

GCE

Edexcel GCE

Chemistry (Nuffield) (8086, 9086)

6251/01

Summer 2005

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Mark Scheme (Results)

SECTION A

1 (a) Any two

(Misty) steam / water droplets / condensation (on upper part of the test tube) (1)

NOT water vapour

NOT white gas

Brown gas / fumes / vapour evolved (1)

NOT NO₂ evolved

NOT fizzing

Crystals dissolve (in their own water of crystallisation) /melt /liquefy/ form a solution (1)

NOT crystals decompose/ get smaller/disappear

Forms a white solid (1)

(2 marks)

(b) Name (1)

Test (1) - *is dependent on correct material*

e.g.

Water / Steam / H₂O (1)

(Anhydrous) CuSO₄(s) - (white) to blue

OR

CoCl₂(paper) - (blue) to pink/purple (1)

NOT damp CoCl₂(paper)

OR

Nitrogen dioxide / Nitrogen(IV) oxide / NO₂ (1)

(moist) litmus/pH paper turns to red/orange/pink (1)

NOT pH meter

IF nitric acid, allow test with pH paper for 1(out of 2)

OR

Oxygen / O₂ (1)

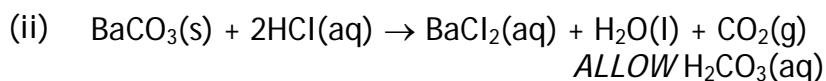
glowing splint (re)kindles (1)

(2 marks)

- 4 (a) (i) Protons = 19 and electrons = 19 (1)
 neutrons = 20 (1)
ACCEPT as words or numbers (2 marks)
- (ii) $1s^2 2s^2 2p^6 3s^2 3p^6 (3d^0) 4s^1$
ALLOW subscripts
MUST be in this order (1 mark)
- (b) (i) $MnO_4^{(1)-}$ (1 mark)
- (ii) **Purple /violet / mauve / lilac / pink** colour has moved towards/
 is at the positive / left-hand electrode / anode
If purple colour associated with K^+ (0) (1 mark)
- (iii) **Blue** colour moves towards the negative / right-hand electrode
 /cathode (1)
 The Cu^{2+} /positive copper ion (is blue) (and is attracted to it) (1)
ALLOW:
 Red/brown **deposit** forms on cathode (1)
 $Cu^{2+} + 2e^{(-)} \rightarrow Cu$ or in words (1)
OR
 Effervescence at anode (1)
 $4OH^- - 4e^{(-)} \rightarrow 2H_2O + O_2$, *or in words* (1) (2 marks)

Total 7 marks

- 5 (a) (i) Coal (mine)/coke/charcoal/graphite (1 mark)
- (ii) Oxygen loss/gain argument
 It removes the oxygen from the BaSO₄
OR the barium sulphide / BaS has lost oxygen
OR carbon has gained oxygen
NOT S has lost oxygen
- OR*
oxidation number argument
 O.N. of sulphur decreases (from (+)6 to -2)
OR
 O.N. of carbon increases (from 0 to (+) 2)
If oxidation numbers given, they must be correct
- OR*
OILRIG argument is acceptable if backed up with relevant chemistry ie "carbon loses electrons" is not enough (1 mark)
- (b) BaS(s) + CO₂(g) + 1½O₂(g) → BaCO₃(s) + SO₂(g) (1 mark)
Any correct multiple
- (c) Any one
- Barium compounds are toxic / poisonous (1)
OR
 CO is toxic/poisonous (1)
 SO₂ is responsible for "acid rain" (1)
IGNORE reference to global warming / ozone layer
Use of the word "harmful" is not enough UNLESS qualified (1 mark)
- (d) (i) Filter (1)
- Evaporate some of the filtrate by **boiling / heating** (1)
- Leave to crystallise / cool (collect crystals) (1)
- Dry between sheets of filter paper / blotting / dessicator / warm oven (1)
NOT "dabbing" / "patting" on its own
NOT "hot oven"
NOT "oven"
If temperature quoted, must be < 70 °C
- Stages must be in correct order.*
Mark until procedure fails
Can score remaining 3 marks even if initial filtration has not been carried out (4 marks)



balanced equation (1)

state symbols (1)

*BaCl₂.2H₂O(aq/s) acceptable, providing extra H₂O(l) on left
ALLOW 2nd mark provided a sensible but unbalanced equation is given.*

(2 marks)

(iii) moles of HCl used =

$$((25/1000) \times 1.0)$$

$$= 0.025 / 2.5 \times 10^{-2}$$

IGNORE units

(1 mark)

(iv) $M_r [\text{BaCl}_2 \cdot 2\text{H}_2\text{O}(\text{s})] = 137 + 71 + 36$
 $= 244 \text{ (g mol}^{-1}\text{)}$

(1 mark)

(v) Moles of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O} = 0.5 \times 0.025 = 0.0125$
Mass of crystals = $0.0125 \times 244 = 3.05 / 3.1 \text{ (g)}$
*IGNORE units
ALLOW transferred error from (ii), (iii) and (iv)*

(1 mark)

(vi) **Any one**

BaCl_2 lost in the (saturated) filtrate when crystals collected
/OWTTE (1)

Transfer loss/ OWTTE (1)

Loss when washing (1)

*NOT incomplete reaction/ inaccurate measurement of materials /
spillage on its own BUT neutral otherwise*

(1 mark)

(e) (i) (Apple) green / yellow-green *NOT* yellow

(1 mark)

