GCSE MARKING SCHEME

SCIENCE - CHEMISTRY (LEGACY)

SUMMER 2012

INTRODUCTION

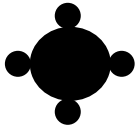
The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - CHEMISTRY (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Chemistry 1 (Legacy)

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)	(i)		1	reactants are converted into products	products made produce new materials	useful materials	
			(ii)		1	produce new / useful materials		make fuels, plastics etc.	
			(iii)	I	1	crude oil / metal ores			metals
				II	1	nitrogen	N_2	N	
			(iv)		1	**crude** oil			
		(b)	(i)		1	oxygen	O_2	oxide / O	
			(ii)		1	1			
			(iii)		1	7			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)			3	CaCl (1) MgO_2 (1) Li^+ (1)			
		(b)	(i)		1	more than one **type** of atom joined (both needed for mark)	different elements joined together		
			(ii)	I	1	hydrogen nitrogen (both needed)		H N	
				II	1				

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)			1	deodorant			
		(b)			1	anti-bacterial			
		(c)			1	1-100**nm**			
		(d)			1	**may** cause long term health problems/long-term effects unknown	named health problems	harmful	**will cause** cancer etc.

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)			2	respiration – C photosynthesis – A combustion – B all correct (2) any 1 correct (1)			
		(b)	(i)		1	650			
			(ii)		2	175 (1) **increased** burning of fossil fuels / deforestation (1)	more factories / industry / pollution		–175
			(iii)		1	increases			
			(iv)		1	global warming			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)			2	magnesium + hydrochloric acid (1) → magnesium chloride + hydrogen (1)			magnesium *ribbon* hydrogen *gas*
		(b)	(i)		1	**gas** syringe			
			(ii)		3	all points correct (2) 6 points correct (1) 5 or fewer correct (0) smooth curve through points (1) consequential, must go through (0,0)			
			(iii)		1	magnesium all used up		magnesium dissolved / melts	
6					3	coastlines (1) rocks (1) fossils (1)	 fossils rocks		

Question Number								
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	(a)			5	A – bottom of Group 1 B – bottom of Group 7 C – top of Group 0 D – 2nd in Group 7 E – 2nd in Group 2 (see below)			
		(b)			1	2, 8, 4 shown on diagram	**if no diagram** 2,8,4 written		
		(c)			1	add up the total number of electrons (in the structure)		number of protons	number of electrons in particular shell

																	C(1)
	E(1)												X			D(1)	
A(1)																B(1)	

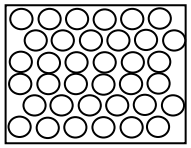
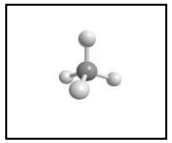
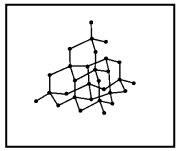
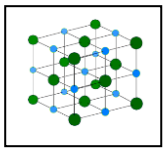
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	2	(a)	(i)		1	carbon and hydrogen (both needed)		C and H	
			(ii)	I	1	heated	vaporised/ turned into a gas /boiled		burned
				II	1	condensed / cool down			
			(iii)		1	**fractional** distillation			fractionation fractionating
			(iv)		2	smaller molecules (1) lower boiling point(1)		 different boiling points	
		(b)	(i)		1	increases			
			(ii)		1	crude oil is running out / finite resource more demand for petrol/crude oil		tax increases more cars	

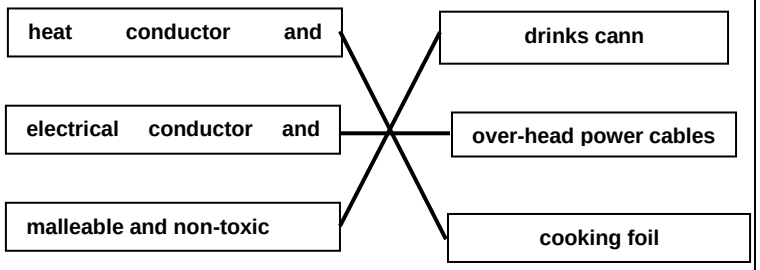
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	3	(a)	(i)		1	magnesium carbonate/magnesium	$MgCO_3$ / Mg		
			(ii)		1	carbon dioxide	CO_2		
			(iii)		1	sodium chloride	NaCl		
			(iv)		1	hydrogen	H_2		
			(v)		1	zinc oxide / zinc	ZnO / Zn		
		(b)			1	$Mg(OH)_2$	Mg^{2+} $(OH^-)_2$		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	(a)			1	Nazca and South American / Pacific and Eurasian			
		(b)			3	magma rises to fill gap (1) cools and solidifies / forms new rock (1) igneous rock / basalt (1)			
	5	(a)			1	study of particles between 1 and 100 nm in size	study of **very small** particles / nano particles		
		(b)			2	anti bacterial / viral / fungal (1) sterilising sprays / deodorants / in socks / in underwear / plasters / wound dressings (1)			reference to 'cleaning'
		(c)			1	may cause long-term health problems / long term effects unknown		reference to tracing in environment	**will cause** cancer etc.

