AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.4.2 REACTIONS OF ACIDS (PACK 4)

SCORE	PERCENTAGE
/159	%

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Mark schemes

Q1.

(i) neutralisation/acid base reaction

for 1 mark

1

(ii) 17 (tonnes)
give 80 (tonnes) (even if only in working)

for 1 mark each

320 (tonnes) or alternative method)

3 marks for correct answer

(if 17 and 80 not given allow 1 mark for correct answer using their figures)

3

[4]

Q2.

(a) (i) $H^+ + OH^- \rightarrow H_2O / H_3O^+ + OH^- \rightarrow 2H_2O$

for 1 mark

1

(ii) 1 point from e.g.
smaller bits
bigger surface area
faster reaction
dissolve faster
more particles open to attack by acid

any 1 for 1 mark

1

(iii) $MgCO_3$ or $MG^{2+}CO_3^{2-}$ or CO_3 Mg

for 1 mark

1

(b) (i) 2 HCl

for 1 mark

1

(ii) aqueous/<u>dissolved</u> in water (not in solution)

for 1 mark

1

(iii) CO_2/gas evolved/gas has mass

for 1 mark

1

(c) (i) plotting points
scales
curve
labelling axes including units

for 1 mark each

4

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(d) faster
same final mass
for 1 mark each

2

[12]

Q3.

(a) (i) hydrogen/H_2
for 1 mark

1

(ii) i.e. $2Cl^- - 2e^- \rightarrow Cl_2$
for 1 mark

1

(iii) hydroxide or OH^-
for 1 mark

1

(iv) sodium hydroxide/caustic soda/NaOH/bleach/
chemical name of bleach
for 1 mark

1

(b) (i) Na_2CO_3 or $(Na+)_2\ CO_3^{2-}$
for 1 mark

1

(ii) coal
water/H_2O
limestone/$CaCO_3$/calcium carbonate
any one for 1 mark

1

(iii) calcium chloride/$CaCl_2$/sodium hydrogen carbonate/$NaHCO_3$
for 1 mark

1

(iv) decomposition/heating of limesstone
decomposition/heating of coal
decomposition/heating of sodium hydrogen carbonate
any 1 for 1 mark

1

described change e.g. $NaHCO_3 \rightarrow Na_2\ CO_3$
(Use judgement)
breakdown (owtte.)
by heat
for 1 mark each

2

(v) carbon dioxide/CO_2 or ammonia/NH_3
for 1 mark

1

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(c) (i) zinc carbonate/$ZnCO_3$/zinc hydroxide/$Zn(OH)_2$

for 1 mark

1

(ii) It is insoluble
zinc carbonate is insoluble in water

for 1 mark

1

[13]

Q4.

(a) potassium / K

for 1 mark

1

(b) carbon dioxide / CO_2

for 1 mark

1

(c) losing
electrons
gaining
electrons

for 1 mark each

4

(d) (i) power supply, (not mains)
beaker containing solution,
(inert) electrodes and circuit
ammeter or bulb/
(or see bubbling etc. at electrodes written by drawing)

for 1 mark each

4

(ii) reading on ammeter/bulb lights / (solution) conducts (electricity)
bubbling / gas produced
hydrogen produced
chlorine / oxygen produced
ions move
to electrodes (must be linked to ions move)
negative ions move to the positive electrode
<u>and/or</u> positive ions move to the negative electrode
negative ions lose electrons
<u>and/or</u> positive ions gain electrons

any 3 for 1 mark each

3

[13]

Q5.

(a) (2) : (6) : (2)

All 3 correct gains 2 marks
2 correct gains 1 mark

2

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(b) no water present/moist air cannot enter/do not thoroughly mix/ must be in solution etc.

for 1 mark

1

(c) (i) hydroxide (ion) / OH^-

for 1 mark

1

(ii) hydrogen (ion) / H^+

for 1 mark

1

(iii) water/H_2O/hydrogen oxide

for 1 mark

1

[6]

Q6.

(a) (i) test tube / boiling tube

for 1 mark

1

(ii) Na_2CO_3
NaCl

each for 1 mark

2

(b) (i) flask
measuring cylinder

each for 1 mark

2

(ii) used smaller pieces

gains 1 mark

but larger surface area for reaction

gains 2 marks

2

(c) (i) steeper line
straight line

each for 1 mark

2

(ii) reaction occurs when particles collide
higher temperature, higher speed of particles
so harder collisions
more frequent collisions

any three for 1 mark each

3

[12]

Q7.

