out by hydrogen flow through the external circuit [1], which constitutes the electric current. [2]

(iii) [2]