F331

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>C, B, A, D</td><td>3</td><td>4 correct (3)
2 correct (2)
1 correct (1)</td></tr>
<tr><td></td><td>b</td><td>i</td><td><table><tr><th>sub-atomic particle</th><th>mass/amu</th><th>electrical charge</th></tr><tr><td>proton</td><td>1</td><td>+1</td></tr><tr><td>neutron</td><td>1</td><td>0/zero</td></tr><tr><td>electron</td><td>negligible</td><td>-1</td></tr></table></td><td>1</td><td>all correct (1)
must have - sign</td></tr>
<tr><td></td><td></td><td>ii</td><td>mass number is protons + neutrons / nucleons (1) ;
A_r is average / mean (1) ;
of (naturally occurring) isotopes (1) ;</td><td>3</td><td>allow cannot have fractional protons and neutrons
do not allow sub-atomic particles</td></tr>
<tr><td></td><td>c</td><td></td><td>$^{226}_{88}Ra \longrightarrow {}^{4}_{2}He + {}^{222}_{86}Rn$
Ra correct (1) ;
Alpha / He correct (1) ;
Rn correct (ecf on Z) (1) ;</td><td>3</td><td>If not alpha decay – zero
con 1 mark if numbers are on wrong side (any one)
con 1 mark if upper case used for second letter in symbol
allow – He on LHS; 2+ charge on He</td></tr>
<tr><td></td><td>d</td><td>i</td><td>any two from:
half life / decay constant has remained unchanged ;
no loss / gain of parent isotope / original radioisotope same age as rock ;
no loss / gain of daughter products/no daughter product at start ;</td><td>2</td><td>‘original rock contained the parent isotope but not the daughter isotope’ …..for this answer,
allow one mark for idea of assuming no presence of daughter product from an alternative source
allow no loss of gas
do not allow half life/mass must be known</td></tr>
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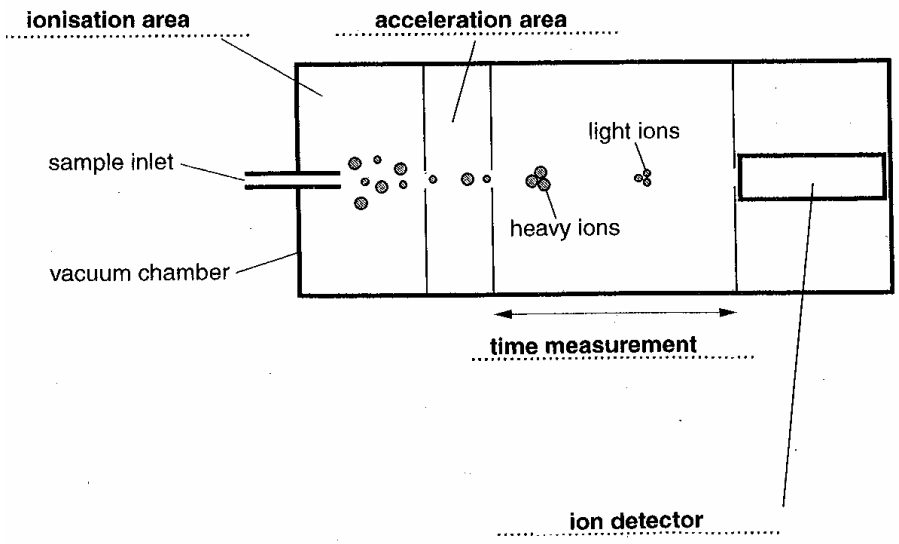
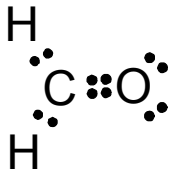
		ii		4	*one mark for each correct label;* ionisation area (1) **;** acceleration area (1) **;** ion detector (1) **;** time measurement (1) **;** **allow** paraphrases/shortened phrase eg detector
			Total	**16**	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	coloured / bright / rainbow / visible spectrum (background)(1) ; black <u>lines</u>(1) ; getting closer at higher frequency(1) ;	3	**do not allow** spectrum of light **allow** getting closer at shorter / smaller / lower wavelength ORA
		ii	black/dark background(1) ; coloured/bright <u>lines</u>(1) ;	2	**note:** check above before awarding on this part for ecf's e.g. **a (i)** may have got first two marking points wrong way round (zero) but answered this part as a reverse argument therefore scores two (effectively one mistake penalised in **a (i)**).
	b	i	 two lone pairs on oxygen (1) ; two crosses and two dots between C and O (1) ; dot and cross between <u>each</u> C and H (1) ;	3	must look like pairs too many electrons on C atom ***cons*** second mark **allow** other variations of dots/crosses eg squares/triangles etc. **note:** expected answer on left does **not** show difference clearly enough to score 2nd and 3rd marking points.
		ii	bond angle between 118 -122^0 (1) ; 3 sets (AW) of electrons (1) ; around C atom (1) ; repel as far as possible/minimise electronic energy / repulsion (1) ; planar/flat molecule (1) ;	5	Please tick marks awarded **allow** regions/areas of (high) of electron density **allow** reference to central atom **do not allow** atoms repel but **allow** bonds repel.... (already penalised on second marking point unless clear that bonds refer to pairs of electrons - in which case both points scored) **ignore** triangular / trigonal ***con*** pyramidal structure (diagram or words)
			Total	**13**	

