Mark schemes

1 (a) any **one** from:

- they are made of layers

  *do **not** accept line / rows / lattice*

- atoms / ions / particles / layers (of atoms) can slide over each other

1

(b) any **one** from:

- smaller / tiny **or** very small

  *do **not** allow small alone*

- correct size range 1 to 100 nanometres

- a few hundred atoms in size

  if they state smaller and give a size outside range ignore size if it is less than 20,000

1

(c) harder

1

plus **one** from:

- so does not wear as quickly / erode as quickly
  ignore corrode
- less vulnerable to damage owtte
  *harder to wear down = **1** mark*
- because they have a high surface area to volume ratio

or

stronger (1)

plus **one** from: (1)

- less likely to break / do not break
  accept withstand pressure
- not as vulnerable to damage owtte
  *harder and stronger alone gains **1** mark*
- do not bend out of shape
- because they have a high surface area to volume ratio

1

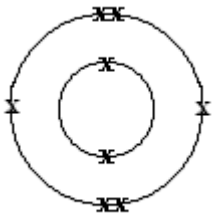
[4]

2 (a) $2Mg + O_2 \rightarrow 2MgO$

accept correct multiples / fractions

1

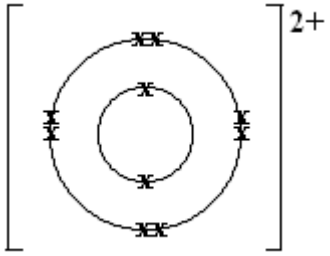
(b)



electrons do not need to be paired
accept dots / circles / e instead of crosses
*do **not** allow 2.6 without diagram*

1

(c)



electrons do not need to be paired
allow without bracket s/ must have the charge
accept dots / circles / e instead of crosses
ignore extra empty outer shells
ignore nucleus
*do **not** allow $[2.8]^{2+}$ without diagram*

1

(d) oppositely charged (ions / atoms)
allow positive and negative(ions / atoms)

1

(they) attract
must be in correct context
accept held by electrostatic forces
ignore ionic bonding
***maximum 1** if they refer to intermolecular forces / attractions / covalent bonds*

1

(e) magnesium chloride
accept $MgCl_2$ (if correctly written)

1

[6]

3 (a) (an alloy) that can return to its original shape (after being deformed / bent / twisted)
accept (on heating / cooling) it returns to its shape

1

(b) any **two** from:

- brass / it is a mixture
  accept brass / it is not pure
- zinc changes structure / disrupts patterns or layers
- copper metal atoms / layers able to slide over each other
  accept zinc prevents atoms / layers sliding over each other

2

(c) (i) oxygen / O_2 / O

1

(ii) lead remains (in furnace) because of its high boiling point

1

zinc boils / evaporates (out of furnace) because of its low boiling point 1 if neither mark awarded then allow **1** mark for different boiling points
ignore references to melting points

1

[6]

4

high

1

giant
allow covalent

1

four

1

covalent

1

[4]

5 any **four** points from:

- high melting point owtte
  ignore boiling point
- many **or** all atoms joined together
- each silicon (atom) joined to four oxygen (atoms) **or** each oxygen joined to two silicon
- covalent (bonds)
- many bonds would need to be broken
- strong bonds
  allow hard to break bonds
- lot of energy / heat needed to break bonds
  allow high temperature needed to break bonds
- giant / macromolecular / lattice / diamond structure
- unreactive
  *allow doesn't react with materials within furnace = **1** mark*
- rigid / hard structure
- no free electrons
- poor conductor of heat

  *giant covalent structure = **2** marks*
  *max **3** if ionic / metallic bonding mentioned*
  ignore electrostatic
  ignore molecules / intermolecular forces

[4]

6 (a) 2.8.3 on diagram as Xs / dots

or e

*accept paired **or** unpaired*

1

(b) any **two** from:

- electrons in highest energy level **or** electrons in outer shell
- electrons are delocalised **or** sea of electrons
- electrons are free **or** electrons move around / flow
- electrons carry charge / current

ignore carry electricity

2

[3]

