

- 1 (a) correct method shown [1]
 i.e. $126/14 (= 9)$ **or** $14x = 126$ **or** $x = 9$ **or** $(12 \times 9) + 18 = 126$ [1]
 C_9H_{18}
note: correct formula only = 1 [1]
- (b) (i) all hydrogen atoms 1bp [1]
 C—C bond atoms 1bp [1]
 C=C 2 bp [1]
- (ii) correct repeat unit [1]
 continuation [1]
- (iii) bonds broken [1]
 H-H +436 (kJ/mol) C=C +610 = +1046 (kJ/mol)
 bonds formed
 2C-H -415×2 kJ/mol C-C $-346 = -1176$ (kJ/mol) [1]
 -130 kJ/mol / more energy released than absorbe [1]
or:
 bonds broken
 3882 (kJ/mol) [1]
 bonds formed
 4012 (kJ/mol) [1]
 -130 kJ/mol / more energy released than absorbe [1]
allow: ecf for final mark as long as the answer is not positive
note: units not necessary
- (c) (i) butan-1-ol or butan-2-ol or butanol [1]
- (ii) $CH_3-CH_2-CH(Br)-CH_2Br$ [2]
 $C_4H_8Br_2 = 1$
note: any other dibromobutane = 0
- (iii) HI [1]

- 2 (a) (i) heat / roast / combustion / high temperature [1]
accept burn [1]
in air / oxygen [1]
any incorrect Chemistry MAX [1]
- (ii) $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$ [1]
OR $2\text{ZnO} + \text{C} \rightarrow 2\text{Zn} + \text{CO}_2$
the equation must balance, if not [0]
not carbon monoxide as a reactant /
- (iii) fractional [1]
distillation [1]
- (b) making alloys / brass / named alloy which contains zinc [1]
galvanising / sacrificial protection / electroplating [1]
accept galvanising / one specific use which depends on galvanising
zinc coated screws / roofing / buckets / sinks
not just plating other metals
- (ii) positive ions / cations [1]
not nuclei / atoms
- delocalised / free / mobile or sea of electrons [1]
bond is attraction between (positive) ions and delocalised electrons [1]
it is a good conductor because there are delocalised / free / mobile electrons [1]
Note must be clear that electrons are moving / carry charge / reason why it is a
good conductor

[Total: 11]

- 3 (a) (i) (concentration) of reactants/CO and Cl_2 increases [1]
 (concentration) of product decreases/ $COCl_2$ [1]
- (ii) (decrease in pressure favours side) [2]
 with more molecules **or** moles **or** side with bigger volume (of gas)
NB [2] or [0]
- (b) forward reaction is exothermic [1]
COND because it is favoured by low temperatures **or** cool [1]
ACCEPT argument re back reaction
- (c) hydrogen chloride **or** hydrochloric acid [1]
 carbon dioxide **or** carbonic acid **or** hydrogen carbonate [1]
- (d) 8e around both chlorine atoms [1]
 4e between carbon and oxygen atoms [1]
 8e around carbon atom [1]
 8e around oxygen [1]
 if a bond contains a line with no electrons, no marks for atoms joined by that line
 ignore keying

[Total: 12]

- 4 (a) (i) Burn sulphur in air (or oxygen) [1]
- (ii) as a bleach [1]
- (iii) kill bacteria/micro-organisms [1]
NOT prevents food going bad or rotten or decaying
- (b) (i) decrease [1]
- (ii) exothermic [1]
COND increase temperature favours back reaction so it is endothermic, so forward reaction must be exothermic [1]
OR any similar explanation will be awarded the mark, for example The forward reaction is not favoured by an increase in temperature so it is exothermic (rather than endothermic)
- (iii) Low enough for good yield [1]
High enough for (economic) rate [1]
Any similar explanation will be awarded the mark
NOT just that it is the optimum temperature
- (iv) bubble into (conc) sulphuric acid [1]
add water [1]
NOT consequential

[TOTAL = 10]

- 5 (a) (i) Correct equation [2]
 not balanced [1] ONLY
 $2\text{Pb}(\text{NO}_3)_2 = 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$
 $\text{Pb}(\text{NO}_3)_2 = \text{PbO} + 2\text{NO}_2 + \frac{1}{2}\text{O}_2$
- (ii) potassium nitrate → potassium nitrite + oxygen [1]
- (b) (i) close **or** tightly packed [1]
 ordered **or** lattice [1]
 vibrational [1]
 NOT forces
- (ii) melting **or** freezing **or** fusion **or** solidification [1]
- (c) (i) oxygen and nitrogen (in air) [1]
 react at high temperatures (and high pressure) [1]
 If nitrogen in fuel [0] out of [2]
- (ii) catalytic converter
 react with carbon monoxide **or** hydrocarbons
 form nitrogen
 ANY TWO [2]
- (d) Add excess lead oxide to nitric acid [1]
 can imply excess
 filter NOT if residue is lead nitrate [1]
 evaporate **or** heat solution [1]

TOTAL = 14

6	(a)	protons	2	
		electrons	2	
		neutrons	4	[3]
	(b)	(i)	$\text{La}^{3+} + 3\text{e}^- = \text{La}$	[1]
		(ii)	hydrogen	[1]
			bromine NOT Bromide	[1]
			caesium hydroxide	[1]
			ignore any comments about electrodes	
	(c)	metal hydroxide or hydroxide ions		[1]
		hydrogen		[1]
	(d)	correct formula 1Ba to 2Cl		
		charges correct		
		8e around the anion		
		All three points		[2]
		Two points ONLY	[1]	
		If covalent	[0] out [2]	
	(e)	alternating (positive and negative)		[1]
		pattern		[1]
	(f)	(i)	barium - oxygen or ionic	[1]
		(ii)	bond forming energy released/exothermic	[1]
			bond breaking energy taken in/endermomic	[1]
			more energy released	[1]

TOTAL = 17