AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.1.1 ATOMIC STRUCTURE, SYMBOLS, RELATIVE ATOMIC MASS, CHARGE AND ISOTOPES (PACK 3)

SCORE	PERCENTAGE
/233	%

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Q1.

(a) protons **(and)** neutrons

*both needed for **1** mark*
ignore p / + and n / 0
*do **not** accept electrons*

1

(b) because the number of protons is equal to the number of electrons

allow protons and electrons balance / cancel out
allow positive / + and negative / - balance / cancel out

1

(c) *it = atom A*

because atom A has a full highest energy level **or** full outer shell

*allow all the shells are full **or** no incomplete shell*

or because atom A has a stable arrangement of electrons

allow because atom A is in Group 0 / a noble gas

1

(d) (atom) B / lithium / Li **(and)**

(atom) C / sodium / Na

*both needed for **1** mark*

1

because they have the same number/one outer electron(s)

linked to answer for first mark
accept because both need to lose one / an electron
allow because (atoms) B and C are in Group 1 / the same group / are alkali metals

1

[5]

Q2.

(a) oxygen **and** water

both needed for mark
allow hydrogen oxide for water
in any order
ignore formulae

1

(b) (i) best fit line, omitting point at 10s

straight line drawn through all correct points

1

(ii) circle around point at 10 s

allow any indication

1

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(iii) 7.5

allow ecf from candidate's line

1

(iv) increases (with time)

accept goes from 0 to 12.5

1

(c) (i) higher

1

(ii) more concentrated

1

(d) (i) share

1

(ii) covalent

1

(iii) simple molecules

1

(e) Water has a boiling point of 100°C

1

Water has a melting point lower than room temperature

1

[12]

Q3.

(a) 79

1

79

1

(b) hundred

1

(c) (i) electron(s)

1

(ii) three

1

(d) changes rate of reaction

accept lowers activation energy

or

speeds up / slows down reaction

accept reduces costs

1

(e) (i) melt

1

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(ii) crosslinking

allow answers on diagram

or

(covalent) bonds between polymers / chains

allow bonds between layers
*do **not** allow intermolecular*

1

[8]

Q4.

(a) 118

1

(b) it loses / transfers electrons

it = Au / gold atom

1

three electrons

*sharing / covalency = max **1** mark*

1

(c) (i) O_2

1

2 CO and **2** CO_2
or
correct balancing of equation from O

accept correct multiples / fractions throughout

1

(ii) *reference to incorrect bonding = **1** mark max*

because carbon dioxide is simple molecular / small molecules

1

there are <u>*intermolecular*</u> forces (between the molecules)

allow <u>intermolecular</u> bonds

1

so a small amount of energy needed (to separate molecules) **or** (*intermolecular forces*) are weak

1

(d) any **three** from:

- gold is the only catalyst for some reactions
- catalysts are not used up
- improves speed of reaction

reduces amount of energy **or** process needs low(er) temperature

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*if no mark awarded, allow catalyst reduce costs (of the process) for **1** mark*

- only small quantities (of catalyst) needed

3

[11]

Q5.

(a) because calcium is +2 and hydroxide is –1

accept to <u>balance</u> the charges

or

to make the compound neutral (in terms of charges)

allow calcium needs to lose 2 electrons and hydroxide needs to gain one electron

1

(b) particles of size 1-100 nm

allow clear comparison to 'normal' size particles

or particles with a few hundred atoms / ions

or particles with a high surface area (to volume ratio)

or as different properties to 'normal' size particles of the same substance

1

(c) $\mathbf{M}_r$ CaO = 56
and

$\mathbf{M}_r$ $Ca(OH)_2$= 74

1

2/56 (x74) **or** 0.036 (x74)
or

allow ecf from step 1

74/56 (x2) **or** 1.3(214…) (x2)

1

2.6(428…) in range 2.6 to 2.96

*correct answer with or without working gains **3** marks*
allow ecf carried through from step 1
ignore final rounding to 3

1

[5]

Q6.