7 (a) (i) contain enough metal to make it economical / worth while to extract

1

(ii) reduction

accept displacement

accept redox

1

(iii) $Fe + CO_2$

*do **not** accept Fe_2 / Fe_4*

1

correct balancing

accept multiples and halves

$\mathbf{2}Fe_2O_3 + \mathbf{3}C \rightarrow \mathbf{4}Fe + \mathbf{3}CO_2$

allow Fe_2 / Fe_4 as ecf

1

(b) **Pure Iron**

(in pure metal all the atoms are the same size and) able to slip / slide over each other – (property soft)

OWTTE

ignore references to molecules / particles

if they say 'move' both times, allow ***one*** *mark but 'crack' or 'split' is wrong..*

1

Cast iron

(in cast iron) different sized atoms / larger atoms **or** structure is distorted / disrupted

OWTTE

1

so it is difficult for layers of atoms to slip / slide over each other

OWTTE

1

(c) any **three** from:

- conserves / saves resources / metal ores
- saves energy resources (used for extraction / processing)

  accept cheaper / saves money
- decreases waste materials
- decreases a named pollution

  do ***not*** *accept acid rain*

3

[10]

8 (a) (i) any **one** from:

- iron ore is a limited resource / non-renewable
- iron is in high demand
- provide jobs
- economic advantage

1

(ii) any **two** from:

- would damage (wildlife) habitats / countryside / greenfield sites
- extra traffic
- visual (pollution) / eyesore
- noise (pollution) / sound (pollution)
- dust (pollution)
- river (pollution)
- carbon dioxide (from traffic) / adds to greenhouse effect / global warming
- damage roads / buildings by vibrations / shockwaves

2

(b) (i) carbon monoxide / carbon

accept formulae CO / C

1

(ii) atoms

accept (particles) are all the same (size) / type for one mark

1

are all the same (size) / type

1

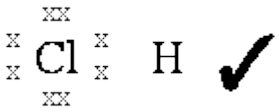
(iii) any **two** from:

- impurities / carbon / different (sized) atoms **or** elements **or** metals
- changes the structure / disrupts the pattern or layers
- prevents layers sliding over each other
- it is an alloy

2

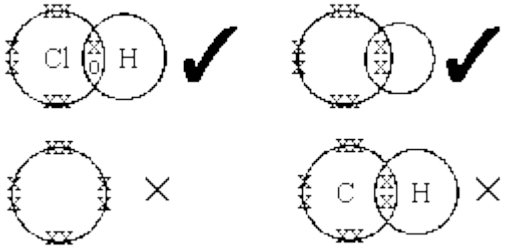
[8]

9 (a) bonding pair in the overlap **and** 6 other electrons arranged around the chlorine



must have either circles or symbols

need not be pairs but must not be in the overlap region
accept without H and Cl if clear
accept all x's or all o's



1

(b) H_2 + Cl_2 → 2HCl

accept multiples or fractions
accept correct formulae but not balanced for 1 mark

correctly balanced equation containing
'correct' lower / upper case symbols gets 1 mark

2

(c) $MgCl_2$

accept $Mg^{2+}(Cl^-)_2$

1

(d) because magnesium chloride is made of ions **or** is ionic

accept there are strong forces of attraction between the ions / particles in $MgCl_2$ *or strong electrostatic attractions*

accept more energy to separate particles in $MgCl_2$

*do **not** accept* $MgCl_2$ *molecules*
*do **not** accept reference to breaking bonds*

1

hydrogen chloride is made of molecules **or** is covalent

accept there are only weak forces of attraction (between the particles / molecules) in HCl

*do **not** accept weak covalent bonds*
*do **not** accept reference to breaking bonds*
*do **not** accept* $MgCl_2$ *is a solid and HCl is a gas*

1

[6]

