



Question	Answer	Marks	AO Element	Notes	Guidance
1	transition (elements)	1			
2(a)	A (1) low melting point / lowest melting point (1) does not conduct when molten / does not conduct when liquid (1)	3			
2(b)	D (1) does not conduct when solid but conducts when molten / only conducts when molten (1) soluble in water (1)	3			
3	2nd box down ticked (have high densities) (1) 4th box down ticked (have high melting points) (1)	2			
4	any two from: • act as catalysts • variable oxidation numbers • form coloured compounds / coloured ions • higher melting point • higher density • harder	2			

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5(a)	N	1			
5(b)	O	1			
5(c)	Be	1			
5(d)	N	1			
5(e)	Ne	1			
5(f)	Li	1			
6	first box down ticked (iron forms coloured compounds) (1) second box down ticked (iron can act as a catalyst) (1)	2			
7	diatomic	1			
8	selenium / Se	1			
9	helium is inert / helium is unreactive / hydrogen is flammable / hydrogen is explosive	1			

Question	Answer	Marks	AO Element	Notes	Guidance
10(a)	boiling point of chlorine: any value between -180°C and $+50^{\circ}\text{C}$ (inclusive) (1) density of iodine: any value between 3.2 g / cm^3 and 10.0 g / cm^3 (inclusive) (1)	2			
10(b)	increases (down the group)	1			
10(c)	solid	1			
10(d)	3rd box down ticked (light yellow)	1			
11(a)	melting point of lithium: values between 110°C and 210°C (inclusive) (1) atomic radius of potassium: values between 190 pm and 240 pm (inclusive) (1)	2			
11(b)	decreases (down the group)	1			
11(c)	there is no trend in thermal conductivity (of the other elements down the group)	1			

Question	Answer	Marks	AO Element	Notes	Guidance
11(d)	liquid (1) 45 °C is between the melting points and boiling point / 45 °C is above the melting point and below the boiling point (1)	2			
12(a)	density of chlorine: any value between 1 g / cm ³ and 3 g / cm ³ inclusive (1) boiling point of iodine: any value between 115 °C and 320 °C inclusive (1)	2			
12(b)	increases (down the group)	1			
12(c)	liquid (1) 50 °C is between the melting point and boiling point / 50 °C is higher than the melting point but lower than the boiling point (1)	2			
13(a)	carbon monoxide	1			
13(b)	propene	1			
13(c)	carbon dioxide	1			
13(d)	chlorine	1			
13(e)	sulfur dioxide	1			

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14	1 mark each for any two of: ∞ high density ORA for Mg ∞ forms coloured compounds ORA for Mg ∞ forms ions with different charges / has variable oxidation number ORA for Mg ∞ forms complex ions ORA for Mg ∞ copper is catalyst ORA for Mg ∞ reference to difference in chemical properties e.g. magnesium reacts with dilute acid / copper does not react with dilute acid	2			
15	fluorine more reactive than chlorine ORA	1			
16(a)	potassium / K	1			
16(b)	calcium / Ca	1			

Question	Answer	Marks	AO Element	Notes	Guidance
17	any three from: • high melting point / high boiling point • high density • forms coloured compounds • forms ions with different charges / forms ions with variable valency / form ions with different oxidation numbers • forms complex ions • can be used as a catalyst	3			
18(a)	has complete outer (electron) shell / has full outer (electron) shell / outer shell cannot gain or lose electron(s)	1			
18(b)	lamps / inert atmosphere (in metal extraction)	1			
19(a)	bromine (1) potassium iodide (1)	2			
19(b)	chlorine more reactive than iodine / iodine less reactive than chlorine	1			

Question	Answer	Marks	AO Element	Notes	Guidance
20(a)	chlorine (1) sodium iodide (1)	2			
20(b)	chlorine is more reactive than bromine / bromine is less reactive than chlorine	1			
21(a)	any two from: • low melting point or low boiling point • soft • low density	2			
21(b)	any one from: • fizz / bubbles • moves • floats • melts / forms a ball • gets smaller / disappears	1			
22	nickel has: M1 higher density ORA M2 higher melting point / boiling point ORA	2			

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23	M1 solid M2 black	2			
24	solutions of nickel compounds are coloured ORA	1			
25	form coloured compounds / ions (1) act as catalysts (1)	2			
26	1 mark each for any 2 of: • high melting point / high boiling point for Cr ORA for Na • high density for Cr ORA for Na • forms coloured compounds for Cr ORA for Na • has more than one oxidation state / forms ions with different charges for Cr ORA for Na • forms complex ions for Cr ORA for Na • catalyst for Cr ORA for Na • hard for Cr ORA for Na • idea that Cr less reactive than Na ORA	2			

