01. 0620_m20_ms_42 Q: 4

(a)	Haber (process) (1) ammonia (1)	**2**
(b)(i)	green	**1**
(b)(ii)	$Fe^{2+}(aq) + 2OH^-(aq) \rightarrow Fe(OH)_2(s)$ $Fe(OH)_2$ (as only product) (1) Fe^{2+} and $2OH^-$ (as reactants) (1) state symbols (1)	**3**
(c)(i)	oxidising agent	**1**
(c)(ii)	presence of an acid	**1**
(c)(iii)	lose an electron	**1**
(c)(iv)	colourless	**1**
(d)	3+ 3+	**2**

02. 0620_p20_ms_40 Q: 4

(a) (i) Any two from:
chromium
is harder;
has higher density;
has higher melting point / boiling point;
stronger;
ora; [2]
note: comparison must be made

(ii) Any two from:
sodium is more reactive;
chromium has more than one oxidation state, sodium has one;
chromium forms coloured compounds, sodium compounds are white;
sodium reacts with cold water, chromium does not;
chromium forms complex ions, sodium does not;
chromium has catalytic properties, sodium does not; [2]
note: difference must be clear

(b) (i) Any two from:
appearance / shiny / more attractive / decoration;
resists corrosion / resists rusting;
hard surface; [2]

(ii) $Cr_2(SO_4)_3$ [1]
ignore: correct charges on ions

(iii) $Cr^{3+} + 3e \rightarrow Cr$ [2]
note: one mark for equation and one mark for correct balancing

(iv) oxygen / O_2 [1]

(v) to replace chromium ions (used to plate steel) / chromium ions used up; [1]
copper ions replaced from copper anode; [1]

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03. 0620_w20_ms_43 Q: 5

Question	Answer	Marks
(a)	become more reactive down the group **ORA** (1)	1
(b)(i)	one mark each for **any two** of: • floats • dissolves / disappears / melts • moves • bubbles / fizzes / effervesces • lilac flame	2
(b)(ii)	$2K + 2H_2O \rightarrow 2KOH + H_2$ all formulae (1) equation fully correct (1)	2
(c)(i)	$Cl_2 + 2KI \rightarrow 2KCl + I_2$ **OR** $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ all formulae (1) equation fully correct (1)	2
(c)(ii)	brown / black	1
(d)(i)	**breakdown** by (the passage of) **electricity** (1) of an **ionic compound** in **molten or aqueous** (state) (1)	2

Question	Answer	Marks
(d)(ii)	heat until it melts / heat to or above melting point	1
(d)(iii)	$Na^+ + e \rightarrow Na$	1
(e)(i)	one mark for each of any two from: • (chromium has) high melting point **ORA** • (chromium forms) coloured ions / coloured compounds **ORA** • (chromium has) variable valency / variable oxidation state / variable oxidation number **ORA** • catalytic behaviour **ORA** **ORA ALLOW** group 1 **or** sodium **if stated** • no colour **or** white **or** colourless ions or compounds • fixed valency / +1 charge **only or one** oxidation state / forms **one** chloride • low melting point • doesn't behave as a catalyst	2
(e)(ii)	one mark for each of any two from: • (chromium / sodium) **conducts** electricity • (chromium / sodium) compounds are **soluble** (in water) • (chromium / sodium) form hydrated salts / form hydrated compounds	2

04. 0620_s18_ms_41 Q: 5

(a)(i)	(a substance which) increases the rate of a reaction	1
	without being used up (at the end) / remains unchanged or unaffected or without changing mass	1
(a)(ii)	variable oxidation states	1
(b)	any **two** from: high(er) melting point / boiling point (very) hard(er) (very) strong(er) dense(r)	2
(c)(i)	$ZnSO_4$	1
	H_2 written on product line	1
	states (aq) **AND** (g)	1
(c)(ii)	(labelled) arrow pointing upwards starting level with reactants and finishing level with top of the hump.	1
(c)(iii)	exothermic **AND** products are at lower energy (than reactants)	1
(d)	lower hump starting from reactants line	1
(e)(i)	$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ 1 mark for any equation which has Cu as the product or Cu^{2+} ions on left 1 mark for correct species 1 mark for correct state symbols	3
(e)(ii)	(a pink / brown) solid / deposit forms	1
(e)(iii)	bubbles / fizzing (at the anode)	1
	solution becomes paler / less blue / colourless	1