10 (a) (i) **Quality of Written Communication**

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

maximum 2 marks if ideas not expressed well

layers / lattice / giant structure / regular pattern of atoms (diagram)

allow layers / lattice / giant structure / regular pattern of ions

*do **not** accept particles*

1

outer (shell) electrons

accept valence electrons

1

(free to) move (through whole structure)

accept delocalised / mobile / free

1

(ii) the free electrons (allow the metal to conduct electricity)

accept electrons move / mobile / delocalised

1

(iii) atoms / ions / layers can slide / slip / move over each other

1

(b) (i) copper oxide formed **or** Cu reacts with oxygen **or** Cu is oxidised

1

this is a poor conductor **or** gets in the way of free moving electrons **or** fewer mobile electrons

*do **not** accept electricity*

1

or

oxygen atoms / oxygen molecules / oxide ions in metal

do not accept oxygen pockets / bubbles

prevents / disrupts flow of electrons /
current or fewer mobile electrons (1)

*do **not** accept macro explanations*
*do **not** accept electricity*

(ii) hydrogen reacts with oxygen or water is formed **or** hydrogen reduces copper oxide etc.

1

[8]

11 (a) (i) to remove or separate copper oxide

accept to remove or separate unreacted or excess base

accept to remove or separate insoluble solids

1

(ii) heat (the solution)

accept heat the water

accept evaporate the water

***rapid** cooling/cool to lower temperature*

accept boil the water or solution

***not** increase surface area, put in draught*

***not** increase the temperature*

1

(iii) aqueous

accept in water

accept solution

***not** soluble in water*

1

(b) add water/liquid/solution

1

colour changes to blue

1

[5]

12 (a) made of atoms which contain the same number of protons

accept made of only one type of atom

accept cannot be broken down into anything simpler by chemical means

1

(b) non-metals

1

metals

1

(c) sodium

1

<u>too</u> reactive (with water **or** air)

*accept has a low melting point **or***
*will melt **or** not strong **or** will explode **or** will burn*

*do **not** accept dangerous (neutral)*

*do **not** accept iron as rusting **or***
*copper **or** sodium as expensive (neutral)*

*do **not** accept not a good conductor of heat*

1

[5]

13 (a) any **two** points **one** mark each

accept comparison between aluminium and iron

aluminium has:

- a low density

  accept lighter or fewer pylons

- a good conductor of electricity
- does not corrode **or** rust

  *do **not** accept does not react with air*

  *do **not** accept last longer*

2

OR

- iron has:
- high density
- is a less good conductor (of electricity)
- rusts or reacts with air

(b) any **5** from:

- employment of people **or** cost of employment
- depletion or use of resources

  *do **not** accept depletion here*

- cost of energy resources
- cost of machines **or** buildings
- pollution by noise from traffic **or** quarrying

- air pollution by dust **or** traffic fumes
- danger of traffic on roads
- damage to landscape (eyesore)
- damage to habitats of wildlife
- lowers the value of houses nearby
- subsidence **or** vibration can affect roads **or** houses
- providing raw materials

*do **not** accept danger **or** falling in*

5

[7]

14 (a) (i) (s) (aq) (1) (g)

*2 **or** 3 correct **1** mark*
*1 correct **0** marks*

2

(ii) calcium chloride

1

(b) (i) points

*deduct **1** mark for each error to a maximum of **2** marks*

2

line

accept a single line 'best fit' curve
accept reasonable attempt at curve

1

(ii) increase temperature **or** heat

*accept increase surface area **or***
*increase concentration **or** description*

1

(iii) 75% or ¾

not pure 1 mark

only 60 cm^3 (instead of 80 cm^3 of gas)

or $\frac{60}{80}$ *× 100 **1** mark*

3

[10]

15 (i) electrons 1

for 1 mark

(ii) covalent 1

for 1 mark

(iii) made of small molecules:
usually gas or liquid) dependent on
have low melting points) having first
have low boiling points) point above
forces between molecules are weak

any 1 for 1 mark

3

[5]

16 (a) 8 marks Particularly well structured answer with most points mentioned.

7-6 marks Well structured answer. The two metals will have been compared rather than simply listing advantages/disadvantages. Most of the advantages and disadvantages of each metal have been mentioned.

5-3 marks Some structure to the answer. An attempt to compare the metals by giving some advantages and disadvantages.