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6				5	surface area / concentration / temperature (any 2 for 1 mark) explanation – 2 marks max for each factor *surface area* – greater surface area = more particles exposed / more chance of collision / faster rate (any 2 for 1 mark each) *concentration* – increased concentration = more particles in given volume / more chance of collision / faster rate (any 2 for 1 mark each) *temperature* – higher temperature = particles have more energy / move faster / more chance of collision / faster rate (any 2 for 1 mark each)	‘more chance of collision’ credited once only higher level answer in terms of activation energy	reference to catalyst more collisions	
	7	(a)	(i)		2	increases (1) but more rapidly as time goes on (1)	slow then rapid increase (2)		
			(ii)		1	increases	gets hotter		
			(iii)		1	more flooding / extreme weather / increased sea levels / ice caps melting more quickly			
		(b)	(i)		1	3234 – 42 = 3192 (1)			
			(ii)		2	3192 – 2(464) – 4(413) (1) = 612 (1) correct answer only - 2 marks	consequential marking		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)			3	lithium – floats and bubbles / moves slowly(1) sodium - melts into a ball / moves quicker(1) potassium - produces lilac flame / moves even faster(1) - 2 max if general e.g all three float/move/fizz			
		(b)			3	Na + H_2O (1) → NaOH + H_2 (1) balancing 2,2,2,1 (1)			
	9	(a)			1	insoluble solid formed when two solutions react (1)			
		(b)			2	A silver nitrate B sodium chloride C potassium iodide all 3 for 2 marks, any 1 for 1 mark			

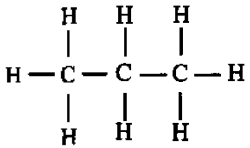
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)	(i)		1	**A**			
			(ii)		1	**C**			
		(b)	(i)		4	aluminium  (1) methane  (1) diamond  (1) sodium chloride  (1)			
			(ii)		1	sodium chloride	NaCl		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)	(i)		1	aluminium oxide / alumina	Al_2O_3		cryolite bauxite
			(ii)		1	cathode / negative (electrode)	– (minus sign)		
			(iii)		1	oxygen	O_2 carbon dioxide / CO_2	O	
		(b)			2	nearby power station (1) coastal position (1)			
		(c)			2	 all correct (2) any one correct (1)			

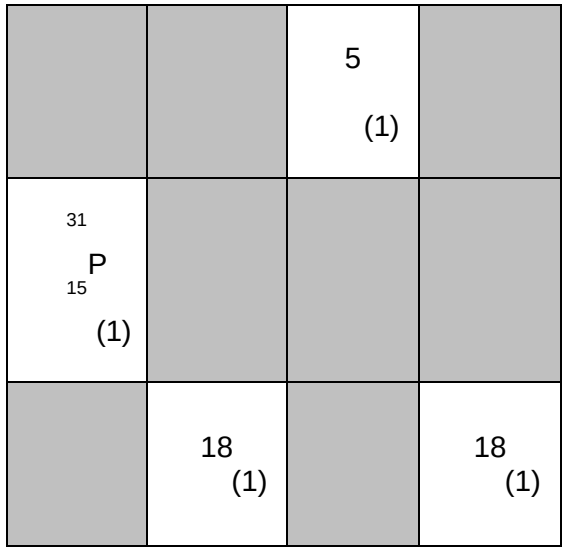
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)			1	nitrogen: atmosphere hydrogen: natural gas - both needed	air		
		(b)			2	reactants : nitrogen + hydrogen (1) product: ammonia (1)	N_2 + H_2 NH_3 (ignore balancing)	reference to N and H	 *liquid* ammonia
		(c)	(i)		1	forms a liquid / condenses	liquefies		
			(ii)		1	put back into the reactor/ recycled / put back into the reaction / used again			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)			1	thermochromic (materials)			
		(b)			1	hydrogels			
		(c)			1	shape memory alloys			
		(d)			1	photochromic (materials)			

Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
5		(a)			3	Must imply • all three give a lather (1) • Bangor gives more lather than Wrexham & Brecon (1) the harder the water, the less lather is formed (1)	bubbles /foam / froth / suds = lather	reference to 'scum'	No lather
		(b)			1	• 1 cm^3 soap solution / same amount of soap solution / same volume of soap solution • 10 cm^3 water / same amount of water / same volume of water • shaken for 10s / shaken for the same time • same size test tube • same temperature - any one			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
6									
		(a)	(i)		1				
			(ii)		1	12	C_5H_{12}		
		(b)			2	$(4\times12) + (10\times1)$ (1) = 58 (1) ***award 2 marks if correct answer given without any working***			
		(c)	(i)		2	• stronger / doesn't rip easily (1) • waterproof / water resistant (1) • non-biodegradable / doesn't rot (1) a***ny two from three marking points***	strong / stretches	durable/ flexible/ tougher lasts longer	light /harder easily coloured can be re-used
			(ii)		2	• lighter / less dense (1) • does not corrode (1)	does not rust/ low maintenance/ doesn't have to be painted	tough / can be recycled easily coloured / easily shaped	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	(a)	(i)		3	all points plotted correctly (2) any 4 plotted correctly (1) tolerance ± ½ square line of 'best fit' (1) ***drawn with a ruler*** ***judgement by eye***			
		(b)	(i)		1	65 ±1 ***i.e. anywhere from 64-66 ^{o}C***			
			(ii)		1	19 ±1 ***i.e. anywhere from 18-20 g per 100g of water***			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	2				4				

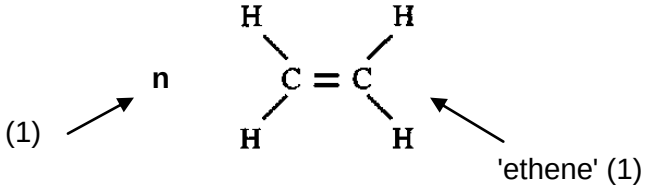
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	3	(a)	(i)		2	most reactive: **magnesium** **zinc** **copper** least reactive: **silver** all correct (2) any 2 correct (1)	Mg Zn Cu Ag		metal nitrates
			(ii)		2	reactants: copper + silver nitrate (1) products: silver + copper nitrate (1)	Cu + $AgNO_3$ Ag + $Cu(NO_3)_2$		
		(b)			2	***magnesium gains oxygen*** to form magnesium oxide - ***oxidation*** (1) **copper oxide** ***loses oxygen*** to form copper - ***reduction*** (1) no reference to specific reaction e.g. gaining oxygen is oxidation and losing oxygen is reduction - 1 mark			

Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	4	(a)			2	photochromic (1) darkens/changes colour (on exposure) to (sun)light (1)		Sun changes 'appearance'	
		(b)			2	thermochromic (1) changes colour with heat (1)		changes 'appearance'	

Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	5	(a)			4	• (add) equal volume of soap solution *(or 'add soap solution 1cm^3 at a time until a permanent lather is formed)* (1) • (use) equal volume of water sample (1) • shake for an equal number of times/ equal time (1) [add soap, shake to give lather (1) if none of the first three marks credited] • **C** has most lather and **A** least lather (*or **C** needs least soap and **A** needs most)* **comparative answer needed** (1)	equal amounts equal amounts 'shake equally'		
		(b)	(i)		1	• strengthens bones • strengthens teeth • reduces heart disease • does not dissolve lead from lead pipes		• healthier • better for you • tastes better • *good for* bones • *good for* teeth	
			(ii)		1	• limescale / scale / boiler scale / fur blocks kettles • limescale/ scale/ boiler scale / fur blocks boilers	• cost of water softener	• wastes money • wastes energy • wastes electricity / gas	reference to 'scum' and 'wasting soap'