(a) causes dust pollution

1

increases traffic

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1

(b) (i) it is soft

accept the layers of atoms can slide over each other

ignore other properties

1

(ii) contains chromium / nickel

allow contains other <u>metals</u>

1

(c) (i) an element

1

(ii) hard

1

(iii) is resistant to corrosion

1

[7]

Q7.

(a) (i) B

1

(ii) A

1

(iii) C

1

(b) D and E

1

(c) electron

1

[5]

Q8.

(a) gases

1

white

1

solid

1

ammonium chloride

1

(b) reversible

allow phonetic spelling

allow goes both / two / either way(s)

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1

[5]

Q9.

(a) (i) hydrochloric

1

(ii) insoluble

1

filtration

1

(iii) crystallisation

1

(b) any **four** from:

any reference to incorrect bonding = max 3

- calcium atom reacts with **2 chlorine atoms**
- calcium atoms lose electrons

  accept calcium ion is formed
- lose **two** electrons

  accept calcium has a 2+ charge / calcium ion has a 2+ charge

  allow Ca^{2+}
- chlorine atoms **gain** electrons

  accept chloride ion formed
- gain one electron

  accept chlorine / chloride has a negative charge / is a negative ion/ is a negative particle

  allow Cl^-

  *if no other marks awarded allow ionic bonding **or** complete outer shell for **1** mark*

4

[8]

Q10.

(a) less dense than air

1

(b) (i) water

accept hydrogen oxide

*do **not** accept hydrogen dioxide / hydro oxide*

1

(ii) unreactive

1

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(c) atoms

1

(d) electron(s)

1

nucleus

1

[6]

Q11.

(a) (i) removal of oxygen

*accept definition in terms of electrons **or** oxidation numbers*
ignore oxides

1

(ii) 2 (Cl_2)

allow correct multiples

1

(iii) no atoms are lost / made (during a chemical reaction)
or
the atoms are rearranged (during a chemical reaction)

accept because of (the law of) conservation of mass / matter

1

(b) (i) sodium is more reactive (than titanium)

*accept sodium is very reactive **or** titanium is less reactive*
*do **not** accept sodium is more reactive than argon*

1

(ii) any **one** from:

- sodium / titanium would react with oxygen / air
  accept air / oxygen is reactive
- sodium / titanium does not react with argon
  accept argon is unreactive / inert / a noble gas / in group O

1

(c) (i) all atoms are the same / it only contains one type of atom

accept all ions are the same
*do **not** accept only got one atom*
*do **not** accept all atoms are the same size*
ignore particles

1

(ii) two <u>different</u> / <u>types</u> atoms / elements / ions

accept more than one type of atom / ion / element
*do **not** accept different size*

1

bonded / joined together

accept definite proportions

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*do **not** accept mixture*

1

[8]

Q12.

(a) diagram **A**

1

(b) the atoms can slide over each other.

1

the atoms are in layers

1

(c) (i) sulfuric

1

(ii) bubbles are produced

1

the magnesium disappears

1

(iii) crystallisation

1

[7]

Q13.

(a) (i) 65

*correct answer with or without working = **2** marks*
if answer incorrect
*evidence of (81 - 16) for **1** mark*
ignore units

2

(ii) zinc

accept error carried forward from (a)(i)
allow correct symbol
answer given should be element / metal closest to their answer
*do **not** allow compounds*

1

(b) (i) • it loses electrons

*sharing / covalency = max **1** mark*

1

• three electrons

1

(ii) 8 electrons shown in second shell.

accept dots / crosses / mixture of dots and crosses / e
electrons do not need to be paired
*do **not** allow extra electrons in first shell*

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1

[6]

Q14.