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(i) sulphuric acid / H_2SO_4

accept sulfuric *1 for one mark*

1

(ii) exothermic

for one mark

1

(iii) Na_2SO_4 / $(Na)_2SO_4$ / $Na_2(SO_4)$ / $(Na^+)_2SO_4^{2-}$

for one mark
lower case O(Na_2SO_4) not accepted / tops of subscripted letters should be in line or lower than lower case letters of symbols

1

[3]

Q8.

(a) NO_2 / $2NO_{2(g)}$ / Nitrogen dioxide

for one mark

1

(b) particles of gas move / they move

reject spread out
particles move randomly / mix / go between air molecules / diffusion

any two for 1 mark each

2

(c) faster reaction / more surface area (*not* smaller pieces)

for one mark

1

(d) (i) **either** lower temperature / particles move slower
fewer collisions (owtte) / less energetic collisions / owtte
or acid diluted (owtte)
fewer collisions (owtte)

for 1 mark each

2

(ii) alkali <u>neutralises</u> the acid / stops the reaction
or water will only slow the reaction not stop it

either for 1 mark

1

[7]

Q9.

(a) (i) sulphuric acid / H_2SO_4 (accept sulfuric)

for one mark

1

(ii) Na_2SO_4 / $(Na)_2SO_4$ / $Na_2(SO_4)$ / $(Na_+)_2SO_4^{2-}$

for one mark

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lower case O (Na_2So_4) not accepted/tops of subscripted numbers should be in line with or lower than lower case letters of symbols / upper case 'a' not accepted

1

(b) (i) exothermic

for one mark

1

(ii) 60 KJ

for one mark

1

(iii) energy given out when bonds form
energy taken in when bonds break
energy given out is greater then energy taken in (owtte)

for 1 mark each

3

(iv) activation energy is low / many molecules have enough energy to react
for one mark

1

[8]

Q10.

sodium nitrate

1

N_aNO_3

*do not credit lower case N **or** O, upper case A*

1

potassium sulphate

1

K_2SO_4

*accept potassium hydrogen sulphate **or*** $KHSO_4$
do not credit lower case K, S or O
ignore charges on ions

1

[4]

Q11.

(a) ammonium nitrate

accept NH_4NO_3
*do **not** accept ammonia nitrate*

1

(b) different reactions need different catalysts

1

(c) they are used over and over again

accept they are reused
accept they are not used up

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accept they are not changed
recycling is neutral

1

(d) any **two** from

they speed up reactions

they reduce energy requirements
accept allow reactions to take place at a lower temperature

they reduce costs
accept make process more economic

2

(e) (high pressure) increases the frequency of collisions
accept more collisions
move faster is neutral

1

this increases the rate of reaction
accept 'more successful collisions' for 2 marks

1

[7]

Q12.

(a) (i) allow a number between 2.5 and 3 (inclusive)
accept just under 3 ***or*** *about 3*

1

(ii) alkaline **or** alkali

1

(iii) 25
ignore any reference to units

1

(b) (i) a circle round KOH or 2 KOH

1

(ii) K_2SO_4
do not credit potassium sulphate

1

[5]

Q13.

(a) Bunsen (burner)
accept spirit burner do not credit candle

1

(b) blue

1

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white

credit (1) if both colours correct but answers are reversed

1

to cool the tube (B)

*accept answers which anticipate part (d) e.g. 'to condense the water vapour' or gases **or** vapours*

1

(d) (i) water

do not credit 'condensation'

1

(ii) (Water) vapour from the crystals (from tube A)

*accept steam **or** steam from tube A*

1

condenses **or** cools

accept turns to (liquid) water

1

(e) add water

gets hot **or** hotter **or** warm **or** warmer turns into solution
dissolves

or the temperature rises or there is an exothermic reaction
*accept steams **or** hisses ignore any reference to colour(s)*

2

(f) sulphuric acid

accept H_2S0_4 only if correct in every detail

1

[10]

Q14.

NOTE

In this question and throughout the Paper, if the name of a chemical is asked for, then the formula is acceptable only if it is correct in every detail. If the name is correct and the candidate has tried to be 'helpful' by giving, in addition, an incorrect version of the formula, then this is acceptable provided it does not lead to ambiguity.