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)	(i)		3	sodium atom loses 1 electron (1) fluorine atom gains 1 electron (1) *neutral atoms needed* *only one transferred electron allowed* Na^+ and F^- ions formed (1) *octet of electrons around F^- not needed* *discrete pair of ions needed for this mark*			
			(ii)		2	(four) **shared pair(s)** of electrons (1) **octet of electrons** around C atom (1)			
		(b)			2	bonding: covalent (1) structure: giant molecular (1)	giant covalent		'giant'

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)	(i)		1	20			
			(ii)	I	1	increases	goes up		
				II	1	decreases	goes down		
		(b)			2	(add warm) sodium hydroxide (solution) (1) damp (red) litmus paper turns blue or damp universal indicator turns blue / purple (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)	(i)		2	 ***ignore brackets around ethene***	C_2H_4		
			(ii)		1	addition			additional
			(iii)		1	• (it contains) a double bond / C=C bond • it is unsaturated		• it is an alkene	
		(b)			2	• softens on heating / loses its shape on heating (1) • no bonding between chains/ chains can slide over each other / weak forces between chains (1)	• diagram showing no links between chains	reference to melting / change of state tangled molecules chains	reference to layers

Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	9	(a)			2	$3e$ / $3e^-$ (1) $2O^{2-}$ (1)			
		(b)	(i)		3	$M_r(Al_2O_3) = 102$ (1) 2(102) form 4(27) **or** 204 forms 108 (1) 10.2 forms 5.4 (1) ***award 3 marks for correct answer if no working shown***	10.4/102 = 0.1 0.1 : 0.2 0.2 (27) = 5.4		
			(ii)		2	4.3/5.4 × 100(1) = 79.62 % (1) a*ccept values from 79.6-80%* ***award 2 marks for correct answer if no working shown*** ***- mark consequentially***			

CHEMISTRY 3 (Legacy)

Foundation Tier

Q.1	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	hydrogen	H_2		H
b	1	relights/rekindles		glows brighter	
c	1	yellow			

Q.2	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	(filter) funnel			
b	1	evaporation	vaporise		
c i	1	filtration			
ii	1	distillation		evaporation / method B	

Q.3	Mark	Answer	Accept	Neutral answer	Do not accept
a	2	making cement (1) the extraction of iron (1)			
b i	1	a reasonable correct diagram with the delivery tube going into the lime water inside test tube/beaker			
ii	1	goes milky/white/cloudy			
iii	2	calcium carbonate (1) calcium oxide + carbon dioxide (1)	$CaCO_3$ $CaO + CO_2$		limestone quicklime
c	2	benefit – creates wealth/more jobs – any one for 1 mark drawback – noise/dust/spoils the landscape – any one for 1 mark		pollution	

Q.4	Mark	Answer	Accept	Neutral answer	Do not accept
a	3	C_3H_8 (1) any number from -41 to 19 (1) gas (1)			
b i	1	heat			
ii	1	cover with damp cloth/fire proof mat / fire blanket	carbon dioxide	fire extinguisher – unless qualified	water/foam
c i I II III	1 1 1	**B** **E** **F**			
ii	1	C_2H_4			

Q.5	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	136.8 – 136.3 = 0.5 (g)			
b	2	same volume/amount/100 cm^3 of water same mass/amount/0.5 g of alcohols / fuels spirit burner the same distance from the beaker/water - any two for 1 mark each			
c	1	ethanol – the increase in temperature is more/greater - both needed for the mark	more heat given out	final temperature higher	
d	1	loss of heat/not all the heat transferred to the water /not properly insulated	not stirred/draft		

Q.6	Mark	Answer	Accept	Neutral answer	Do not accept
a	4	iron (II)/Fe^{2+} add sodium hydroxide – both needed for 1 mark green precipitate (1) iodide/I^- add silver nitrate – both needed for 1 mark yellow precipitate (1)			
b i	1	Na^+ and CO_3^{2-}- both needed for 1 mark		sodium and carbonate	
ii	1	Na_2CO_3			

Q.7	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	5-6	5/6		
ii	1	(weak) acid			strong acid
b	1	sulphuric acid is **stronger** than ethanoic acid / pH of 0-2 is a stronger acid than a pH of 3-4 any one for 1 mark		sulphuric acid is a strong acid	
c	2	pH value would increase/go up (1) purple (1)	 navy blue		 green / blue

