AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.1.2 THE PERIODIC TABLE (PACK 3)

SCORE	PERCENTAGE
/193	%

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Q1.

(a) (i) melting point increases as atomic number increases

accept 'increase' / higher / bigger / larger

1

(ii) 200 to 350 °C

1

exactly on 85 ± $\frac{1}{2}$ square

up to <u>their</u> value **±** $\frac{1}{2}$ *square*

1

(b) (i) chlorine **or** fluorine

accept if both chlorine and fluorine ticked, otherwise list principle

1

(ii) chlorine / fluorine are more reactive (than bromine)

accept chlorine / fluorine are higher (up group 7)
accept a more reactive halogen will displace a less reactive halogen

1

(iii) 500 (litres)

1

[6]

Q2.

(i) any **two** sensible ideas such as:

- (why) put in order of mass

  accept other equally valid orders, eg alphabetical

- he left gaps **or** table not complete

- no evidence for undiscovered elements
  or they believed all the elements had been discovered

  accept predictions could not be backed by evidence
  accept why change previous ideas

- he changed the order of some elements
  or there were exceptions to the rule(s)

- he put metals and non-metals together

  accept they didn't like his groupings / groups

- he did not explain his ideas clearly (owtte)

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*do **not** accept modern explanations, eg proton number etc*

2

(ii) (the properties of gallium) fitted the predictions (owtte) **or** predictions were correct **or** (properties) would make it fit in the gap **or** (properties) would make it fit in group 3

*do **not** accept gallium fitted his theory*

accept finding gallium proved there were new elements to be discovered

1

[3]

Q3.

(a) (i) all points plotted to ± $\frac{1}{2}$ square

1

sensible line of best fit extended

could be curve
*must **not** join dots, ie zig zag*
if they draw 2 lines then lose second mark,
but can still gain marks in (a)(ii)

1

(ii) as read from their graph ± ½ square

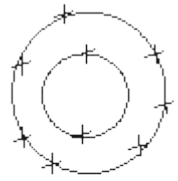
1

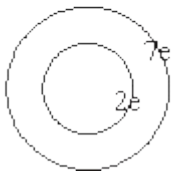
(iii) iodine **and** astatineI/I_2 At/At_2

*must give **both** 1*

1

(b) (i)





ignore symbol
ignore nucleus / lack of nucleus
accept dots / crosses etc / e / e^-
***not** 2.7 alone*

1

(ii) same number of electrons in **outer** shell **or**
seven electrons in **outer** shell (owtte)

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accept missing one electron in <u>outer</u> shell / energy level / orbit
accept trying to gain one electron
accept they all form 1^- ions
*do **not** accept orbital / rings*

1

(c) (i) 8 electrons in outer shell **or** full outer shell / energy level

1

does not need to lose / gain / share electrons **or** don't need to form bonds
accept don't bond ionically or covalently
*they do not react is **not** enough*

1

(ii) fluorine atom is smaller / fewer shells (owtte) **or** outer shell closer to nucleus
accept answers argued in terms of iodine

1

more strongly attracted (to nucleus) **or** less shielding
accept holds electrons tighter (to the nucleus)

1

gains electron(s) <u>more</u> easily
accept easier to gain electrons

1

[11]

Q4.

(i) nucleus

1

(ii) they both have seven electrons in the outer shell
accept they both have the same number of electrons in the outer shell
both need one electron to make full outer shell

1

[2]

Q5.

(a) group seven/7VII
accept halogens

1

(b) (i) in light **bulbs**/lasers
accept any other specified use as an inert atmosphere e.g. (argon)
welding, storing explosives, fluorescent lights

1

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(ii) 2.8.8/has a full/8 in/outer shell

1

electrons

accept does not need to share/gain/lose electrons

1

(c) (i) any one from:

disinfectant

bleaching agent

sterilising water/kills bacteria

manufacture of HCl

water treatment

1

not: *cleaning/in pools*
purification of water
kills germs
warfare
antiseptic

(ii) inner shells 2,8

1

outer shell 7

1

(iii) fluorine:

accept the converse reasons for chlorine

gains **one**/an electron easier/is more

strongly attracted

not *more strongly held*

1

less shielding of nucleus by inner electron shells

1

less distance from (attraction of)

nucleus/less shells

1

[10]

Q6.