(a) • made of layers / rows (atoms / ions / particles)

ignore free / delocalised electrons

1

• which can slide / slip (over each other)

*reference to incorrect particles / covalency / intermolecular forces = max **1***

or

particles / ions / atoms can slide over each other

ignore malleable / ductile / weak bonds

1

(b) (i) sulfuric

accept sulphuric

ignore formula

ignore hydrogen sulfate

1

(ii) any **two** from:

list principle applies for incorrect observations

• (hydrogen) gas produced (or any indication of a gas such as bubbles etc.)

ignore just hydrogen produced

ignore cloudiness / colour changes

• magnesium / solid disappears / goes into solution

accept magnesium / magnesium sulfate / solid / it dissolves

accept forms a liquid / solution

• gets hot

allow exothermic

ignore floats

2

(iii) crystallisation

accept detailed answers such as: evaporate to half volume and then allow the solution to crystallise.

or

evaporation / heating / boiling / cooling

ignore any references to filter

1

[6]

Q15.

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(a) gives out / releases / transfers to surroundings heat / energy

ignore light / burns

ignore the wire gets hot

1

(b) activation energy

1

(c) (aluminium +) oxygen (→) aluminium oxide

accept correct formulae

1

(d) C

1

(e) (i) a negative

1

(ii) loses

1

(iii) gains

1

two

1

[8]

Q16.

(a) gives out heat / energy

allow more energy given out in making bonds than is used in breaking bonds

or

energy / heat transferred to surroundings

ignore light

1

(b) activation

allow phonetic spelling

1

(c) (i) 2 crosses on inner circle **and**

8 crosses on outer circle

accepts dots / e / – for electrons

1

(ii) opposite charges (attract)

allow electrostatic forces (attract)

*do **not** accept intermolecular attraction / shared electrons*

1

[4]

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Q17.

(a)

$\frac{6.21}{207}$ $\frac{0.64}{16}$

***1** mark for dividing mass by A_r*
*max **2** if A_r divided by mass*

1

= 0.03 = 0.04

***1** mark for correct proportions*

1

3 4

***1** mark for correct whole number ratio (allow multiples) can be awarded from correct formula*

1

Pb_3O_4

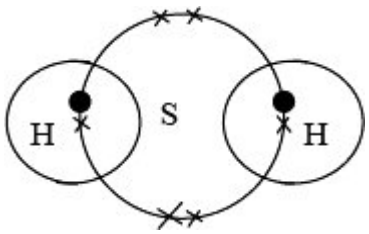
***1** mark for correct formula*

ecf** allowed from **step 2 to step 3** and **step 3 to step 4** if sensible attempt at **step 1

*correct formula with no working gains **2** marks*

1

(b) (i)



*allow all dots **or** all crosses **or** e **or** e^-*

ignore inner shells and any inner electrons

allow 4 non-bonded electrons anywhere on shell as long as not in overlap – need not be paired

1

(ii) forces of attraction / bonds between molecules are weak (owtte)

*do **not** accept intramolecular forces / covalent bonds are weak*

*do **not** accept reference to ions*

or

intermolecular forces / bonds are weak (owtte)

or

it is made of small molecules with weak forces of attraction

*if **2** marks not awarded*

*made of small molecules / simple molecular gains **1** mark*

*forces of attraction are weak (without specifying between molecules / intermolecular) gains **1** mark*

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(accept easily broken / not much energy needed to break instead of weak)

bonds are weak without specifying intermolecular would not gain a mark and would be ignored

2

(iii) 4

1

[8]

Q18.

(a) elements

1

(b) (i) nucleus

1

(ii) six

1

(c) (i) CH_4

1

(ii) bond

1

(d) (i) oxygen

1

(ii) any **one** from:

- (water) does not pollute
  accept no harmful gas(es)
  allow less pollution
- (only) water is produced
- no carbon dioxide / monoxide (is produced)
  *accept no greenhouse gas(es) / effect **or** no global warming*

1

[7]

Q19.

