AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.1.1 ATOMIC STRUCTURE, SYMBOLS, RELATIVE ATOMIC MASS, CHARGE AND ISOTOPES (PACK 6)

SCORE	PERCENTAGE
/114	%

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Q1.

(a) same number/six electrons;
same number/six protons;
react in same way **not** same element or both carbon
any two for 1 mark each

2

(b) different number of neutrons
gains 1 mark

but **or**

$^{14}_{6}C$ has two more neutrons different mass number
gains 1 mark

or

but two mass units bigger
gains 2 marks

$^{14}_{6}C$ has 8 neutrons while $^{12}_{6}C$ has 6 neutrons
gains 2 marks

2

[4]

Q2.

(a) 2.8.2. magnesium or 2.8.8.2. calcium
inner shell (2)
outer shell (2)
intermediate shell/s correct
element named to match structure
each for 1 mark
(Structure correct for element name but not in group 2, award 2 marks)

4

(b) Similar hydrogen and/or an alkali/hydroxide produced
for 1 mark

Reasons: chemical reaction involves loss of an electron
Na + Li have the same number of electrons in the outer shell
(*do not allow* same group of p.table)
each for 1 mark

Different rate of reaction faster for sodium*
for 1 mark

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Reason: outer electron more easily lost from the sodium atom

[* allow sodium hydroxide produced]

for 1 mark

5

[9]

Q3.

(a) (i) $2H_2 + O_2 \rightarrow 2H_2O$

for 1 mark

1

(ii) $4Al + 3O_2 \rightarrow 2Al_2O_3$

for 1 mark

1

(b) *idea that:*

must end up with the same number of atoms as at the start

any 2 each

otherwise matter is shown to be lost/gained

for 1 mark

won't show correct amount of each element/compound

2

[4]

Q4.

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

for 1 mark

1

(ii) sodium nitrate (accept correct formula)

for 1 mark

1

[2]

Q5.

(a) *reference to*

hydrogen (atoms))

nitrogen (atoms)) but **not** molecules

each for 1 mark

ratio of 1N to 3H **atoms**

for 1 further mark

or 1 nitrogen atom and 3 hydrogen atoms

(ignore any incorrect statements about nature of bonding)

3

(b) *evidence of*

H = 1

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N = 14
O = 16

gains 1 mark

but
H = 1
N = 14
O = 16 × 3 or 48

gains 2 marks

but 63

gains 3 marks

3

[6]

Q6.

(a) (i) $2\ H_2 + O_2 \rightarrow 2\ H_2O$ (*allow* $H_2 + ½O_2 \rightarrow H_2O$)

both circled for 1 mark

1

(ii) $4\ A1 + 3\ O_2 \rightarrow 2\ A1_2O_3$

all circled for 1 mark

1

(b) *idea that:*
must end up with the same number of atoms
otherwise matter is shown to be lost/gained
doesn't show correct amount of each element/compared

each for 1 mark

2

(c) *idea that:*
oxygen has 2 electrons short in outer shell) in words or
chlorine has 1 electron short in outer shell) indicated on diagram
(shared pair/covalent bond with) hydrogen
atom supplies **one** further electron*
(but do not allow hydrogen **gives away electron or **ionic bond**)*

for 1 mark each

3

[7]

Q7.

(a) (i) 27

(ii) 13

each for 1 mark

2

(b) each proton has a/1 positive charge and each electron has a/1 negative charge OR electrons and protons have (equal but) opposite charges
there are equal numbers of protons and electrons in the atom/ so charges cancel or balance (each other)

each for 1 mark

2

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(c)

PARTICLE	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Fluorine atom		10	
Fluoride atom	9		10

each for 1 mark

3

[7]

Q8.

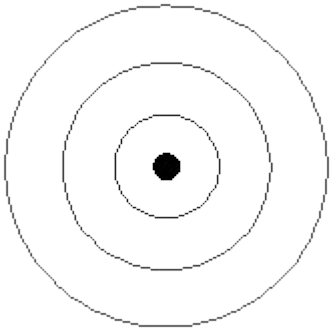
contains oxygen atoms
contains hydrogen atoms
atoms are [chemically] bonded
ratio of two hydrogen to two oxygen atoms

each for 1 mark

[4]

Q9.

(a)



each shell completed correctly
[*for written 2.8.2 award 1 mark*]

for 1 mark each

3

(b) idea that

- chemical reactions of metals, involves losing electrons

  for 1 mark

- these three elements have the same number of electrons in the outer shell/highest energy level

  gains 1 mark

but

- these three elements all have two electrons in the outer shell/highest energy level

  gains 2 marks

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All form ions with a 2+ charge gains all 3 of these marks

- reactivity depends on how easily the electrons are lost
  for 1 mark

- the further the electrons are from the nucleus/the higher the energy level they are in, the more shells the atom has* then the more easily they are lost
  for 1 mark

- in calcium the electrons are further from the nucleus than in magnesium than in beryllium
  for 1 mark

or as you go down the group .....
(*not just "the more electrons"....)