(a) (i) **all** correct **two** marks **one or two** correct **one** mark

electron
proton
neutron

2

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(ii) (argon has) a full outer shell (of electrons)

accept energy level for shell

accept does not lose or gain electrons

*do **not** accept does not form bonds **or** react **or** is a noble **or** inert gas*

1

(b) <u>oxygen</u> would react (with metal)

accept oxygen is reactive

*do **not** accept metal would react (neutral)*

1

metal would burn

*accept metal would be 'destroyed' **or** metal oxide formed **or** metal is oxidised*

*do **not** accept it would explode **or** would not last long*

accept filament for metal

1

[5]

Q7.

(a) (i) low density

accept floats (on water)

1

(ii) forms an alkaline solution with water

*accept <u>alkali</u> (metal) **or** basic*

*do **not** accept group 1 metal*

1

(b) 3 **or** three (protons)

1

3 **or** three (electrons)

1

4 **or** four (neutrons)

1

[5]

Q8.

(a) atomic number or proton number

1

(b) (i) sodium **or** potassium **must** be name

*accept rubidium **or** caesium **or** francium*

1

(ii) silicon **or** phosphorus **or** sulphur **or** chlorine **or** argon **must** be name

1

[3]

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Q9.

(a) (i) number

1

periods

1

groups

1

(ii) some elements (**or** metals) had not been isolated

*accept some elements (**or** metals) had not been discovered (found)*

*do **not** accept matching properties*

*do **not** accept some elements were not known*

1

(b) (i) He **or** Ne **or** Ar

*accept Kr **or** Xe **or** Rn*

accept correct names

1

(ii) arrangement of electrons correct

accept He 2
Ne 2 . 8
Ar 2 . 8 . 8

arrangement of electrons must match

correct answer if given in (i)

*do **not** accept other elements*

1

(iii) (all) have one electron in the outer shell **or** energy level

*accept (all) have same number of electron(s) in the outer shell **or** energy level*

accept all have to lose one electron

*do **not** accept all in same group*

1

(iv) K Na Li

accept names

accept correct indication of order of reactivity

1

(v) H_2

*do **not** accept H*

1

correctly balanced → 2 + 1

must have H_2 correct to get balancing mark

1

[10]

Q10.

(a) (i) green

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*accept 'green-yellow' but **not** 'yellow' alone*

1

bromine or Br or Br_2

*do **not** accept bromide*

1

(ii) same number of electrons in outer energy level **or** *accept shell for energy level*

7 electrons in outer shell

accept need to gain 1 electron

1

(b) any **two** from:

- hydrogen **or** H_2

  *do **not** accept gas given off **or** fizzes*

- heat

  accept exothermic

  *do **not** accept flame*

- alkaline solution

  *accept (metal) hydroxide **or** NaOH **or** OH^-*

  *do **not** accept dissolves **or** forms a solution **or** floating*

  *accept balanced chemical equation for **2** marks*

2

[5]

Q11.

(a) any (must be named)

1

(b) F_2

1

(c) $-/F^-$

1

(d) (i) covalent

1

(ii) made of molecules etc.
type of bonding when non-metals react.

1

[5]

Q12.

(a) (i) 14 electrons =

gets 1 mark

2.8.4 =

gets 2 marks

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2

(ii) outer shell electrons

1

(iii) same number of electrons in outer shell

1

(b) (1) shiny
conducts electricity

(2) oxide neutralises alkalis
covalent bonds

4

[8]

Q13.

(a) (i) 2.7

1

(ii) 2.8.8

1

(iii) gains an electron
more easily than Cl
because the higher the energy level
the less easily an electron is gained
each for 1 mark

4

(b) (i) very unreactive **or** give reactivity trend

1

(ii) fluorine reacted with silicon from glass
each for 1 mark

2

(iii) Reactivity increases down the group
radon likely to react because lower in group than xenon
more reactive than xenon
Kr may or may not react
higher in group than xenon
less reactive than xenon
any 5 for 1 mark each

5

[14]

Q14.

(a) (i) same number of shells/2 full shells/3 shells/same number of energy levels
any 1 for 1 mark

increasing number of electrons/different number of electrons/ number of electrons same as group number

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(if electrons not specifically mentioned assume they are referring to electrons)

any 1 for 1 mark

2

(ii) all have 7 electrons in outer shell/same number in outer shell/
each has one electron missing from outer shell
each can accept one electron

any 1 for 1 mark

number of shells/energy levels increases
increasing number of electrons

any 1 for 1 mark

2

(b) (i) increases down group/decreases up

for 1 mark

1

(ii) down group atoms get bigger/larger/have more shells/
more energy levels

for 1 mark

electrons further away from nucleus/more
shielding down group

for 1 mark

outer electron more easily lost/less
firmly held

for 1 mark

3

(c) H^+ or has positive ions/one electron in outer shell/can lose
one electron/H^+ ions discharged at negative electrode (max 2)
covalent bonds or compounds/forms diatomic mols. or example/
ability to form H^- ions/non-conductor/
low Mt.Pt or low B.P. (max 2)

(overall max 3)

3

[11]

Q15.

