

2850 Chemistry (Salters): Chemistry for Life

June 2004

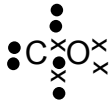
Mark Scheme

The following annotations may be used when marking:

X	=	incorrect response (errors may also be underlined)
^	=	omission mark
bod	=	benefit of the doubt (where professional judgement has been used)
ecf	=	error carried forward (in consequential marking)
con	=	contradiction (in cases where candidates contradict themselves in the same response)
sf	=	error in the number of significant figures

Abbreviations, annotations and conventions used in the Mark Scheme:

/	=	alternative and acceptable answers for the same marking
;	=	separates marking points
NOT	=	answers not worthy of credit
()	=	words which are not essential to gain credit
<u> </u> (underlining)	=	key words which <u>must</u> be used
ecf	=	allow error carried forward in consequential marking
AW	=	alternative wording
ora	=	or reverse argument

Question	Expected Answers	Marks
1 a i	${}^1_6\text{X}$ X 1 for each number	2
1 a ii	carbon	1
1 a iii	<i>two from:</i> higher temperature/heat/very hot/more energy available (1); higher pressure/more compressed (1); high gravity(1) not concn/density	2
1 b i	p: 7 (1); n: 6(1); e: 7(1) mark separately but ecf on protons.	3
1 b ii	electron (1) (or correct symbol)	1
1 b iii	${}^1_7\text{N} \rightarrow {}^0_{-1}\text{e} + {}^1_8\text{O}$ 3 for completely correct, otherwise: 1 for correct β particle; 1 for consistent symbol and atomic no (<u>except N</u>)	3
	short half-life/decays/doesn't last long enough.....(1)	1
1 d i	Dative/co-ordinate (1)	1
1 d ii	 6 electrons between atoms (1); correct electrons and <u>arrangement</u> between atoms (1); <u>one</u> lone pair/two electrons on each not between atoms (1)	3
1 d iii	Theory: electron pairs/groups/regions <u>around central</u> atom/carbon (1); Electrons repel (1); get as far away possible/minimize repulsion/energy (1); Application to OCS: two double bonds/regions of electron density (1); molecule/CO ₂ linear/bond angle 180 ⁰ (1); (diagram can scores both)	5
	Total	22

Question	Expected Answers	Marks
2 a	exothermic (1)	1
2 b i	$\text{CaO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(s)}$ (1) for correct state symbols	1
2 b ii	Elements box correctly filled as $\text{Ca(s)} + \text{O}_2\text{(g)} + \text{H}_2\text{(g)}$ elements (1) state symbols (1)	2
2b iii	$\Delta H_r = -\Delta H_f\text{CaO} - \Delta H_f\text{H}_2\text{O} + \Delta H_f\text{Ca(OH)}_2$ /correct figures used (+635 +286 -986) (1) ecf 2 nd mark on calculator Correct calculation leading to answer <u>on line</u> (with sign) -65 kJ mol^{-1} (1)	2
2 c	12/56 moles CaO (1) x 18 = 3.9 g water (1) 2 sf (1)(mark independently); { 3.9 or 3.8 (from $12/56 = 0.21$) scores 3}	3
2 d i	Stir(1); <u>Insulated</u> beaker/polystyrene cup/water jacket (1); Measure temperature rise/change /initial & final temperatures (1) ; Measure mass of solid/(known) amount/quantities (1) Measure volume/mass of water/(known) amount/quantities (1)	5
2 d ii	hard to ensure all water reacts with CaO before any Ca(OH)_2 dissolves/ difficulty in maintaining a standard temp./25 ^o C(1)	1
2 e i	Alkali(ne) (1)	1
2 e ii	test: named indicator/pH paper/pH meter (1); <u>Not</u> precipitates or react with acid. results: pH>7(pH meter)/ alkaline colour(dependent on indicator) (1)	2
2 f i	Calcium(hydroxide) more soluble/more soluble down group (1); (ora)	1
2 f ii	$\text{MgO} + 2\text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2\text{O}$ correct formulae (1); balanced (for 'sensible equation') (1)	2
		21

Question	Expected Answers	Marks
3 a i	A, B, D <i>other letters contradict correct answers(allow F)</i>	1
3 a ii	B and D	1
3 a iii	C	1
3 a iv	E	1
3 a v	F	1
3 b	2-methyl (1); pentane (1); ignore dashes,commas,spelling etc	2
3 c	entropy (1)	1
3 d i	(more)complete combustion/less incomplete combustion/O ₂ combines/converts more C to CO ₂ (1)	1
3 d ii	lower engine temperature/less energy to break bonds in reactants(1); less N ₂ -O ₂ reaction (1); OR more O ₂ and NO → NO ₂ (max 1)	2
3 e i	Catalyst in different <u>phase/state</u> from reactants (1); Two from: speeds up reaction; catalyst unchanged/not used up AW; Alternative reaction pathway/lowers activation enthalpy;	3
3 e ii	Two from: large surface area (1); reaction takes place on surface (1); Pt/it is expensive/the <u>thin layer</u> cuts down costs (1); allows Pt to heat up more quickly(1);	2
3 f i	<i>M_r</i> of heptane = 100 (1) <i>subsumed by correct final answer</i> 3/100 = 0.03 (mol) (1) ecf on <i>M_r</i>	2
3 f ii	15 mol (per mol of heptane) (1) <i>subsumed by correct answer</i> 0.03 x 15 (or 7 and 8 separately) = 0.45 mol s ⁻¹ (1) ecf on (i)	2
3 f iii	0.45 x 60 = 27 dm ³ s ⁻¹ (1) ecf on (ii)	1
	Total	21

Question	Expected Answers	Marks
4 a	Charged atom/group of atoms/molecule <u>or</u> atom/group of atoms/molecule that has lost <u>or</u> gained electron(s) NOT charged particle or specific ion(e.g. cation)	1
4 b	arrow going up (1) from a definite lower level to higher one (1)	2
4 c	arrow going down (1) (ignore positioning)	1
4 d i	Diagram showing drop to <u>different energy</u> levels(or in words) (1); Each set caused by a drop to a <u>specific</u> level(1)	2
4 d ii	Higher energy levels get closer/gaps becomes smaller (must state or label diagram) (1); Reference to frequency related to energy <u>gap</u> / $E = hu/f$ (1)	2
4 e i	Different <u>isotopes</u> (1); with different masses/numbers of neutrons (1)	2
4 e ii	Abundances/ratio/% of different isotopes/used to calculate A_r (1);	1
	Total	11

(Paper total 75)