2-1 marks Little structure or attempt to compare. Marks gained by listing a few advantages or disadvantages.

Advantages of Nickel:
Relatively low cost which makes the sparking plugs cheaper to produce.
Quite high melting point which is needed because the temperature in the engine is very high.
Good conductor of electricity needed to carry electricity into combustion chamber to produce spark.

Disadvantages of Nickel:
Subject to corrosion in engine which means they only last a short time
because nickel is higher in reactivity than platinum.
Idea that this leads to reduced efficiency, unburnt petrol and air pollution.

Advantages of Platinum:
Less susceptible to corrosion (not corroded) because platinum is very low in reactivity.
Idea that this improves efficiency and reduces pollution.-
Higher melting point than nickel to withstand the high temperatures in the combustion chamber.
Last a lot longer than nickel electrodes due to low reactivity.
(Sensible extension here could be longer service intervals etc.)-
Good conductor of electricity as for nickel.
Extension here could be linked to the idea that the conductivity does not deteriorate as quickly as nickel.)

Disadvantages of Platinum:
Cost *which will make the sparking plug more expensive.*
A good candidate might justify cost by longer life, better fuel consumption and less pollution.

8

(b) (i) giant structure/lattice/regular arrangements of atoms
any for 1 mark

of atoms/of ions (provided free electrons mentioned)
either for 1 mark

delocalised or free electrons
for 1 mark

3

(ii) electrons free/can move
for 1 mark each

2

[13]

17 (a) coinage bronze

1

(b) (97/100) × 2.5 = 2.425
each line for 1 mark

2

(c) 3 points from the following:
hard wearing,
resistant to corrosion,
low in reactivity
low density
abundant metal/low cost
shiny/appearance
not brittle
(Other properties of metals treated as neutral)

3

[6]

18 (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

(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]

19 (a) 4 HCl / $2H_2O$, allow multiples **or** fractions if whole equation balances

for 1 mark

1

(b) germanium tetrachloride + water = germanium oxide + hydrochloric acid
If symbol equation given it must be correctly balanced
Allow germanium

for 1 mark

1

(c) to purify the germanium oxide/remove impurities/give in pure product/to make pure germanium

for 1 mark

1

ensure complete reaction/reaction does not give a good yield

not to increase efficiency/to purify germanium

for 1 mark

1

(d) (i) remove oxygen/addition of hydrogen/gain up electrons allow remove oxygen molecules

(ii) $GeO_2 = 73 + (2 \times 16) = 105$
mass of germanium = 525 × (73/105)
= 365 g
(or alternative methods)
apply consequential marking
for 1 mark each

3

(e) (i) germanium is shiny/lustrous
conducts a small amount of electricity *
germanium oxide reacts with hydrochloric acid
(and) metal oxides react with acid
metal oxides are basic
metal oxides are reduced by hydrogen
Information must be taken from the passage.
Apply the list principle if more than three answers are given.
Assume the word 'it' refers to the metal.
any 3 for 1 mark each

3

(ii) germanium is brittle
germanium tetrachloride is a (volatile) liquid
made of molecules
germanium tetrachloride has covalent bonding or when two non-metals react they have covalent bonding
$GaC1_4$/the salt of germanium undergiven hydrolysis/reacts with water
germanium is not a good conductor of electricity*
* conductivity mark can only be given once
any 3 for 1 mark each

3

[13]

20 (a) elements: aluminium, copper,
compounds: pure water, sodium chloride,
mixture: beer, milk
2/3 correct gains 1 mark
4/5 correct gains 2 marks
all correct gains 3 marks

3

(b) metals: can be hammered into shape,
good conductor of electricity, shiny
non metals: brittle, dull, poor conductors of electricity

2/3 correct gains 1 mark
4/5 correct gains 2 marks
all correct gains 3 marks

3

[6]

