1 **(a (i)** enzymes (1) [1]

(ii) reduces growth of microbes / rate of reproduction of microbes is lower / microbes are dormant (1)
fewer (enzymes) to decay food (1)
OR
enzymes less efficient at lower temperatures (1)
slower reaction rate (1) [2]

(b) correct linkage (1)
rest of molecule correct **and** continuation shown (1)
(other product is) water (1) [3]

(c) any **three** from:
photosynthesis (1)
light / photochemical (1)
chlorophyll / chloroplasts (1)
carbon dioxide and water needed (1)
(glucose and) oxygen (1) [3]

[Total: 9]

2 **(a** C **and** F [1]

(b) A [1]

(c) B [1]

(d) D [1]

(e) E [1]

(f) A **and** D [1]

[Total: 6]

3 In **(a)**, **(b)** and **(c)**, descriptions of chemical properties need not be detailed. If more than one answer is given in each section, mark the **first** one and ignore anything subsequent unless it contradicts what they have already written. No marks for reversing physical and chemical properties.

(a) properties should focus on a group 1 metal and not just metals in general

PHYSICAL soft / can be cut (with a knife) / low density / light / low melting point / (good) conductor (heat or electricity) / shiny (when freshly cut) / malleable / ductile / tarnishes [1]

CHEMICAL react with water (**not** steam) / (very) reactive / forms salts with halogens / react vigorously with acids (**ignore** concentration) / forms an alkaline or basic oxide / fixed oxidation state or oxidation number or valency of +1 / has one valency or outer shell electron **not** forms ionic compounds on its own. [1]

(b) properties should focus on a transition metal

PHYSICAL hard / high density / dense / high mp or bp / (good) conductor (heat or electricity) / strong / malleable / ductile / silver or grey or lustrous or shiny solid [1]

CHEMICAL more than one oxidation state or valency (**accept** many oxides) / forms coloured compounds or ions (**not** coloured on its own) / forms complex ions / behave as a catalyst / less reactive than group 1 [1]

(c) PHYSICAL colourless gas / yellow gas [1]
not diatomic molecules

CHEMICAL most reactive halogen / **very** reactive / forms **ionic** fluorides / bonds with metals / form **covalent** fluorides / bonds with non-metals / powerful oxidant / gains one electron (to be stable) / fixed oxidation state or valency of –1
allow decolourised when reacts with alkene) / forms F^- ions / forms acidic oxides / forms an acid when reacted with hydrogen / hydride is acidic [1]
not bleaching agent

Question	Answer	Marks
4(a)(i)	/heat **and** in air/oxygen;	**1**
(a)(ii)	$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$; SO_2 on right of equation; all formulae and balancing correct;	**2**
(b)(i)	**M1** heat produced by carbon/coke (burning in) oxygen/air; **OR** $C + O_2 \rightarrow CO_2$ produces heat/exothermic; **OR** $2C + O_2 \rightarrow 2CO$ produces heat/exothermic (scores **M1** and **M2**); **M2** $C + CO_2 \rightarrow 2CO$; **OR** $2C + O_2 \rightarrow 2CO$; **M3** $ZnO + CO \rightarrow Zn + CO_2$; **OR** $ZnO + C \rightarrow Zn + CO$; **OR** $2ZnO + C \rightarrow 2Zn + CO_2$;	**3** 1 1 1
(b)(ii)	temperature (inside the furnace) is above 907 °C/temperature (inside the furnace) is above the boiling point (of zinc)/1000 °C is above the boiling point (of zinc);	**1**
(b)(iii)	con /condensing/condense;	**1**
(c)	**M1** zinc is more reactive than iron/zinc is higher in the reactivity series than iron ora; **M2** zinc loses electrons; **M3** iron/steel/oxygen/air/water gains electrons **OR** electrons move to iron/steel/oxygen/air/water; **M4** (therefore) iron does not lose electrons/get oxidised/form iron(II)/form iron(III);	**4** 1 1 1 1

Question	Answer	Marks
(d)(i)	green precipitate; red-brown / brown / orange precipitate;	**2** 1 1
(d)(ii)	ox agent / oxidant;	**1**
(d)(iii)	agent / reductant;	**1**
(d)(iv)	iron(III) / Fe^{3+};	**1**
(d)(v)	iron(II) / Fe^{2+};	**1**