AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.3.5 USE OF AMOUNT OF SUBSTANCE IN RELATION TO VOLUMES OF GASES

SCORE	PERCENTAGE
/46	%

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Q1.

(a) solid (zinc chloride) does not conduct (electricity)
or
zinc chloride needs to be in solution **or** molten
allow liquid / aqueous

1

(because) ions cannot move in the solid
or
(as) ions can (only) move in liquid / solution
*do **not** accept references to movement of electrons in zinc chloride*

1

(b) each carbon / atom forms 3 (covalent) bonds

1

one electron per carbon / atom is delocalised

1

(so) these electrons carry charge through the graphite
or
(so) these electrons move through the structure
ignore carry current / electricity

1

*if no other mark scored, allow **1** mark for delocalised / free electrons*
allow free electrons for delocalised electrons

(c) use measuring cylinders (instead of test tubes)
allow use burettes
allow use (gas) syringes
allow Hoffmann voltameter

1

(because) test tubes cannot measure volume
or
(because) test tubes have no graduations / scale
allow (so that) volume can be measured

1

(d) any **three** from:

- the volume of hydrogen collected is directly proportional to the time
  allow the (volume of) hydrogen is collected at a constant / steady rate
- the rate of collection of hydrogen is 0.45 (cm^3/min)
- up to 8 minutes chlorine is collected at an increasing rate
  allow any value from 6 to 8 minutes
  allow initially chlorine is collected at an increasing rate

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- after 8 minutes the rate of collection of chlorine is the same as that of hydrogen

  allow any value from 6 to 8 minutes

  or

  after 8 minutes the rate of collection of chlorine is 0.45 (cm^3/min)

  allow after 8 minutes the (volume of) chlorine is collected at a constant / steady rate

  *if neither bullet point 3 nor bullet point 4 is awarded allow **1** mark for chlorine is collected slowly up to 8 minutes and then more quickly*

  allow any value from 6 to 8 minutes

3

(e) chlorine reacts with water

or

chlorine dissolves (in the solution).

1

(f) $(\text{volume} =) \frac{6.6}{1000}\ (dm^3)$

or 0.0066 (dm^3)

allow 6.5 (cm^3) for 6.6 (cm^3)

1

$(\text{moles} =) \frac{0.0066}{24}$

allow use of incorrect volume from step 1

1

$= 2.75 \times 10^{-4}$ (mol)

allow 2.8×10^{-4} (mol)

allow answer from incorrect calculation given in standard form

alternative approach for marking points 1 and 2

24 dm^3 = 24 000 cm^3 (1)

$(\text{moles} =) \frac{6.6}{24\,000}$ (1)

1

*an answer of 2.75×10^{-4} (mol) or 2.8×10^{-4} (mol) scores **3** marks*

*an answer of 0.000275 / 0.00028 / 2.75×10^{-1} / 2.8×10^{-1} (mol) / scores **2** marks*

*an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps*

[10]

Q2.

(a) cool

1

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to −34 °C

allow temperatures below −34 °C but above −196 °C

1

(b) recycled (to the reactor)

1

(c) $825 \times \frac{2}{3}$

1

= 550 (dm^3)

1

*an answer of 550 (dm^3) scores **2** marks*

(d) a lower pressure would decrease the equilibrium yield

1

a lower temperature would make the reaction too slow

1

(e) nitrogen / N

1

(f) **B** and **C**

1

contain nitrogen, phosphorus and potassium

1

(g) (**B**)

any **two** from:
- more stages
- uses more energy
- uses more raw materials
- takes longer

*allow converse for **C***

2

[12]

Q3.

(a) (i) filtration

1

(ii) cylinder

1

(iii) 0.6

*correct answer with or without working gains **2** marks*
*if answer incorrect, allow mass of lead bromide = 36.0–35.4 for **1** mark*

2

(b) (i) all points plotted correctly

± half a small square

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*4 or 5 correct for **1** mark*

2

smooth curve through five points (excluding anomaly)

*do **not** accept straight sections / multiple lines*

1

(ii) point at 60°C circled

1

measured out more than 50 cm^3

*explanation **must** explain why mass dissolved is too large*

1

so solution contained more lead bromide

or

did not heat until all water gone

so additional mass of water

or

heated water to over 60 °C

so more dissolved

allow correct explanation for an incorrectly circled point

1

(c) (i) because (a measuring cylinder) has graduations on it

1

so it is easier to read how much precipitate

or

(a measuring cylinder) has a flat bottom

so measurement of depth is more accurate

1

(ii) straight line covering points from (2,5) to (8,20)

line need not be extrapolated to (0,0), but line is correct only if any extrapolation would go through (0,0)

1

straight line through points (8,20) and (10,20)

all straight lines must be drawn with a ruler

1

(iii) 20 mm

1

all of the lead nitrate has reacted **or** lead nitrate is limiting **or** potassium bromide is in excess **or** reaction was over when 8 cm^3 potassium bromide were used

1

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(iv) amount / depth of precipitate would be less

1

because lead bromide is more soluble at higher temperatures **or** less solid / more dissolved **or** solution of lead bromide more concentrated

1

[18]

Q4.

(a) (i) 84 / 84.5 / 83.98

*correct answer with or without working gains **3** marks*

(moles of NaN_3 =) 130/65 (1)

moles of nitrogen = 3 (1)

mass of nitrogen = 3 x 28 = 84 (1)

or

2 x (23 + (3 x 14)) (1)

3 x (2 x14) (1)

or

$2NaN_3$ = 130 (1)

$3N_2$ = 84 (1)

if answer is incorrect then look for evidence of correct working.

allow ecf from previous stage

***1** mark lost for each mistake in the working if they do not have the correct answer.*

3

(ii) 72 / 72.24 / 72.2

allow ecf from part (i) × 0.86

or

ignore working

69 **or** 68.8

1

(b) (i) 2 **and** 5

1

(ii) any **one** from:

- corrosive / burns
- alkaline / basic
  *do **not** accept acidic*
- attacks / destroys / damages living tissue / cells
  allow irritant
  ignore reference to reactivity
  ignore reference to silicates
  ignore harmful / toxic

1

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[6]

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