21 (a) covalent/description of covalent

for 1 mark

1

(b) forces/bonds between the molecules/particles (<u>not</u> atoms) are weak

for 1 mark each

2

(c) non-flammable so it will not burn etc.
extremely unreactive so it will not react with materials in the transformer,
does not conduct electricity so it can insulate the transformer
gas so it has freedom to move and insulate whole area

for 1 mark each

3

[6]

22 (a) some electrons from outer shells
(some electrons) free to move/mobile
through whole structure/between atoms/sea of electrons
hold atoms together

for 1 mark each

<u>or</u> positive ions in a sea of electrons (owtte)

2 marks

atoms in regular structure/layers
giant structure
close packed
credit diagrams – look for labels

for 1 mark each any 4

4

(b) (i) electrons,
free to move (reference to electrons)

for 1 mark each

2

(ii) layers/atoms can slide over each other

for 1 mark

1

(iii) free electrons hold atoms strongly together/strong forces of attraction/bonds (between atoms)/tight packing of atoms

for 1 mark

1

[8]

23 (a) **X** – (metal) atom / ion

1

Y – electron

1

(b) free electrons or electrons move

1

(allow metal) atoms / ions to slide over each other

OR

bonding non - directional for 2 marks

1

[4]

24 (a) (i) $2\ Mg + O_2 \rightarrow 2\ MgO$

both 2s needed

*allow O_2 **or** any correct multiple* $\frac{1}{2}$

1

(ii) solid

1

gas

1

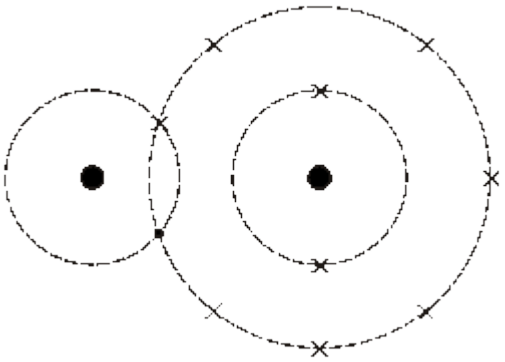
(b) $MgCl_2$ / $C1_2Mg$

*do **not** accept MG mg mG CL cl cL*
ignore charges

1

[4]

25 (i) 1



(ii) weak forces

accept weak bonds

1

between <u>molecules</u> / intermolecular

reject intramolecular

1

[3]

26 (a) proton + (1)

both required

neutron 1

both required

electron – (1)

both required

3

(b) 2.8.3

accept words or diagram to this effect

1

(c) (i) 24

1

(ii) 52

1

(d) any **one** of

- gains one or more electrons

  accept gains an electron

- becomes an anion

  do not credit becomes an ion

- becomes a negative ion

1

(e) sodium ions have a (single) positive charge and chloride ions have a (single) negative charge

do not credit 'chlorine ions' but

allow this error to be carried forward

1

ions with opposite charge are attracted (to each other)

***or** the positive ions and the negative ions are attracted (to each other)*

***or** the sodium ions and the chloride ions are attracted (to each other)*

1

(positive and negative) ions are arranged alternatively (in each direction **or** dimension)

***or** ions with the same charge are repelled (by each other) no mark for just ionic bonds*

1

[10]

27 (i) two

or 2

1

(ii) magnesium **and** chloride

either order

***not** positive / negative*

do not credit'chlorine'

*accept Mg^{++} **and** Cl^{-}*

do not credit just Mg and Cl^{-}

*accept cation(s) **and** anion(s)*

1

(iii) 2

1

(iv) electrons

accept charges

1

(v) any **three** from

- (is a) giant structure/lattice structure
- crystalline / hard

  accept just 'crystals(s)'
- high melting point / solid
- high boiling point
- conductor (of electricity) when dissolved **in** water

  ***or** conductor (of electricity) when ions are free to move*
- conductor (of electricity) when molten
- soluble in water

3

[7]

