e ii	They are recycled/not used up/remain unchanged (AW) (1); Catalysts provide a route with lower activation enthalpy/energy (*accept; They lower the activation e.*) (1)	2
e iii	CFCs/halogenoalkanes/ named halogenoalkanes *NOT chlorine*	1
e iv	radical(s)	1

2 a	copper(II) oxide (1); copper(I) oxide (1) *ignore gaps*	2
2 b i	CO_3^{2-} + $2H^+$ ~~CO_2~~ + H_2O (2) CO_3^- + anyH^+ $\rightarrow CO_2$ + anything scores (1) CO_3^{2-} + H^+ $\rightarrow CO_3^-$ (1) CO_3^{2-} + $2H^+$ ~~H_2~~ CO_3 (1)	2
2 b ii	protons are transferred (AW) (1); carbonate/CO_3^{2-} (*allow* ecf on formula from (i)) (1)	2
2 b iii	They are unaffected/ unreacted/spectator ions / they go from the lattice/malachite(1); They end up in solution/ form copper chloride (*but NOT "molecules" or copper-chlorine bonding implied*) (1)	2
2 c	$3s^23p^63d^{10}4s^1$/$4s^13d^{10}$ (2) $3s^23p^6$ $3d^94s^2$/$4s^23d^9$ scores (1)	2
2 d i	M_r chalcopyrite = 184 (1) *stated or implied* %Cu = 64 x 2/184 = 0.70(%) [1] *2 sig figs (mark separately and award provided answer is less than 2%)* (1)	3
2 d ii	froth flotation *or a description (in which case ignore name)*	1
2 e i	$4CuFeS_2$ + $10.5O_2$ → $4Cu$ + $2FeO$ + Fe_2O_3 + $8SO_2$ +2 0 0 +2 +3 +4 all correct (3); four/five correct (2); two/three correct (1) *Do not award third mark if signs follow numbers*	3
2 e ii	sulphur dioxide/SO_2 (1); is toxic/harmful to life/causes respiratory problems/ causes acid rain (1) *IGNORE any other reasons given*	2
2 f i	M_r SO_2 = 64 (1) *stated or implied* 320/64 = 5 (1)	2
2 f ii	Twice as many moles of NaOH as SO_2 *stated or implied* (1) (10 moles) volume = moles/conc. *stated or implied* (1) (10/0.5) calculation leading to answer (1) (20 dm^3)	3