(a) three from:
high mp/melts above 60 °C
conducts (electricity)
basic oxide /alkaline oxide
chloride has high mp
molten chloride conducts electricity
form positive ions/form ionic compound with non-metals
solid at room temperature

any 3 for 1 mark each

3

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(b) group 2
formula of oxide is XO/ion is X^{2+}/
oxide forms alkaline solution

for 1 mark each

2

(c) XCl_2/ $X^{2+}(Cl^-)_2(X^{2+})(Cl^-)_2$
Symbol of any group 2 element instead of X
(b) → (c) error carried forward accepted.
e.g. Group 1 → XCl
Group 3 → XCl_3

for 1 mark

1

[6]

Q16.

(a) same number of electrons in outer shell/highest energy level
or they all form 1+ ions
If number of electrons is given it must be correct
Allow loss of same number of electrons to give full shell
not gain of electrons

for 1 mark

1

(b) electrons are lost more readily/more easily
further from nucleus/bigger atom/more shielding/more energy levels/
not just more electrons
not just reduced attraction

for 1 mark each

2

[3]

Q17.

(a) Group 2 / Alkaline Earth Metals

for 1 mark

1

(b) (i) $MgCl_2$/Mg^{2+} $(Cl^-)_2$
(or equation with correct answer)

for 1 mark

1

(ii) ionic / electrovalent

for 1 mark

1

[3]

Q18.

(a) gas

for 1 mark

1

(b) AlX_3

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for 1 mark

1

(c) 7 / halogens

for 1 mark

1

[3]

Q19.

(a) same number of electrons in outer shell / 1 / an electron in outer shell / lose <u>one</u> electron

for 1 mark

1

(b) (i) C

for 1 mark

1

(ii) E

for 1 mark

1

(c) (i) $2Na + 2H_2O \rightarrow 2NaOH + H_2$
symbols must be correct
correct multiples / fractions accepted
Balancing mark is independent

formulae gains 1 mark
balancing gains 1 mark

2

(ii) Assume 'it' means potassium
potassium more reactive / vigorous / faster reaction / violent (can be awarded in either section)
potassium atom larger than sodium / higher outer energy level / outer shell further from nucleus / more shells (not just more electrons)
electron in outer shell is less strongly attracted / greater shielding
outer electron more easily lost

for 1 mark each

4

[9]

Q20.

Mendeleev's table
contains only elements
divides metals and non-metals
contains far more elements which were discovered later
groups elements according to chemical properties

puts elements in order of atomic number / atomic mass / table includes these numbers

can use to work out / linked to electronic structures

left gaps for missing elements which had not been discovered

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other sensible answers

any two for 1 mark each

[2]

Q21.

(i) B **or** 2, 8, 1

for one mark

1

(ii) A **or** 2, 8

for one mark

1

[2]

Q22.

(a) (i) H, Cu, Ag (rules of upper and lower case to be applied here)

both for one mark

1

(ii) hydrogen
copper
silver

any two for 1 mark

2

(b) Group O / Noble gases / Group 8 / Group 18 / Inert gases / Rare gases / Transition elements / Metals

for one mark

1

(c) sensible suggestions based on their knowledge of the periodic table
left spaces for elements which had not been discovered
left gaps so that elements could be placed in columns with other elements which had similar properties

for one mark

1

(d) proton (atomic)

for one mark

1

(e) they react with water to give alkaline solutions
they form an ion with a 1+ charge
they are metals

for 1 mark each

3

(f) <u>maximum of 1 mark for description</u>
floats / surface
may melt (*not* gets hot)
moves around
bubbles / steam / fumes / smoke / fizz
dissolves / disappeared / gets smaller
flame

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(*ignore* sounds / heat)

any one for 1 mark

2 marks for correct product

sodium hydroxide or a solution containing sodium and hydroxide ions)
NaOH / caustic soda hydrogen / H_2
(if more than 2 products given subtract one for each incorrect to maximum –2)

three for 1 mark each

3

[12]

Q23.