(ii) Pt/nichrome (wire)/ceramic rod / spatula
NOT nickel / chromium wire
NOT wire of indeterminate material

(1 mark)

Total 16 marks

- 6 (a) Carbon atom joined to the hydroxyl / "hydroxide" / functional group is attached to two other carbon atoms / alkyl groups

OR

Carbon atom joined to OH group is attached to (only) one hydrogen atom / alcohol contains a -CH(OH) group

IGNORE use of "molecule" rather than "atom"

(1 mark)

- (b) (i) But(-)1(-)ene IGNORE punctuation

NOT butan-1-ene / butene

(1 mark)

- (ii) Aluminium oxide/alumina/porcelain/pumice / Al_2O_3

ALLOW correct name with wrong formula

If formula given on its own must be correct

(1 mark)

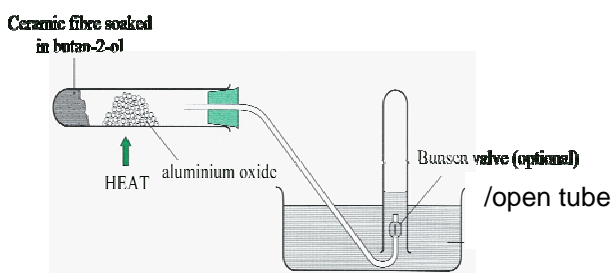
- (iii) Elimination / dehydration

NOT catalytic cracking

If more than one answer given both must be correct.

(1 mark)

- (iv)



Ceramic fibre / glass/mineral/cotton wool soaked in butan-2-ol (1)
NOT wire wool

Aluminium oxide / pumice / catalyst / solid X etc in correct position in tube (1)

- These must be in the correct order in the tube

Heat directed at solid - must be under some of solid (1)

- heat can be shown as just an arrow

Collection over water (1) - water does not need to be labelled

ALLOW non-cross sectional diagrams

IGNORE open tube following Bunsen valve, providing gas can be collected

If LHS is incorrect collection mark can still be awarded.

penalties -1

poor diagram (e.g. apparatus will not work / delivery tube passing through side of test-tube or trough / single line used for tubing

(4 marks)

- (v) $\text{CH}_3\text{CH} (=) \text{CHCH}_3$
 Allow *cis* or *trans* versions
 Allow *displayed formulae* (1 mark)
- (c) (i) **Any two**
- Effervescence/ fizzing / bubbling (1)
 NOT gas given off
 NOT white fumes
- Sodium disappears / moves about on surface / "dissolves" (1)
 NOT floats on surface
- Mixture becomes warm (1)
 NOT heat given off / exothermic
- White solid/ppt formed (1)
 NOT solid/ppt *on its own* (2 marks)
- (ii) $\text{C}_4\text{H}_9\text{O}^{\ominus}\text{Na}^{\oplus}$
 MUST be molecular
 Atoms can be given in any order
 Wrong charges (0) (1 mark)
- (d) (i) $\text{CH}_3\text{COCH}_2\text{CH}_3$ OR $\text{CH}_3\text{COC}_2\text{H}_5$ OR $\text{CH}_3\text{-CO-CH}_2\text{-CH}_3$ OR $\text{CH}_3\text{C=OCH}_2\text{CH}_3$
 OR

$$\begin{array}{c} \text{CH}_3\text{CCH}_2\text{CH}_3 \\ || \\ \text{O} \end{array}$$
- Butanone / butan-2-one (1) NOT but-2-one
 Mark independently (2 marks)
- (ii) (Mixture remains) blue
 No mark for "nothing happens"
 ALLOW TE from (i) providing $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ and butanal: green / brown / yellow / orange / red (ppt) (1 mark)
- (e) *N.B. we are looking for a precaution, not the associated hazard*
Any one
- Keep away from flames
 Use in a well-ventilated area
 ACCEPT carry out in a fume cupboard
- NOT precaution which applies generally e.g. wear gloves/goggles
 NOT wear a gas mask *on its own*, BUT otherwise neutral (1 mark)

Total 16 marks

- 7 (a) $\text{Ca}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{Ca}^{(2+)}\text{CO}_3^{(2-)}(\text{s})$
left-hand side (1)
right-hand (1)
BUT if all formulae correct (including charges) but missing/wrong state symbols 1 max (2 marks)
- (b) (i) (Energy = $100 \times 4.2 \times 1.5 =$) (+) 630 (J)
NOT - 630 (J) (1 mark)
- (ii) Quantity of $\text{CaCl}_2 = (50/1000) \times 1.00$
= 0.05 mol (1 mark)
- (iii) $\Delta H = \frac{(630/0.05)}{1000} = + 13 \text{ kJ mol}^{-1}$ [2 SF]
answer (i) \div (ii) (1)
sign, units and 2 SF (1)

2nd mark dependent on 1st unless clear method given
Answer can be calculated in J mol^{-1}
+ 13 kJ mol^{-1} *with no working* (2) (2 marks)
+ 13 000 J mol^{-1} *with no working* (2)
- (iv) Temperature, since ΔT is so small (and therefore leads to relatively large % error) / thermometer has limited accuracy
Heat loss / gain not sufficient (1 mark)
- (v) Thermos flask / (expanded) polystyrene/plastic cup / a beaker contained in a larger one lagged with cotton wool
OR
Calorimeter (unqualified) (0) *BUT "with cotton wool" / insulated/lagged etc gets* (1) (1 mark)
- (c) 1.5 °C / no change (1 mark)

Total 9 marks

TOTAL FOR PAPER 60