SNGS Mark scheme for Year 4 IP EOY 2020 Paper 1

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

Answers to Section A: Circle the most appropriate answer to each question.

Section A (50 marks)

	1				
A1	а	Manganese(IV) oxide	[1]		
		OR			
		Nickel			
	h	Ammonium chloride	[1]		
	D D		[1]		
			541		
	С	Calcium carbonate	[1]		
	d	Lead(II) hydroxide	[1]		
	е	Aluminium sulfate	[1]		
	-		1.1		
	f	Ammonium chlorido	[1]		
	1		ניז		
		OR			
		lodine			
A2	а	γ	[1]		
	-		1.1		
	h	t			
	D	temperature / °C			
		90 -			
		60 -			
		50 +			
		total volume of distillate collected / cm ³			
		Flat, horizontal line drawn at 55 °C			
		Flat, horizontal line drawn at 80 °C			
		Vertical lines at other parts of the graph			
		Start and end at the given temp range			
	с	4/6	[1]		
	-	- 0.67	1.1		
		- 0.07			
		Not in 2 day 1/2 m			
<u> </u>	<u> </u>	$\frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{11}$	F 4 7		
	d	Yes, substance Y and the toxic dye have the same Rf value.	[1]		
l	1		1		

	е	Pencil lead is insoluble in water / the solvent, hence	[0.5]	
		It will <u>not be separated together with the toxic dye and intenere with the results</u>		
		OR		
		Pen ink is soluble in water / the solvent, hence		
		it will be separated together with the toxic dye and interfere with the results		
A3	а	Structure V	[1]	
	b	Structure III	[1]	
	С	Structure I and II	[1]	
	d	Molecules	[1]	
		Far apart, randomly arranged High speed in all directions	[0.5]	
	-		[0 5]	
	е	In the solid state, there are strong electrostatic forces of attraction between	[0.5]	
		oppositely charged ions	[0.5]	
		No mobile ions to conduct electricity	[0.5]	
A4	а	Use acidified aqueous potassium manganate(VII)	[1]	
		missing aqueous/solution of (VII) of wrong spelling: minus ½	[0.5]	
		Turns it from <u>purple</u>	[0.5]	
	-			
	b	<u>Cu₂S is reduced</u> as The oxidation state of copper decreased from +1 in Cu ₂ S	[0.5] [0.5]	
		to <u>O in Cu</u>	[0.5]	
		CU_2S is also oxidised as The oxidation state of sulfur increased from -2 in Cu ₂ S	[0.5]	
		to <u>+4 in SO₂</u>	[0.5]	
	С	$CaCO_3 + SO_2 \rightarrow CaSO_3 + CO_2 [1m]$	[1]	
		OR		
		$SO_2 + H_2O \rightarrow H_2SO_3$ CaCO ₃ + H ₂ SO ₃ \rightarrow CaSO ₃ + CO ₂ + H ₂ O		
		[award 1/2 m if any one equation above is balanced & correct] Wrong formula = 0 m		
A5	а	Increases	[1]	
	b	Number of electron shells / atomic radius / size increases down the group	[0.5]	
		distance between sea of delocalized electrons and positive ion increases Electrostatic forces of attraction decreases	[0.5] [0.5]	
		Less energy required	[0.5]	
1	1		1	