(a) (i) protons

1

(ii) neutrons

1

(b) heavier than

1

H-2 atoms are heavier than H-1 atoms

can be awarded even if they do not circle heavier than

or

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the hydrogen atoms are heavier / more particles in the nucleus of the hydrogen atoms / one more particle in each hydrogen atom / a neutron in each hydrogen atom etc

must be linked to heavier than

a correct explanation of the increase in mass by ref. to the particles in the hydrogen atoms

ignore reference to particles in the oxygen atoms

or

molecule A has more particles / neutrons

*do **not** accept incorrect numbers of particles*

accept molecule A has more protons and neutrons

molecule A has higher mass numbers

or

molecule A has a larger nuclear mass / atomic mass
A has two more neutrons than B

hydrogen has a greater mass number in A

all the numbers in the molecule A

add up to 6 and in molecule B add up to 4

molecule A has

$^{2}_{1}H$

and B

$^{1}_{1}H$

1

[4]

Q20.

(a) (i) mix (owtte)

accept to allow more collisions / helps particles to collide (owtte)

idea of more efficient heat transfer

*do **not** allow heat is a catalyst*

1

(ii) higher **and** more

1

powder **and** big

1

concentrated **and** more

1

(b) electrons

1

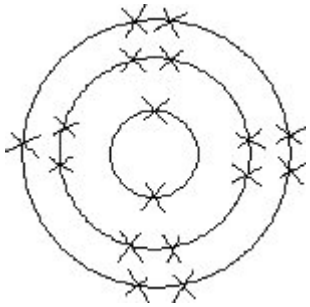
(c) H^+

1

[6]

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Q21.

(a) 

accept dots / crosses / e
must be drawn on diagram
electrons do not need to be paired
ignore brackets or + or -charges
ignore 2,8,7

1

(b) (one) electron

recognition that electrons are involved

1

lost / given away / transferred from sodium / transferred to chlorine owtte

must be linked to electrons
*accept loses electron(s) for **2** marks*
*NB loses 2 or more electrons gains **1** mark*
*reference to sharing / covalent max **1** mark*
ignore charges on ions formed

1

(c) (i) any **one** from:

- ions / atoms / they are / it is negatively charged / anions
  accept they are negative
- opposite (charges) attract
  accept they are <u>attracted</u> or it is oppositely charged
  ignore opposite forces attract

1

(ii) hydrogen

accept H_2
ignore H or H^+

1

(d) (i) poisons released into environment (owtte)

accept any sensible idea of harm / harmful / poisons / poisonous / pollution / damaging
*do **not** accept answers such as global warming / ozone layer etc.*
ignore safety unless qualified

1

(ii) any **one** sensible idea eg

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- loss of work / unemployment
  eg shops / house prices etc.

  or
  company goes out of business
- any adverse effect on local economy (owtte)
- any adverse effect on paper production / cost of paper / cost of water (treatment)
  allow less expensive to use chlorine or converse
- chlorine (compounds) have been used (for many years) without causing harm owtte
- only a tiny amount of chlorine is released so it would not cause harm
  ignore uses of chlorine to treat drinking water unless qualified

1

(iii) ideas related to bias
accept more reliable or valid or fair
ignore more accurate / fair test

1

[8]

Q22.

(a)

$^{2}_{1}H$

2 and 1 must be on the left
2 must be above half-way on the H and the 1 below half-way
accept diagram with 2 <u>different</u> particles in centre and 1 particle on circle

1

(b) (i) 18
ignore working
ignore units

1

(ii) forces (of attraction) between molecules **or**
bonding between molecules **or**
intermolecular forces /intermolecular bonds

1

are weak **or** not much energy needed to break them **or** easily overcome
must be linked to first mark
*if no other mark awarded allow <u>small</u> molecules / small M_r for **1** mark*
*allow forces / bonds are weak for **1** mark*

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*do **not** allow covalent bonding is weak*