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27(a)	M1 Transition element has higher melting point/ higher boiling point ORA M2 Transition element has higher density ORA	2			
27(b)	good conduction of heat or electricity OR malleability OR ductility	1			
27(c)	1 mark each for any two of: • catalyst • more than one or different or variable oxidation state / oxidation number / valency • coloured compounds / coloured ions	2			
28	iodine (1) chlorine is more reactive than iodine ORA (1)	2			
29(a)	state of fluorine: gas (1) boiling point of chlorine: between – 160 °C and 20 °C (inclusive of these two values) (1)	2			

Question	Answer	Marks	AO Element	Notes	Guidance
29(b)	(chlorine is a) gas (at room temperature)	1			
30(a)	decrease in hardness down the Group ORA	1			
30(b)	any value between 30 (°C) and 62 (°C) (inclusive)	1			
30(c)	there is no definite trend / the values go down and up / no fixed pattern	1			
31	bromine is more reactive than iodine ORA	1			
32(a)	atomic radius of Rb: any value between 228 and 264 (inclusive of these values) (1) relative thermal conductivity of K: any value between 3.8 and 1.7 (inclusive of these values) (1)	2			
32(b)	decreases down (the Group) / increases up (the Group) / decreases from sodium to caesium ORA	1			
32(c)	bursts into flame / extremely rapid bubbling / explodes	1			

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33	density of iodine: values between 3.10 and 6.35 (excluding these two values)	1			
	melting point of At ₂ : values greater than 114 °C but less than 500 °C	1			
	colour of At ₂ : black / grey-black	1			

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34	One mark each for any 3 of: - Mn has high melting point/boiling point/ ORA for Na - Mn has high density/ ORA for Na - Mn has catalytic activity/ ORA for Na - Mn forms coloured <u>compounds</u> / ORA for Na - Mn <u>compounds</u> have variable oxidation states / form ions with different charges / ORA for Na - Mn is hard / Na is soft / Mn is strong / Na is weak - one suitable difference in chemical properties e.g. Mn is less reactive than Na ORA / Na reacts with cold water / Mn does not react with cold water	3			

Question	Answer	Marks	AO Element	Notes	Guidance
35(a)	relative hardness of potassium: between 1 and 3 (exclusive of these two values) (1) melting point of rubidium: less than 63 °C but not lower than 20 °C	2			
35(b)	slow bubbling / fewer bubbles than sodium	1			
36(a)	any one from: conduct electricity conduct heat malleable ductile shiny	1			
36(b)(i)	any one from: melting point hardness strength density	1			
36(b)(ii)	(cobalt) high(er) / (cobalt) strong(er)	1			

Question	Answer	Marks	AO Element	Notes	Guidance
37(a)	density of fluorine: ALLOW: values lower than 1.56 (but not 0 or negative numbers) melting point of chlorine: ALLOW values between –220 and –7 °C (excluding these two values)	2			
37(b)	<u>lighter</u> because the trend of colour down (the Group) is towards dark(er) colours / <u>lighter</u> because the trend of colour up (the Group) is towards light(er) colours	1			
37(c)	liquid (1) 40 °C is between the melting and boiling points OR 40 °C is between –7 °C and 59 °C OR 40 °C is higher than the melting point AND lower than the boiling point (1)	2			
38(a)	aluminium (1) has the lowest density / has a low density (1)	2			

Question	Answer	Marks	AO Element	Notes	Guidance
38(b)	aluminium has the best (electrical) conductivity	2			
38(c)	cobalt AND nickel	1			
39(a)	water purification / water treatment / killing bacteria / in (swimming) pools / disinfectant	1			
39(b)	breaking down of a compound / breaking down of a substance (1) (using) heat (1)	2			
39(c)	any two distinct pollution problems: • litter OR eyesore • sticks in gullets OR throats of birds / animals • blocking of drains OR watercourses • animals gets trapped OR tangled (in plastic) • poisonous vapours when burned • fills landfill sites	2			

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40	<i>Any two of:</i> • high densities • high melting points / high boiling points • catalysts • (compounds have) variable valency / variable oxidation numbers / form ions with different charges • form coloured compounds • form complex ions	2			
					[Total: 118]