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for the guidance of teachers

9701 CHEMISTRY

9701/52

Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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G		CE AS/A LEVEL – May/June 2012	9701
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Question	Sections	Indicative mate	rial MA

Question	Sections	Indicative material	mbri
1 (a)	PLAN Problem	(i) & (ii) States the moles of product increase (as the moles on ammonium nitrate (V)/reactant increases) and the x-axis is labelled moles ammonium nitrate (V)/reactant.	109
		Accept proportional or directly proportional for increase. In (ii) it has to be clearly stated that both products are increasing with the increase in ammonium nitrate moles.	
		There are a 1:1 & 1:3 ratios correctly given either in text or in the graph. No curves or plateaus	[1]
		Two lines starting at the origin with moles on the <i>y</i> -axis are correctly labelled with temperature or gas identity and the higher temperature line has a slope greater than that of the other line. No curves or plateaus.	[1]
(b)	PLAN Broblom	(i) moles of ammonium nitrate.	
	FIODIeIII	(ii) moles of nitrogen(I) oxide.	[2]
		Accept mass/weight of ammonium nitrate and volume of nitrogen(I) oxide together for one mark.	
(c)	PLAN Method	A diagram which shows a heated (closed but with an output tube) piece of apparatus. No water baths or hot plates	[1]
		Showing a condenser and collector for water (e.g. cooled (ice) U-tube) connected to the ammonium nitrate apparatus. If a gas collector is after this piece then the water collector must be gas tight. If no gas collection is attempted after the water condenser then it must be open to air. Allow a Liebig condenser provided it fulfils the same conditions as stated above.	[1]
		Showing a calibrated collecting device accept label syringe/ burette/measuring cylinder as equal to calibrated. To be labelled with size (minimum 10 cm ³). To be in train after the water condenser – if a condenser not present – then connected to the heating apparatus.	[1]

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d) PLAN Method	At least five experiments. May be in table counts as 5 experiments). States intended gas volumes. The range t from x cm ³ to 3 times x cm ³ where x > = 1 volume does not exceed collector capacity A correct calculation for a mass of ammon produce one of the gas volumes above. O stated mass. This calculation is not restric the gas collector.	(Five+ rows in the table to run as a minimum 0 cm ³ and maximum y. hium nitrate that will br a volume from a ted to the capacity of	(1)
	Stopping at a constant volume of gas (not solid disappeared/syringe plunger stops most a deduction as – all decorgas.	constant mass)/ all noving. Must be an nposed or no more	[1]
e) PLAN Method	Identification of ammonium nitrate as oxid NH ₄ NO ₃ combustible) from the hazcard in suitable precaution – keeping away from o wear (chemical) resistant gloves. Accept h resistant gloves/tongs.	ising or explosive (Not formation and giving a combustible material / not apparatus with heat	[1]
f) PLAN Method	Four columns are required. mass/weight (not amount) of ammonium r nitrogen(I) oxide (/cm ³) (/dm ³); number of nitrate (no unit); number of moles of nitrog The full word for the unit can be used with Four fully correct, two marks; three correct zero.	hitrate (/g); volume of moles of ammonium jen(I) oxide (no unit). or without / or (). t, one mark; otherwise	[2]

Page	4	Mark Scheme: Teachers' version	Syllabus	er
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(a)	ACE Data	The required two column headings PV and then 1/V and (1/B) and /cm ⁻³ are fully corre- the unit can be used with or without / or (). column headings are required. Can accep unit only e.g. 3.05 data as /10 ³ kPacm ³ or data in standard form. Both columns are fully completed to the co	d (A × B) and /kPacm ect. The full word for . All 3 features of the ot standard form in the (10 ³ kPacm ³). Allow	[1]
		significant figures and all the calculations i correct, (allow two errors).	in each column are	
(b)	ACE Data	Check for a slightly downward sloping con straight/horizontal lines. Ignore the line be after the last point.	ntinuous curve. No fore the first point and	[1]
(c)	ACE Data	Label the <i>x</i> -axis pressure and the <i>y</i> -axis 1 column headings or unambiguous descrip unit in the correct form (/ or ()). The axes r the plotted points must cover at least half directions and all points must be on the give required on both scales.	/volume. Labels can be tions with the correct must be scaled so that the grid in both ven grid. A true origin is	[1]
		This mark not available for other plots. marks for inverted plots.	Allow subsequent	
		First check any outlying points then check 5, 7, 9 & 10. All 10 points present.	the plotting of points 1,	[1]'
		Line/curve starting at the origin, accept be origin to point 5 (170 kPa) then curving to points. Due to differences in plotting, the s further and remain correct provided it term provided it is the line of best fit.	ing straight up from the include the remaining 4 straight line may extend ninates in a curve and	[1]'
(d)	ACE	These marks not available for other plo	ots.	
		All the anomalous points are circled on the unambiguously stated in the text. (Selection this mark.) (max 5 anomolies)	e grid or ons on the line negate	[1]
		An appropriate explanation gains one mar low). Volume measured at a lower temper low 1/V, accept higher temperature.	k. Point 7 (1/V high, V ature. For a misplot of	[1]

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	Page 5		Mark Scheme: Teachers' version Syllabus	er	
		G	GCE AS/A LEVEL – May/June 2012 9701		
2	(e)	ACE Data	Two pairs of construction lines on the graph drawn from the line in the initial straight section to the axes and correctly deduces the values of these two intercepts. If the true origin has been used in calculating the slope then only one pair of lines and one intercept is necessary.	ambrio	
			These construction lines must be in the initial straight section of the plot into the origin and would normally not exceed 170 kPa on x. If the actual plotting and straight line of the candidate exceeds this point a construction that is in the straight line section is correct. No construction lines into curved sections can be used. If the initial straight line is produced onwards then any intercept more than 170 kPa is correct.		
		Allow data from points on the plotted line to be used provided there is some indication on the plot that the point has been used in slope calculation. If the candidate has drawn a straight line rather than a curve then the construction may be anywhere along the line provided the line is drawn into the origin. Do not allow gradients on tangents to a curve unless the curve is at the origin or at $x = 0$ or $y = 0$.			
			A correctly calculated value of the slope using the candidate's figures. Check the candidate's calculation and correct rounding. The mark is for the magnitude (ignore units). If the candidate used the true origin in the slope calculation then two zeros are not needed in the calculation. Value of slope is around $2.8-2.9 \times 10^{-4}$.		
			If the slope expression is inverted, then the calculation mark is lost but the intercept value mark can be gained.		
	(f)	ACE Conclusion	These marks not available for other plots. This must relate to the initial shape of their plot.		
			(i) The 'law' is justified.		
			AND		
			(ii) In the (initial section of the plot/at lower pressure) the data produce a straight line from the origin.	[1]	
			(iii) The graph is a curve or not a straight line. Or the graph has a variable gradient.	[1]	
			The best way to verify a relationship is by way of a straight line plot (not a curve).	[1]	

er	Syllabus	Mark Scheme: Teachers' version	3 	Page 6
C.	9/01	JOE AJ/A LEVEL - May/Julie 2012		
mbridg	s. Treat these points	These marks not available for other p as the same question	ACE Evaluation	(g)
[1]	constant gradient. ideally or (an area)	(i) This is the area of linearity/straight line Accept (at low pressures) the gas behave where Boyle's law is obeyed.		
[1]	e value of 1/k.	(ii) It is the 1/proportionality constant. It's		
		(* is mark available for other plots)		