

MARK SCHEME

GCSE

CHEMISTRY

AQA - TRIPLE SCIENCE

C6 - TEST 5

RATE OF REACTION

Advanced

Mark schemes

- 1.** (a) cool 1
- to $-34\text{ }^{\circ}\text{C}$
- allow temperatures below $-34\text{ }^{\circ}\text{C}$ but above $-196\text{ }^{\circ}\text{C}$* 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]
- 2.** (a) $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ 2
- allow 1 mark for correct formulae*
- (b) sensible scales, using at least half the grid for the points 1

all points correct

$\pm \frac{1}{2}$ small square

allow 1 mark if 8 or 9 of the points are correct

2

best fit line

1

(c) steeper line to left of original

1

line finishes at same overall volume of gas collected

1

(d) acid particles used up

allow marble / reactant used up

1

so concentration decreases

allow surface area of marble decreases

1

so less frequent collisions / fewer collisions per second

do **not** accept fewer collisions unqualified

1

so rate decreases / reaction slows down

1

(e) mass lost of 2.2 (g)

1

time taken of

270 s

allow values in range 265 – 270

1

$$\frac{2.2}{270} = 0.00814814$$

allow ecf for values given for mass and time

1

0.00815 (g / s)

or

8.15×10^{-3}

allow 1 mark for correct calculation of value to 3 sig figs

accept 0.00815 or 8.15×10^{-3} with no working shown for 4 marks

1

(f) correct tangent

1

eg 0.35 / 50

1

0.007

allow values in range of 0.0065 – 0.0075

1

7×10^{-3}

accept 7×10^{-3} with no working shown for 4 marks

1

[20]

3.

(a) in a closed system

1

the rate of the forward and backward reactions are equal

1

(b) concentration increases

1

(because) reaction / equilibrium moves to the left / reactant side

1

(since the) reverse reaction is exothermic

allow (so that) temperature increases

1

(c) becomes blue

1

(because) reaction / equilibrium moves to the right / product side

1

(so) concentration of blue cobalt compound increases

allow (so that) concentration of hydrochloric acid decreases

1

(d) (cobalt has) ions with different charges

allow (cobalt is a) transition metal

1

(e) Co^{3+}

1

(f) they allow reactions to reach equilibrium more quickly

1

they provide a different reaction pathway

1

(g) $13\text{H}_2 + 6\text{CO} \rightarrow \text{C}_6\text{H}_{14} + 6\text{H}_2\text{O}$

allow multiples

1

(h) C_8H_{18}

1

(i) curve below printed curve

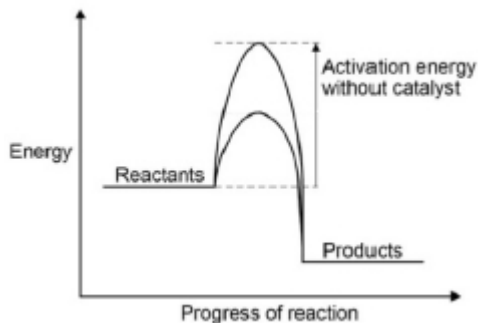
do not accept different reactant or product levels

1

vertical arrow from reactant level to peak of **printed** curve

1

an answer of:



scores 2 marks

[16]

4.

(i) a reaction in which the products can be changed back to reactants

*accept a reaction that can go forwards **or** backwards*

1

under certain conditions

1

(ii) $M_r \text{ CaCO}_3 = 100$

1

$M_r \text{ CaO} = 56$

1

mass of CaO = 140 (tonnes)

1

mark consequentially

[5]

5.

(a) (i) iron **must** be named

do not accept Fe

1

(ii) hydrogen

1

and oxygen mixtures

1

burn rapidly

1

- (b) (i) lowers concentration
accept dilutes the acid
*do **not** accept cooling* 1
- less collisions (between particles) 1
- (ii) H^+ (aq)
accept H_3O^+ only if 2 in front of H_2O 1
- OH^- (aq)
if spectator ions correctly included on both sides, maximum = 1 mark 1
- (iii) $Ca(OH)_2$ weak alkali
accept NaOH strong alkali 1
- $Ca(OH)_2$ causes no problems
accept NaOH causes named problem
*(eg caustic **or** exothermic **or** burns **or** corrosive)* 1

[10]

- 6.** (a) (i) 2.25
correct answer gains three marks
if incorrect allow 1 mark for 2 correct readings (130 and 175) and further mark for $45 \div 20$
allow e.c.f. 3
- (ii) concentration of reactant(s) lower 1
- fewer collisions per second / time unit 1
- (b) labour costs lower / enzymes costs lower
***not** stop and start* 1

[6]

- 7.** (a) from natural gas [*allow from water/ steam / brine / river / lake / sea*]
for 1 mark 1
- (b) *idea that they are recycled / re-used*
for 1 mark 1

(c) *ideas that*

- nitrates may get into ground water / rivers
- so contaminate / get into our drinking water
- eating animals which have eaten crop/ or eating contaminated fish
[do not allow 'eutrophication']
any two for 1 mark each

2

(d) (i) *idea that*

when rate of forward = rate of reverse reaction
[not just 'reversible' or 'can be reversed']
*[allow ammonia is breaking up into nitrogen and hydrogen
as fast as nitrogen and hydrogen are forming ammonia
or amounts of products and reactants stay constant]*
for 1 mark

1

(ii) *ideas that*

- at higher temperatures, equilibrium moves to **the left**
or reverse / endothermic
- reaction / favoured **or** makes products → reactants
- but at lower temperatures the (rate of) reaction is (very) slow
- so a higher temperature is used for economic reasons/so ammonia is produced at higher rate
- iron powder is a catalyst / speeds up the reaction
[not increases the yield]
- low yield not wasteful if reactants re-cycled

[credit iron powder has a greater surface area]
each for 1 mark

4

[9]