(i) nitric (acid)

accept $HN0_3$

1

(ii) sulphuric (acid)

accept H_2SO_4

1

(iii) heat given out

***or** temperature rise*

***or** energy given out*

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or *steam*
do not credit just 'use a thermometer'
do not credit just 'change in temperature'

1

(iv) neutralisation

accept neutralise
accept neutral
accept formation of salt ***or*** *water*
do not credit exothermic

1

[4]

Q15.

(a) $CaCO_3$ + **2**HC1 → $CaC1_2$ + **CO_2 + H_2O**

one mark for CO_2 and H_2O ***or*** *H_2CO_3*
one mark for balancing the equation

2

(b) (i) linear suitable scale for y axis

± *one small square*

1

accurate plots

deduct one mark for each error plot

1

smooth curve through the points **or** a line of best fit

this mark requires a neat smooth curve

1

(ii) curve becomes almost horizontal at **or** above 268.5

do not credit a straight line reaching 268.5 at 11 mins
accept a plot at 268.6

1

(iii) steeper initial part to curve

1

becoming nearly horizontal between 268.6 and 268.4 g

1

[8]

Q16.

(a) gas

1

(b) (i) acid

ignore any reference to a particular kind of acid

1

(ii) 7

1

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(c) 1

*credit potassium **or** K written into Group 1*

1

(d) (i) reacts rapidly **or** quickly **or** fast

*credit melts **or** fizzes **or** dissolves **or** violently **or** less violently (than K)*

1

sodium hydroxide **or** hydrogen

*credit NAOH **or** H2*

1

(ii) add universal indicator

*credit add indicator **or** litmus **or** use pH paper*

1

turns blue **or** purple

credit 'it goes purple' providing something has been added to the water

1

(e) any two from

heat **or** warm

cut it up **or** have smaller pieces or larger surface area

*do not accept more lithium **or** less water*

stir

2

[10]

Q17.

(a) (i) 8

ammonia

do not credit ammonium

sulphuric acid

do not credit just sulphuric; credit sulfuric acid

do not credit hydrogen sulphate

3

(ii) (as a) fertiliser

1

(iii) nitric (acid)

accept HNO_3 if correct in every detail

1

(b) (i) chemical change (in which)

***or** under suitable conditions*

1

product(s) can be converted to reactant(s)

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or *direction of reaction can be reversed*

or *equilibrium can be achieved*

do not credit reaction can be reversed

1

(ii) air

or *(the) atmosphere*

1

(iii) made of atoms

1

which are all the same

credit the idea that the particles (in an element) are all the same even if the name of the particles (the first mark) is incorrect

or *which have the same number of protons*

or *which have the same atomic number / proton number*

it cannot be broken down into anything simpler (2) marks

1

[10]

Q18.

(a) sodium ions and chloride ions (not chlorine)
allow sodium chloride/salt/common salt

for 1 mark

1

(b) $H^+ + OH^- \rightarrow H_2O$
H^+ from (hydrochloric) acid
OH^- from alkali/sodium hydroxide
lose 1 mark if no charge shown disregard other ions

each for 1 mark

3

[4]

-

Q19.

(a) (i) sodium ions and chloride ions

(allow sodium chloride/salt) [not "chlorine"] for 1 mark

1

(ii) sodium ions and chloride ions

(allow sodium chloride/salt) for 1 mark

H + ions (*allow* hydrochloric acid)

for 1 mark

2

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(b) $H^+ + OH^- \rightarrow H_2O$ [N.B Na^+ and Cl^- may also be present]
H^+ ions from acid
OH^- ions from alkali

each for 1 mark

[N.B First mark lost if changes on ions not shown]

3

[6]

Q20.

(i) carbon dioxide *(allow* CO_2*)*

for 1 mark

1

(ii) sodium nitrate (accept correct formula)

for 1 mark

1

[2]

Q21.

- correct use of react/reaction/reactants NOT mixed added to join/combine/displace
  NOT equals
- correct use of produce/products/gives/forms/makes/creates
- reactants correctly identified
- products correctly identified

(copper oxide reacts with sulphuric acid to produce copper sulphate and water, will be awarded all 4 marks)

for 1 mark each

Reactants must be correctly identified for 'react' mark to be given. Similarly for products

[4]

Q22.

(a) acidic }
neutral } *in this order*
alkaline}

all correct 2 marks
one correct 1 mark

2

(b) *ideas that*

- nothing happens at first (to pH) / pH stays the same
- then (rapidly) changes / increases
- then stays at same (higher) level

5

[7]

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