1

(c) *any reference to <u>more</u> protons = **0** marks*

H-2 atoms have 1 proton and 1 neutron

*allow H-2 has more neutrons / particles for **1** mark*

1

H-1 atoms have one proton

*allow H-2 has two particles and H-1 has one particle for **1** mark*

or

H-2 atom has one neutron (1)

*allow H-2 atom has one more neutron for **2** marks*

H-1 atom has no neutrons (1)

***NB** heavy water (molecule) has 2 <u>more</u> neutrons = **2** marks*

*heavy water (molecule) has <u>more</u> neutrons / particles = **1** mark*

*if no other mark awarded then heavy water molecule has M_r of 20 = **1** mark*

ignore reference to electrons

1

[6]

Q23.

(a) (i) nucleus

1

(ii) neutron

1

(iii) electron

1

(b) (i) 6

1

(ii) 12

1

(c) $^{14}_{6}C$

1

(d) (i) CH_4

1

(ii) compound

1

(iii) covalent

1

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[9]

Q24.

(a) (i) precipitation

1

(ii) filtration

1

(iii) lead nitrate

1

sodium iodide

1

(b) *sharing / covalent / metallic = max **3***

any **four** from:

- magnesium (atom) reacts with **two** iodine (atoms)
- magnesium (atom) loses
- **2** electrons
- iodine (atom) gains
- **1** electron **or** an electron
- iodide ion formed
  allow iodine ion
  allow iodine
  ignore I^{2-}
- iodide has negative charge / is a negative ion / particle
- magnesium ion formed
- magnesium has positive charge
- oppositely charged ions attract
- a giant structure / lattice is formed
  *if reference to ions being formed is made unqualified, allow **1** mark*

4

[8]

Q25.

(a) 2,4 (drawn as crosses) on shells
accept dots / e / - etc.

1

(b) (i) hard
allow rigid / high melting point

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*do **not** allow references to bonding*
ignore strong
ignore unreactive
ignore structure

1

(ii) any **three** from

*max **2** if ionic / metallic / molecule / intermolecular bonds **or** incorrect number of bonds*

- giant structure / lattice / macromolecular
  allow many bonds
- covalent (bonds)
- (covalent) bonds are strong
  accept needs lots of energy to break bonds (owtte)
- (each) carbon / atom forms four bonds

  or

  (each) carbon / atom bonded to four other atoms

3

(c) any **three** from:

*max **2** if ionic / ions / metallic / molecule*
'it' needs to be qualified

graphite

- has delocalised / free electrons
  *do **not** accept the electrons move unless qualified (around structure etc)*

  or

  electrons that can move through / around the structure
- each carbon is joined to three other carbon atoms
  allow graphite has three bonds

  or

  one electron from each atom is free / delocalised

diamond

- has no free / delocalised electrons
  *do **not** accept the electrons do not move*

  or

  no electrons that move around the structure
- all the electrons are used for bonding

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allow diamond has 4 bonds

or

each carbon joined to four other carbon atoms

3

[8]

Q26.

(a) (i) lead nitrate

accept $Pb(NO_3)_2$

*do **not** accept nitride*

1

sodium iodide / potassium iodide

accept NaI / KI

accept other correct soluble iodides

*do **not** accept sodium iodine / potassium iodine*

1

(ii) filter / filtration / filtering

accept decant / decanting etc.

accept centrifugation

*ignore evaporation **or** heating if after filtration*

1

(b) *metallic / sharing / covalent **or** molecule = max **3***

magnesium <u>loses</u> **<u>2</u>** <u>electrons</u>

all three underlined ideas must be present

*two underlined ideas = **1** mark*

eg magnesium loses electrons

or

magnesium gains 2 electrons

or

magnesium loses 2 ions

*nb magnesium **ion** loses 2 electrons = **1** mark*

*2 errors = **0** marks*

eg magnesium gains electrons

all four underlined ideas must be present

2

<u>iodine gains</u> **<u>1 / an</u>** <u>electron</u>

*three underlined ideas = **1** mark*

eg iodine gains electron(s)

or

iodine loses 1 / an electron

or

iodine gains 1 / an ion

or

iodide (ion) gains 1 / an electron

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*2 errors = **0** marks*

2

(c) any **two** from:

*mention of molecules / intermolecular / covalent / atoms = max **1***

- forces (of attraction) / bonds are <u>strong</u> **or** lot of energy needed to break bonds
- oppositely charged ions <u>attract</u> **or** electrostatic <u>attraction</u> between ions
- <u>giant</u> structure **or** <u>lattice</u>

allow many bonds
ignore ionic bonding unqualified

2

[9]

Q27.

(a) atoms

1

(b) mixture

1

metal

1

structure

1

smart

1

(c) (i) any **two** from:

- saves raw materials / iron ore
- saves energy / fuels
  accept cheaper / saves money
- make new / useful items
- make money / it is economic
- <u>reduces</u> pollution
  allow less harmful for the environment
- decreases cost of steel cans
- reduces carbon dioxide emissions
- decreases waste materials / use of landfill

2

(ii) any **one** from:

- provide information / education of the need to recycle

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- legislate against / charge for waste
- reward / pay people to recycle
  accept fine people for not recycling
- put labels on the cans
- provide recycling bags / bins / areas

1

[8]

Q28.

(a) (Chromium =) 20

1

in correct order

(Nickel =) 8

accept Chromium = 8 ***and*** *Nickel = 20 for* ***1*** *mark*

1

(b) (i) (because iron is made up of only) one type of atom

1

(ii) not strong

ignore soft / corrosive / flexible
accept it rusts / corrodes ***or*** *that it could wear away*
accept could change shape / bend
accept layers / atoms could slide (over each other)

1

(iii) has different sized atoms / particles
or
structure is different/distorted / disrupted

accept not in layers ***or*** *not regular*

1

so it is difficult for layers / atoms / particles to slip / slide (over each other)

accept layers cannot slip / slide

1

[6]

Q29.

(a) C_3H_8

capital letters for symbols numbers must be halfway or lower down the element symbol
allow H_8C_3
do ***not*** *allow 3:8* ***or*** C_3 *and* H_8

1

(b) (i) electron

1

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(ii) covalent

1

(c) low **and** small

*both for **1** mark*

1

[4]

Q30.

(a) (i) increase

1

(ii) high melting point

1

(b) (i) decreases

1

increases

1

(ii) it gives the particles more energy

1

it makes the particles move faster

1

[6]

Q31.

(a) 152 correct answer with **or** without working = **2 marks**
56 + 32 + (4 ×16) gains **1** mark

ignore any units

2

(b) 152g(rams)

ecf from the answer to (a) and g
must have unit g / gram / gramme / grams etc
*accept g / mol **or** g per mole **or** g mole^{-1} **or** g/mol **or** g per mol **or** g mol^{-1}*
*do **not** accept g m*
*do **not** accept G*

1

(c) 76(g)

ecf from their answer to (a) or (b) divided by 2
ignore units

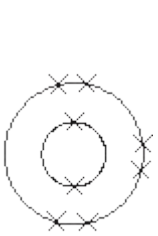
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[4]

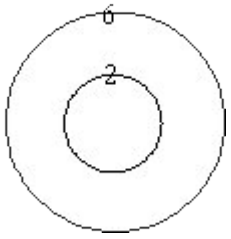
Q32.