(e)(iv)	a green gas would be seen (on the anode)	1

05. 0620_m16_ms_42 Q: 4

(a)	**M1** (substance that) speeds up a reaction / increases the rate of a reaction; **M2** any one from: unchanged (chemically at the end) / not used up; lowers activation energy;	**2**
(b)(i)	at the start/initially / t = 0;	**1**
(b)(ii)	catalyst should be powdered / increase surface area (of catalyst) / decrease particle size (of catalyst); **or** increase temperature / heat / warm;	**1**
(c)(i)	0.002 (mol);	**1**
(c)(ii)	0.001 (mol);	**1**
(c)(iii)	0.024 (dm^3);	**1**
(c)(iv)	no change / no effect;	**1**
(c)(v)	0.048 (dm^3);	**1**
(d)	same mass / amount of / moles / 1.0 g of catalyst; same temperature; same volume **and** concentration of hydrogen peroxide / 20 cm^3 of 0.1 mol / dm^3 of hydrogen peroxide or reactant;	**3**

06. 0620_p16_ms_40 Q: 4

(a) (i) Any two from:
chromium
is harder;
has higher density;
has higher melting point / boiling point;
stronger;
ora; [2]
note: comparison must be made

(ii) Any two from:
sodium is more reactive;
chromium has more than one oxidation state, sodium has one;
chromium forms coloured compounds, sodium compounds are white;
sodium reacts with cold water, chromium does not;
chromium forms complex ions, sodium does not;
chromium has catalytic properties, sodium does not; [2]
note: difference must be clear

(b) (i) Any two from:
appearance / shiny / more attractive / decoration;
resists corrosion / resists rusting;
hard surface; [2]

(ii) $Cr_2(SO_4)_3$ [1]
ignore: correct charges on ions

(iii) $Cr^{3+} + 3e \rightarrow Cr$ [2]
note: one mark for equation and one mark for correct balancing

(iv) oxygen / O_2 [1]

(v) to replace chromium ions (used to plate steel) / chromium ions used up; [1]
copper ions replaced from copper anode; [1]

07. 0620_s14_ms_32 Q: 6

(a) any **three** from:
(it would have) more than one or variable valency / oxidation state / oxidation number (1)

(metal / element / titanium / it has a) high density (1)

coloured compounds / ions / solutions (1)

form complex (ions) (1)

(element/compound act as) catalyst (1) [3]

(b) ScF_3 (1)

correct charges on **both** ions (1)

8 electrons around (each) fluoride (1) [3]

(c) name or formula of strong acid and alkali (1)

reacts with or neutralises both acid and base or alkali (then amphoteric) (1)

it dissolves / soluble in both(acid and alkali) or form solutions in both (1) [3]

[Total: 9]

08. 0620_w13_ms_32 Q: 5

(a) because they have more than one oxidation state or valency / form ions with different charges [1]

there are two iron oxides (iron(III) oxide and iron(II) oxide) / iron forms Fe^{2+} and Fe^{3+} compounds / iron forms iron(II) and iron(III) compounds [1]

(b) (i) to remove the precipitate / remove the silver(I) chromate(VI) / remove the residue [1]

(ii) to remove soluble impurities / remove named soluble salt e.g. potassium nitrate / remove reactants [1]

(iii) to dry solid / to remove water [1]

(c) (i) need one mole of potassium chromate(VI) for two moles of silver(I) nitrate / correct references to mole ratio [1]

(ii) mass of $AgNO_3$ needed is 170 × 0.2 × 0.1 = 3.4g [2]
NOTE: if answer given is 34 they have omitted 0.1
ALLOW: (1) ecf

(iii) number of moles of $AgNO_3$ used = 0.02 × 0.2 = 0.004 [1]

number of moles of Ag_2CrO_4 formed = 0.002 [1]

mass of one mole of Ag_2CrO_4 = 332g

mass of Ag_2CrO_4 formed = 0.664g [1]
NOTE: use ecf when appropriate

[Total: 11]