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GCE

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Chemistry (8080, 9080)

6243/02

Summer 2005

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Mark Scheme (Results)

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1. (a) (i) NH_4^+:

Test – **Warm** with (aqueous) sodium hydroxide /potassium hydroxide / calcium hydroxide **(1)**
ACCEPT name or formula

Observation – **Gas produced / NH_3** turns (damp) red litmus paper blue
Alternative named indicator paper and colour change acceptable NOT 'pH paper'.

OR
Gas produced / NH_3 with conc. HCl produces white fumes/ smoke
This mark depends on alkali being used **(1)**

K^+: **(1)**
Test – Flame Test **(4 marks)**
(1)
Observation – Lilac / purple / mauve (flame) *NOT* pink

(ii) (Precipitate is) barium sulphate/$BaSO_4$ **(1)**
(Therefore D contains) sulphate/SO_4^{2-} *NOT* SO_4^- **(1)**
ALLOW HSO_4^- **(2 marks)**

(b) Add silver nitrate (solution) **(1)**
Followed by **concentrated** ammonia (solution) **(1)**
If (cream) precipitate which dissolves on addition of concentrated NH_3, then KBr present **(1)**

Q If (yellow) precipitate which remains on addition of concentrated NH_3, then
W KI present **(1)**
C

OR **(1)**
Add silver nitrate (solution) **(1)**
Followed by dilute ammonia / ammonia (solution) **(1)**
Cream ppt remains shows Br^- **(1)**
Yellow ppt remains shows I

If NaOH is added and then neutralised or acidified with nitric acid, then no penalty.
If NaOH is added and do not neutralise, or any acid other than nitric is used, then lose 1st mark provided silver compound has been used.

If any other silver compound, or silver ions are used, then 2nd , 3rd and 4th marks can score.

No silver mentioned **(0)**

OR
Add chlorine water/sodium chlorate(I) *OR* bromine water *OR* suitable oxidising agent **(1)**
Named immiscible organic solvent **(1)**
Orange / yellow / brown colour shows KBr **(1)**
Purple/violet colour shows KI **(1)**

OR
Add chlorine water/sodium chlorate(I) *OR* bromine water *OR* suitable oxidising agent **(1)**
Add starch **(1)**
No colour change shows Br^- **(1)**
blue/black shows I^- **(1)**

OR
Add (aqueous) lead nitrate or ethanoate **(1)**
If ppt white then Br^- contaminant **(1)**
If pale yellow the I^- contaminant **(1)**
PbI_2 is yellow $PbBr_2$ is not **(1)** **(4 marks)**

Reference to bromine or iodine instead of ions loses one mark.

Total 10 marks

2 (a) (i) Points accurately plotted **(1)**

Two straight lines of best fit. **(1)**
NOT dot-to-dot, IGNORE any other joining – up. **(2 marks)**

(ii) Suitable extrapolation to find maximum temperature rise at 3½ min **(1)**

Value from candidate's graph ± 0.5 °C **(1)**
(43.5-44.5°C for accurate plot) **(2 marks)**

(iii) (The best fit line) allows for cooling effect
OR heat loss
OR calculation of more accurate temperature **change**
OR response time of the thermometer
OR slowness of reaction
NOT "more accurate" *on its own* **(1 mark)**

(b) (i) Heat change = 50 x 4.18 x ΔT (= 9196J or 9.196kJ)
Consequential on (a)(ii)
If no units given, assume J
If kJ must be correct value
Wrong units eg kJ mol^{-1} **(0)**
IGNORE SF or sign **(1 mark)**

(ii) Density = 1g cm^{-3} / total volume after reaction 50 cm^3/total mass is 50g.
ACCEPT 1g = 1cm^3
ACCEPT Density is same as that for water
ACCEPT Heat capacity of metal is irrelevant **(1 mark)**
NOT density = 1

(iii) (1.0x 50 / 1000) = 0.05(0) (mol) **(1 mark)**

(iv) <u>answer to (b)(i)</u>
answer to (b)(iii) **(1)**

divide by 1000, value, negative sign (for units of kJ mol^{-1}). **(1)**

ALLOW answer in J mol^{-1} if unit given.
IGNORE SF. **(2 marks)**

(c) *Improvement is a stand alone mark, reason is not*
Any two from:

Q
W Improvement: Place a lid on the polystyrene cup **(1)**
C Reason: Reduces heat loss **(1)**

Improvement: Use a pipette or burette (to measure the volume of solution) **(1)**
Reason: More accurate (way of measuring volume) **(1)**

Improvement: Use more precise thermometer / digital thermometer **(1)**
Reason: Gives more accurate temperature **change** **(1)**

Improvement: Mechanical stirrer/magnetic stirrer **(1)**
Reason: to ensure complete/or faster reaction
NOT 'spread heat…' **(1)**

Improvement: Measure temperature more often
Reason: Allows for better extrapolation **(1)**
OR can obtain a more accurate value of maximum temperature / temperature change from graph

NOT repeating a few times
NOT "cotton wool insulation" *alone*
NOT more accurate weighing. **(4 marks)**

Total 14 marks

3 (a) Upper layer - *must attempt a reason to get this mark* **(1)**
Can be shown on a diagram

The organic product has a lower density than water (or than 1 g cm^{-3})/ has density of 0.84 (g cm^{-3}) **(1)**

(2 marks)

If three layers correctly argued from data then **(1 out of 2)**

(b) (i) Carbon dioxide / CO_2
If name and formula given, both must be correct **(1 mark)**

(ii) H^+ / H_3O^+ **(1 mark)**

(c) (i) Bunsen burner should not be used (to heat flammable substances) OR electrical heater /water bath / oil bath should be used **(1)**
Use anti-bumping granules **(1)**
System is sealed *OR* no outlet for gases *OR* no vent **(1)**
Water flow in and out of jacket is wrong way round **(1)**
NOT No thermometer adaptor **Max**
NOT use cylinder / beaker **(3 marks)**
NOT do it in a fume cupboard

(ii) 51 (°C) **(1 mark)**

(d) (i) $\frac{92.5}{74.0} \times 8.00$ **(1)**

= 10.0 (g) - *ALLOW for rounding errors* **(1)** **(2 marks)**
IGNORE SF

(ii) $\frac{6.99}{\text{ans (i)}} \times 100 = 69.9$ / 70% **(1 mark)**

(e) **Reagent:** $PCl_5/SOCl_2$ **(1)**
Result: No steamy/misty/cloudy/fumes/no gas which turns blue litmus paper red **(1)**
ALLOW steamy white *NOT* "white" on its own
If PCl_3, or PCl_5 solution is used then **(0)**

OR
Reagent: Na **(1)**
Result: no bubbles/no effervescence **(1)**

Names or formulae can be given for reagents
Results may be given either as negative tests or in the form "if 2-methylpropan-2-ol were present, there would be steamy fumes" **(2 marks)**
MUST be a chemical test (NOT boiling point check)]

Total 13 marks

4. (a) Keep the test tube at the same height/keep the test tube in the same position / keep Bunsen in the same position, but not 'fixed' on its own **(1)**

Keep the Bunsen flame unaltered/use the same flame/always use roaring flame. **(1)** **(2 marks)**

(b) Molar masses 84 and 197 **(1)**

$\frac{0.21}{84}$ = 0.0025 (moles) **(1)**

197 x 0.0025 = 0.493 (g) **(1)**

IGNORE SF

Correct answer with some recognisable working (3)

Answer with no working (1) **(3 marks)**

(c) (i) (0.0025) x 24 000 = 60 cm^3 / 0.06(0) dm^3 **(1)** **-** *mark is for × 24000 OR × 24 if dm^3*

Value which must have correct units **(1)**

IGNORE SF **(2 marks)**

(ii)

$\left\{ \frac{0.02}{0.21} \times 100 = \right\}$ 9.5% OR 9.52%

If √2 used 6.73 / 6.7 %

IGNORE SF **(1 mark)**

(d) (i) To allow for expansion (of air) OR to show that $BaCO_3$ does not decompose

NOT "to make it a fair test" **(1 mark)**

NOT 'as a control'

(ii) **TEST:** (Bubble gas into) limewater **(1)**

RESULT: (Limewater) turns milky / cloudy/white ppt **(1)** **(2 marks)**

(iii) Volume of gas decreases down the group

OR

rate of gas production slower down group **(1)**

The carbonates become more stable down a group (to heat) (stand alone) **(1)** **(2 marks)**

Total 13 marks

TOTAL FOR PAPER:50 MARKS