6

[9]

Q10.

(a) Fe_2 [56 × 2] **or** 112
O_3 [16 × 3] **or** 48
each gain 1 mark

but M_r = 160
gains 3 marks

3

(b) [$Fe_2O_3 + 2A1 \rightarrow 2Fe + A1_2O_3$]

160 → 112 (NB Credit if unworked
(or value from (a)) (or value but should be totalled) from (a))
gains 1 mark

but
32 g. of Fe_2O_3 → 32/160 × 112
gains 2 marks

but = 22.4
gains 3 marks

3

[6]

Q11.

(a)

	Calcium	Phosphorus	Fluorine
No of protons		15	
No of neutrons			10

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No of electrons	20		

for 1 mark each

3

(b) (i) gain of electron(s)

from (atoms) (of) calcium

for 1 mark

2

(ii) Ca^{+}

gains 1 mark

but superscript only Ca^{2+} / Ca^{++}

gains 2 marks

2

(c) atoms
electrons
molecule(s) not compound

each for 1 mark

3

(d) (i) *ideas that*

- ionic – strong forces between ions
- molecular – weak forces between molecules

each for 1 mark

2

(ii) *ideas that*

- ionic – ions/charged particles are free to move
- molecular -molecules do not carry a charge

each for 1 mark

2

[14]

Q12.

(a) lead chloride } *in any order*
potassium nitrate }

for 1 mark each

2

(b) lead chloride is solid / a precipitate
potassium nitrate is aqueous / in solution / dissolves in water
NOT liquid

for 1 mark each

2

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(Accept ratio of molecular KNO_3 : $PbC1_2$ is 2:1 for 2 marks)
(do not accept relative number of atoms in each compound)

One is a solid, one is a solution – worth 1 mark

[4]

Q13.

idea that

- contains nitrogen atoms
- contains hydrogen atoms
- atoms are chemically bonded NOT linked/joined
- ratio of one nitrogen to three hydrogen (atoms) formula of ammonia is NH_3

for 1 mark each

[4]

Q14.

(a)
- vertical axis appropriately scaled

[i.e. using more than half the grid]

- all three points correctly plotted* (to < ½ a square)
- reasonably straight line drawn through points (to < half a square)*
[*credit both these marks for bars correctly drawn since discontinuous variable]

each • for 1 mark

x [If points incorrectly plotted credit 1 mark for the best fit straight line or curve but not point-to-point]

3

(b) 44 (atomic units)

for 1 mark
(e.c.f. i.e. credit consistent with candidate's graph)

1

(c) hydrocarbons / alkanes

for 1 mark

1

(d) C_2H_6
C_5H_{12}

each for 1 mark

[NB figures must be subscripted]

2

[7]

Q15.

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(a) Mg S O_4
24 + 32 + 16 (×4) or 64 / evidence of <u>all</u> A_r's
gains 1 mark

but (M_r) = 120
gains 2 marks

2

(b) evidence that 24(g) magnesium would produce 120(g) mapesiurn sulphate
gains 1 mark

or correct scaling by 1/6

but 20(g) magnesium sulphate
gains 2 marks
[credit error carried forward from (a) with full marks in (b)]

2

[4]

Q16.

(a) A is sodium/Na*
B is argon/Ar*
each for 1 mark
*(*case of letters must be correct)*

2

(b) (i) *ideas that*

- outer electron (in element C / 2.8.8.1 / potassium) is at a higher energy level / in a more outer shell/further away from <u>nucleus</u> / shielded by more full electron shells
- electron is more easily lost/less strongly held / attracted

each for 1 mark

2

(ii) *ideas that*

- (element B / 2.8.8 / argon) has an outer shell that is complete/has 8 electrons
- no tendency to gain or lose electrons / has a stable <u>configuration</u>
- *(<u>not</u> 'is stable' / 'in group O' / 'a noble gas')*

each for 1 mark

2

[6]

Q17.

(a) positive / + / 2
gains 1 mark

but 2^+ / ++ / +2
gains 2 marks

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2

(b) *Ideas that:* 2
Ca^{2+}
Br^- *[Do not disqualify for "bromine" ions]*
Ions / They are in the ratio 1:2
any two for 1 mark each

2

[4]

Q18.

(a) (i) neutron *(name only)*

2

(ii) nucleus / protons and neutrons
each for 1 mark
(do not allow mass number)

(b) Li *(correct cases of letters required)*
for 1 mark

1

[3]

Q19.

(a) electrons
neutrons
protons
for 1 mark each

3

(b) mass number no. of neutrons
14 8
for 1 mark each

2

[5]

Q20.

(a) lithium = Li
(ignore mass / atomic numbers)
fluorine = F (do not allow if case is incorrect)
for 1 mark each

2

(b) (allow ● or O for electrons)
(*allow any positions for the seven electrons added provided they are on the outer ring)*
for 1 mark

1

(c) $(2,8)^+$ **or** $(2,7)^-$
(brackets not required) gains 1 mark

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but $(2,8)^-$

gains 2 marks

2

[5]

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