	•	Effertion and of a colourloss, adourloss good is observed	[4]
	C	Cos sytimulated lighted aplint with a new second	
		Gas extinguished lighted splint with a pop sound	[[1]
	Ь	Down Group II, the metals/elements become more reactive	[1]
	ч	Honor their (motal) asthenation become more thermally deble	[1]
		nence their (metal) <u>carbonates</u> become <u>more thermally stable</u>	[']
		If student did not differentiate and state the metals and their carbonates explicity:	
		max 1 mark	
		hax - man	
			10 51
	е	No, strontium is more reactive than calcium OR magnesium	[0.5]
		Hence its oxide is very stable and	[0.5]
		cannot be reduced by carbon.	
		If student and not differentiate and state the metals and their oxides explicity: max 1	
		mark	
	f	She will not succeed as	
	•		[4]
		Calcium is more reactive than magnesium	[1]
		Calcium has a higher tendency to lose electrons	[0.5]
		Calcium will oxidise first / corrode in place of magnesium	[0.5]
	a	Fo	[1]
	Э		[1]
		F = 0m	
		Fluorine – 0.5m	
46	а	Mol of MaCO ₂ $= 8.4 / 84 = 0.1$ mol	
70	a		
		$MOI OI HCI = 0.1 \times 1 = 0.1 \text{ mol}$	
		$MqCO_3 + 2HCI \rightarrow MqCI_2 + CO_2 + H_2O$	
		Mol of CO- produced = $0.1/2 = 0.05$ mol	[1]
		V(z) = (20, z) = 0.000 (z) =	
		Vol of CO_2 produced = 0.05 x 24 = 1.2 dm ³	[1]
	bi	↑ volume of gas produced / dm ³	
		graph A	
		B	
		time / s	
		Centler slope / gradient	10 -1
			[0.5]
		Ends at the same volume as graph A	[0.5]

	bii	▲ volume of gas produced / dm ³	
		2.4 6	
		araph A	
		1.2	
		time / s	10 51
		steeper slope / gradient	[0.5]
			[0.0]
		allow ecf if (a) is wrong	
<u> </u>	С	Sulfuric acid is dibasic while hydrochloric acid is monobasic	[0.5]
		Concentration of H ⁺ ions in sulfuric acid higher than / double / twice of hydrochloric acid	[0.5]
		Higher frequency of collisions and effective collisions	[0.5]
		Hence <u>faster</u> rate	
	d	No, ethanoic acid will not dissociate / ionize in ethanol to form mobile	[0.5]
		<u>H⁺ ions</u>	[0.5]
		Only mentioned no presence of water: ½ m	
	•	She did not add the same volume / same moles of acid and hydroxide to each other	[0 5]
	C	OR did not add reactants in the same molar ratio	[0.5]
		Hence, potassium nitrate may be <u>contaminated</u> with excess acid or hydroxide	[0.5]
		Carry out utration	[1]
A7	а		[1]
	b	Al^{3+}	[1]
	С	$Fe^{-1}(aq) + 2OH(aq) \rightarrow Fe(OH)_2(s)$	[2]
		-1 m for any wrong state symbol(s)	
		-1 m if not balanced Wrong formula = 0 m	
	d	Pale green solution turns colourless	[1]
		Grey solids produced	
L	1		1

Section B (30 marks)

B 8	а	70 +/- 5 atm. 200 °C	[1]
	-	930 +/- 10 atm. 300 °C	[1]
	b	70 +/- 5 atm, 200 °C	
		use less energy / requires lower pressure	[0.5]
		hence lower costs / safer to carry out the reaction	[0.5]
		OR	
		930 +/- 10 atm, 300 °C	
		requires higher(very high) pressure / temperature	
		nigner rate of reaction	
		Increase ourface area to valume ratio	[0 5]
	C	More surfaces for particles to collide against	[0.5]
		Higher frequency of collisions and effective collisions	[1]
		Hence increases rate	[0 5]
			[0.0]
	d	2 moles of NH ₃ produced has an energy change of -92 k.l	
	ŭ.	4 moles of NH ₂ produced has an energy change of $-92 \times 2 = -184 \text{ kJ}$	[1]
			[.]
		No or wrong unit -1/2 m	
		No "-" -1/2 m	
	е		[2]
		Ionic compound = 0m	
		Missing any lone pair or additional electrons: -1m	
	-		
	t	944 + 2(436)	[0.5]
		[-[163 + 4(391)]	[0.5]
		=+89 KJ / MOI	[1]
		wrong upit $-1/2$ m	
		$N_0 + + -1/2 m$	
	q	energy	[2]
	5		
		N ₂ H ₄	
		$N_2 + 2H_2$ Ea ΔH	
		Correctly labelled axis ½ m	
		Labelled reactants and products correctly ½ m	
		Ea labelled and directional arrows drawn correctly ½ m	
1	1		