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(a) (i)



or



1

allow any arrangement of electrons on the shells

*accept o, x, - **or** e as representing electrons*

(ii) nucleus

accept nucleus (protons plus neutrons)

*do **not** accept protons plus neutrons on its own*

allow nuclei / nucles / neucleus / phonetic spelling

*do **not** accept neutron*

1

(b) it has **2** more neutrons **or** converse

*accept 'it has more neutrons' **or** 'different number of neutrons' for **1 mark***

*'2 more protons / electrons + correct number of neutrons' = max **1** mark*

or

O-16 has 8 neutrons (**1 mark**)(*)

O-18 has 10 neutrons (**1 mark**)(*)

*(*)if incorrectly calculated but shows more neutrons in 0-18 allow for **1** mark*

accept it has more particles

or

*it has 2 more particles for **1** mark*

ignore any reference to charges

*just 2 more without reference to particles = **0** marks*

2

[4]

Q33.

(a) (i) increase (owtte) **or** gets hotter

ignore gives out heat / takes in heat

1

(ii) any **two** from:

- bonds are strong

  accept hard to break

- a lot of energy needed to break bonds

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allow heat for energy

- all atoms are joined by (covalent bonds
  accept forms lattice

- a large number of bonds would need to be broken
  *reference to ionic / metallic = **1** mark*
  *intermolecular forces /forces between molecules = max **1** mark*
  ignore electrostatic
  *many strong bonds need to be broken = **2** marks*
  accept 'double bonds' as equivalent to bonds

2

(b) any **two** from:

- particles have more energy
  ignore more vibrations

- particles move faster
  ignore move more

- particles collide more often **or**
  more collisions
  accept answers such as hit / bump

- more particles / particle collisions
  have the activation energy
  or
  more of the particles / particle collisions have
  enough energy to react
  or
  collisions are more energetic / harder (owtte)
  or
  more of the collisions are successful
  *if electrons rather than particles stated then max **1** mark*
  *there are more collisions and more of the collisions are successful = **2** marks*
  *accept more collisions per second / unit of time for **2** marks*
  *accept 'more successful collisions' for **1** mark*

2

[5]

Q34.

(a) 2.61 / range 2.5 to 2.7
*correct answer with **or** without **or** with wrong working gains **2** marks*
(accept answers between 2.5 and 2.7)
if answer incorrect moles of salicylic acid = 2/138 = 0.0145 moles
*ie 2/138 **or** 0.0145 gains **1** mark*

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or
*(180/138) × 2 gains **1** mark*
or
*1 g → 180/138 = (1.304 g) gains **1** mark*
*(**not** 1.304g alone)*

2

(b) 42.1 range 40.7 to 42.3

*accept correct answer with **or** without **or** with wrong working for **2** marks*

*ecf ie (1.1 / their answer from (a)) × 100 correctly calculated gains **2** marks*

*if answer incorrect percentage yield = 1.1 / 2.61 × 100 gains **1** mark*

if they do not have an answer to part (a)
or
they choose not to use their answer then:

- yield = (1.1 / 2.5) × 100 (1)
- = 44

*accept 44 for **2** marks with no working*

2

(c) any **one** from:

- errors in weighing
- some (of the aspirin) lost

  *do **not** allow 'lost as a gas'*
- not all of the reactant may have been converted to product

  eg reaction didn't go to completion

  allow loss of some reactants
- the reaction is reversible

  accept other products / chemicals
- side reactions

  ignore waste products
- reactants impure
- not heated for long enough
- not hot enough for reaction to take place

1

(d) any **one** from:

- use lower temperature
- use less fuel / energy

  ignore references to use of catalyst

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- produce product faster **or** speed up reaction
- more product produced in a given time (owtte)
- increased productivity
- lowers activation energy

1

[6]

Q35.

(a) conducts (electricity) **or**

accept flexible

allows electrons / current to flow

ignore conducts heat

1

(b) electron

1

(c) (i) lithium>copper>tungsten **or**

Li>Cu>W

all correct

*allow **1** mark for one metal in the correct position*

2

(ii) has high / highest melting point

accept has high / highest boiling point

or

can withstand the highest temperature

1

(d) unreactive

1

[6]

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