Q.8	Mark	Answer	Accept	Neutral answer
a	1	fermentation		
b	1	liver or kidney damage/vitamin deficiency/heart disease/ memory loss/depression/stomach disorders / cancer / brain damage / high blood pressure		
c	1	violent behaviour/driving accidents/ anti-social behaviour		

Q9	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	oxygen	O_2	air	O
ii	2	sulphur dioxide + oxygen (1) sulphur trioxide (1)	$SO_2 + O_2$ SO_3		
iii	1	increase the speed/reduce the time of the reaction			
iv	1	exothermic			
b i	1	hydrogen and oxygen both needed		H_2/H/O_2/O	
ii	1	corrosive	burns your skin	harmful / irritant	

CHEMISTRY 3 (Legacy)

Higher Tier

Q.1	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	5-6	5/6		
ii	1	(weak) acid	acid		strong acid
b	1	sulphuric acid is **stronger** than ethanoic acid / pH of 0-2 is a stronger acid than a pH of 3-4 any one for 1 mark		sulphuric acid is a strong acid	
c	2	pH value would increase/go up (1) purple (1)	 navy blue		 green /blue

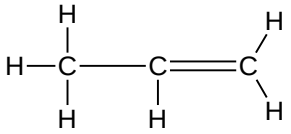
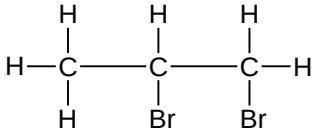
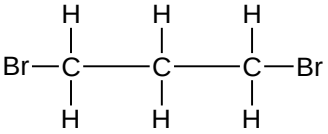
Q2	Mark	Answer	Accept	Neutral answer
a	1	fermentation		
b	1	liver or kidney damage/vitamin deficiency/heart disease/ memory loss/depression/stomach disorders / cancer / brain damage / high blood pressure		
c	1	violent behaviour/driving accidents/ anti-social behaviour		

Q3	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	oxygen	O_2		O
ii	2	sulphur dioxide + oxygen (1) sulphur trioxide (1)	$SO_2 + O_2$ SO_3		
iii	1	increase the speed/reduce the time of the reaction			
iv	1	exothermic			
b i	1	hydrogen and oxygen - both needed		H_2/H/O_2/O	
ii	1	corrosive	burns your skin	harmful / irritant	
c	1	lighted splint/flame gives a ‘pop’ noise			

Q4	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	to record temperature of vapour (rather than liquid below)			
b	1	(liebig) condenser			
c	1	ethanol – **lower** boiling point – both needed for 1 mark		boils/evaporates first	
d	1	distillation	fractional distillation		

Q5	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	C_3H_8			
b	1	**A/F**			
c i	1	**B**	C_2H_4/ethene		
ii	1	**C**	C_2H_5OH		
iii	1	**B**	C_2H_4/ethene		

Q6	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	calcium carbonate – **highest** decomposing temperature/needs the most heat to decompose			
ii	3	heating (1) collecting – delivery tube, teat pipette, gas jar (1) lime water goes milky/white/cloudy (1)			
b i	1	production of iron/steel, road making, making cement, neutralise soil acidity, glass production, statues – any one for 1 mark			
ii	1	neutralise acidic (soils)			
iii	1	slaked lime	lime water		

Q7	Mark	Answer	Accept	Neutral answer	Do not accept
a	1				
b	2	bromine to propane - no change/bromine colour remains/solution stays yellow or orange (1) bromine to propene – solution becomes colourless/decolourises (1)			
c	2	$C_3H_6Br_2$ (1)  (1)			

Q8	Mark	Answer	Accept	Neutral answer	Do not accept
a	2	(muddy) green precipitate (1) iron**(II)** hydroxide (1)	$Fe(OH)_2$		iron hydroxide
b	3	$FeCl_2$ + NaOH (1) $Fe(OH)_2$ + NaCl (1) correct balancing (1)			
c	1	white precipitate			

Q9	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	$\frac{20.00 + 20.05 + 19.95}{3} = 20.0$ (1)			
b	1	pipette/ burette		measuring cylinder unless qualified (e.g. 25 cm^3)	
c	2	$0.2 \times \frac{25}{1000}$ (1) = 0.005 (2) – 2 marks for correct answer			
d	1	0.005	consequential marking		
e	2	conc $\times \frac{20.0}{1000} = 0.005$ (1) conc = 0.25 (1) - 2 marks for correct answer	consequential marking		

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