(a) Copper
Silver
Hydrogen

two correct symbols gains one mark. (√x)

any two for 1 mark each

2

(b) Group O / Noble gases / Group 8 / Group 18 / Inert gases / Rare gases / Transition elements / metals

for one mark

1

(c) sensible suggestions based on their knowledge of the Periodic Table
left spaces for elements which had not been discovered
left gaps so that elements could be placed in columns with other elements which had similar properties

any one for 1 mark

1

(d) atomic (proton)

for one mark

1

[5]

Q24.

(a) transition / transitional metals / elements / d-block

for one mark

1

(b) coloured
catalyst

(*accept* high melting point)

for 1 mark each

2

[3]

Q25.

chlorine atom smaller than bromine atom / has fewer shells / chlorine is higher in the group than bromine so it is more reactive

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the outer electron / extra electron is more strongly attracted with chlorine than bromine / bromide (owtte) / more shielding with bromine / less shielding with chlorine

an extra electron is more easily gained by chlorine **or** chlorine can take an electron from bromide ion (*not* bromine)

for 1 mark each

[3]

Q26.

(a) –220(°C)

accept without unit
*do **not** credit if no minus sign*
no tolerance allowed

1

(b) iodine

allow I or I_2

1

(c) increase *down (the groups)*

*N.B. must be **one** comparative or superlative for either position in group or melting point to obtain 2 marks*

e.g. accept lowest in group has highest melting point for 2 marks
accept highest in group has lowest melting point for 2 marks

accept highest mass numbers or proton numbers or atomic numbers have highest melting point for 2 marks

*allow F has lower **or** lowest melting point for 1 mark*

allow 'Increase from F to 1', i.e. referring to graph rather than periodic table for 1 mark

F has a low melting point no marks

2

(d) brittle

1

poor conductor of electricity

maximum 1 mark if three boxes ticked
no marks if all four boxes ticked

1

[6]

Q27.

low density

1

form hydroxides that dissolve in water

1

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react quickly with water

four ticks – max 2 marks
five ticks – max 1 mark
all boxes ticked – 0 marks

1

[3]

Q28.

(a) (i) Y **or** 2,8,8 **or** Argon **or** Ar

All correct gains 3 marks

(ii) W **or** 2,5

3 correct gains 1 mark

(iii) X **or** 2,7 **or** fluorine **or** F

2 or 1 correct gains 1 mark

(iv) Z **or** 2,8,8,1 **or** potassium **or** K

N.B. number of ticks on script must equal number of marks

3

(b) 1 and 2 (both needed)

do not credit if any other group listed
'transition metals' neutral
allow alkali metals and alkali earth metals

1

[4]

Q29.

(a) same number of outer electrons / have 2 outer electrons

do not accept inner electrons or 2Xs

1

(b) calcium (idea) outer electrons / shell further from nucleus

*do **not** credit lower down group*
do not credit larger / more shells

1

more easily lost / attraction from nucleus less

accept screening of inner electrons

1

[3]

Q30.

(a) less dense than air

no marks if four or five box

1

very unreactive

maximum 1 mark if three boxes ticked

1

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(b) CO_2

1

HCl

1

NH_3

do not penalise upper / lower case or superscript

1

[5]

Q31.

(a) Mendeleev arranged known elements in order of mass or properties

reject explanation in terms of electrons and / or atomic number

1

gaps in Periodic Table / group 1

1

(b) does not last long enough to experiment / very little of it

allow it has a short half-life

1

(c) (i) (much) more violent

accept more reactive

1

(ii) since outer electron / or shell further from nucleus

do not credit lower down group larger / more shells neutral

1

therefore more easily lost

accept screening by inner electrons

1

[6]

Q32.

(a) He

1

(b) carbon / silicon / germanium / tin / lead

accept correctly written symbols C / Si / Ge / Sn / Pb

1

(c) copper

accept Cu

1

(d) iodine

accept I or I_2

1

[4]

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Q33.

(a) **A** – electron

1

B – nucleus

1

C – proton

1

D – neutron

1

(b) Group 1 / alkali metals

1

has one electron in outer shell

accept 3 protons / 3 electrons / atomic number 3
therefore lithium (so Group 1 / alkali metals)

1

(c) lithium

accept Li

1

[7]

Q34.

(a) (i) liquid

allow l

1

(ii) solid

allow s
allow responses written in table

1

(b) fluorine

accept F, reject fluoride

1

(c) hydrogen bromide

reject hydrogen bromine
accept HBr/BrH
allow responses written in table

1

[4]

Q35.

fluorine has fewer shells / less shielding than iodine

1

gains electrons more easily / more pull

1

[2]

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