Question			Expected Answers	Marks	Additional Guidance
3	a		*any **two** from:* sustainable/renewable **;** biodegradable **;** avoids wasting/using up fossil fuels **;** Less CO **;** carbon neutral/no net emission of CO_2 / AW **;**	**2**	**do not allow** any answers in terms of expense **do not allow** produces less pollution / no SO_2 / high octane number / less CO_2 / less global warming
	b	i	uses E=mc∆T (1) **;** 100 x 4.18 x 25= 10450J / 10500 (1) **;** ecf on values for m and ∆T	**2**	**note:** 1.2 x 4.18 x 25 = 125.4 scores (1) equation can be implied by correct working
		ii	**moles burnt** = mass / M_r = 1.20 / 46 = 0.026(ecf's) (1) **;** (answer must be correct for this mark) **energy given out per mole** = 10450 / 0.026 = 401.9kJmol^{-1} (1) **;** (400.58 if not rounded) **three sig figs** = 402kJmol^{-1} (1) **;** (401 if candidate does not round early) minus sign (1) **;**	**4**	ecf's carry through but examiners will need to check through working before deciding whether ecf marks can be awarded. for sig fig mark rounding must be correct from candidates answer sign - independent mark -401 scores all four marks
		iii	heat losses (to surroundings) (1) **;** *plus **one** more from:* incomplete combustion **;** heat loss to calorimeter **;** evaporation of fuel from wick **;** not standard conditions **;**	**2**	**do not allow** answers in terms of operator error unless describing heat loss

	c	**i**	bonds broken: C-C; C-H; C-O; (O-H) (1) **;** O=O (1) **;** bonds made: O-H; C=O (1) **;**	**3**	O-H bond as bond broken not required **allow** named references to bonds i.e. the O to O bond in oxygen **do not allow** C-O for a bond made **allow** CO bond/C triple bond O if referring to carbon monoxide
	c	**ii**	energy in / endothermic to break reactant bonds (1) **;** more energy given out / exothermic to form product bonds (1) **;**	**2**	**ignore** references to number of double bonds formed more bonds formed ***con*s** second mark **note:** second marking point now runs two marking points from previous mark schemes into one
	d		measures tendency / (AW), to autoignite / pre-ignite / knock (1) **;** high value means low auto ignition (1) **;** efficient / prevents damage to engine (1) **;**	**3**	first two marking points can come from one statement **do not allow** stops/prevents auto ignition or two explosions/sparks
			Total	**18**	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	F(1) ; G(1) ;	2	
		ii	appropriate skeletal part (1): ie 'R' group(s) ;	1	circle must cover all R group but **allow** starting or final C missed must not include C of ester group **do not allow** left side vertical carbons
		iii	Skeletal (1) ;	1	**allow** variable spelling as long as recognisable
		iv	$C_3H_8O_3$ (any order) (1) ;	1	extras ***con*** mark unless clearly working eg $3C_3H_8O_3$ scores zero
	b	i	volume = 19 x 24 = 456dm^3 (1) ;	1	
		ii	(O atom in structure allows) combustion more thorough / complete therefore carbon dioxide produced (1) ; QWC mark = any of combustion / combust(s) / oxidised / oxidized / oxidation CO is toxic / poisonous / correct description of why it is toxic (ora) (1) ; fuel more efficient (AW) (1) ;	3	**note:** QWC mark is **not** a separate marking point. Appropriate word has to be spelt correctly to score first mark. **do not allow** harmful/bad for you (too vague) acid rain and greenhouse gas ***con*** toxic mark **ignore** photochemical smog
	c	i	air / atmosphere ;	1	
		ii	$N_2(g) + O_2(g) \rightarrow 2NO(g)$ equation (1) ; state symbols (1) ;	2	**allow** multiples/halves state symbol mark independent as long as correct for species shown
		iii	need to break NN bond / NN bond / stable N_2 molecule very high bond enthalpy / high E_A / very strong(1) ;	1	**must** refer to nitrogen bond (or imply) **ignore** references to oxygen but ***con*** reference to other bond types
			Total	13	

Grade Thresholds

Advanced GCE Chemistry B (Salters) (H035/H435)
January 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
F331	Raw	60	46	41	36	32	28	0
	UMS	90	72	63	54	45	36	0

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.