B9	а	2 x 2 = 4 mg		[1]		
		Wrong unit -1/2m				
	b		N	0		
	~	Mass (%)	46.7	100-46.7		
		Mol 4	6.7/14 = 3.336	53.3/16 =3.331	[1]	
		Simplest	1	1	[1]	
		ratio				
		<i>x</i> = 1				
		OR				
		[14/(14+16x)] + 100	16.7			
		$[14 (14 + 16x)] \times 100 = 46.7$				
		x = 1				
	С	Nitrogen monoxide can b	e oxidized to nitroge	n dioxide and	[0.5]	
		Nitrogen dioxide can diss	olve in clouds/water	to form nitric acid or acid rain	[0.5]	
		Acid rain corrodes buildir	ngs made of cement	/ limestone / metals	[1]	
		OR				
		Decreases pH of soil, kill	ing plants / unsuitab	le for plant growth		
		OR Decreases pH of oceans, killing marine life				
		Decreases ph or oceans, killing marine life				
		OR				
		Causing respiratory problem				
		Allow oof if h is NO				
		Allow ecf if b is NO ₂				
	d	$2NO + 2CO \rightarrow 2CO_2 + N_2 $				
		-1/2 m if not balanced. Wrong formula = 0 m				
			rong ronnala o m			
	е	There will be less dissolved oxygen in the ocean			[1]	
		Marine creatures might s	uffocate / die / will no	ot thrive or survive	[1]	
D40		Lithium motoly crode ()			Г <i>и</i> 1	
Fit	d	LITNIUM METAI: anode (-)				
her					[']	
		Mark labelling and charg	e independently, 0.5	m each		
		5				
	b	Lithium has the lowest re	lative atomic mass of	compared to other metals OR	[1]	
		Among all the metals in t	he periodic table, lith	ium has the <u>lowest relative at</u>	<u>omic</u>	
		mass				
	ci	Cobalt(I\/) ovide is a stro	nder oxidizing agent		[1]	
		It generates a larger volt	age / potential difference	ence	[L'] [1]	
		generatee a <u>larger</u> volt	age / peterniar amore		L.1	
	cii	$LiC_6 + CoO_2 \rightarrow C_6 + LiC_6$	C0O2		[1]	
		-1/2 m if not balanced				
		Wrong formula = 0 m				

	d	Anode: Magnesium electrode becomes smaller/thinner cathode: Pink/reddish brown solid deposited / blue colour of electrolyte fades / electrode increases in size	[1] [1]
	е	Simple cell is not rechargeable / magnesium has to be replaced OR Simple cell generates more waste	[1]
		Not portable. Magnesium-copper simple cell produces a lower voltage (2.69 V compared to 4 V)	[1]
B10 OR	а	Any concentrated soluble aqueous chloride Except CuCl ₂	[0.5] [0.5]
	b	$4OH^{-} \rightarrow 2H_2O + O_2 + 4e^{-}$ -1 m if not balanced Wrong formula = 0 m	[1]
	С	Mol of Cl_2 gas = 2.4 / 24 = 0.1 mol Since $2Cl^- \rightarrow Cl_2 + 2e^-$ Mol of electrons = 0.1 x 2 = 0.2 mol	[1]
	d	Copper electrode or electrode V becomes thinner/smaller Reddish brown/pink solid deposited on electrode X Electrolyte changes from colourless to blue Size of X increases	[1] [1]
	е	1 and 2	[1]
	f	The longer the duration, the larger the mass of silver deposited The larger the current, the larger the mass of silver deposited	[1] [1]
	g	0.108 g	[1]