28 (a) (i) sodium..... positive **or +**

***both** required*

1

chloride... negative **or –**

***both** required*

do not credit chlorine

1

(ii) ions not free (to move) in solid crystal / lattice

ions are free to move when sodium chloride is molten

1

or ions are mobile

do not credit when ions are molten

allow 'particles' for ions (1) mark

do not credit electrons etc

1

(iii) dissolved in water

or *in aqueous solution*

accept in solution

accept in water

or *when a gas/ vapour* ***or*** *solid it will not*

1

(b) (i) 40

1

(ii) (total) number of protons **and** neutrons (in the nucleus)

1

(c) (i) $2Ca + O_2 \text{ -+ } 2CaO$

accept any 2n : n : 2n ratio

do not credit if any other change has been made

1

(ii) any **two** from

electron(s) is / are lost

from the outer shell / orbit / ring

or *from the shell furthest the nucleus*

or *from the 4th shell*

two / both (electrons are lost)

accept two electrons are lost for (2)marks

accept both electrons are lost from the

atom for (1) mark

2

[10]

29 (a) *Idea that*

the electrons do not belong to specific atoms/delocalised electrons

[credit if done on appropriate diagram]

metal atoms form positive ions

the attraction which exists between particles with opposite charges, holds the metal together

no specific bonds exist between adjacent atoms/ions

atoms/ions can slide over each other so allowing metals to bend

each for 1 mark

5

(b) some electrons in the structure are delocalised/free to move

for 1 mark

these free electrons carry the electric current

for 1 mark

from left to right across the period, atoms of elements have more free electrons

gains 1 mark

but from left to right across the period, atoms of elements have more free electrons because they have more electrons in the outer shells

gains 2 marks

4

[9]

30 (a) (i) A calcium hydroxide/limewater/$Ca(OH)_2$ *not CaOH*

(ii) B calcium oxide/Quicklime/CaO

(iii) C hydrogen/H_2 *(accept correct formulae)/* not H_2/H

each for 1 mark

3

(b) (i) *idea that*
electrons are lost (by the calcium atom)

gains1 mark

but two electrons are lost (by the calcium atom)/lose outer electrons to get full shell

gains 2 marks

calcium ions are 2+

for 1 mark

(ii) electrons are gained (by the oxygen atom)

gains 1 mark

but two electrons are gained (by the oxygen atom)/gain electrons to get full outer shell

gains 2 marks

oxygen ions are 2–

for 1 mark

6

(b) (i)(ii) needs:
electron loss/gain
number (2)
charge (+/–)

(c) *idea that*
they are held together by many/strong forces/bonds
a lot of energy/high temperature is required to break these forces/bonds
each for 1 mark

2

[11]

31 (a) *idea that*
some of the outer electrons of the atoms are free to move
can move anywhere across the (giant) structure
the flow of electricity is a stream of electrons
each for 1 mark

or electrons carry a (negative electrical) charge

3

(b) <u>metal element</u>
[shiny] appearance

[high] melting point
forms an oxide that reacts with acids to make a salt
1 of these for 1 mark

<u>non metal element</u>
forms an oxide that reacts with alkalis

with chlorine forms a molecular chloride
1 of these for 1 mark

semi-conductor suggests in between
this, or any other for 1further mark

[NB Maximum of 2 for arguing metal/non-metal only]
Under each head
1 wrong reason → maximum of 1 available
2 wrong reasons → no mark available]

3

[6]

32 (a)

	Calcium	Phosphorus	Fluorine
No of protons		15	
No of neutrons			10
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]

33 (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

(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]

34 (a) 2 Na + Cl_2 → 2 NaCl

allow 2 Na^+ Cl^- for 1 mark

(allow Na + ½Cl^2 → Na Cl)

1

(b) (i) *idea that*

- it has strong (attractive) forces/bonds between ions / charged particles

for 1 mark

(not '..it has a rigid structure'- this defines a solid or '...particles close together' – they are in a liquid)

1

(ii) *ideas that*

- there is increased vibration of ions / particles on heating
- ions have sufficient energy to overcome attractive forces / to break out of the
- rigid structure / to move about

(must be in terms of increased energy of particles lions)

each for 1 mark

2

(iii) • ions can go to electrodes / ions are free to move

for 1 mark
[do not credit 'ions carry charges']

1

(c) *ideas that*

- it has stronger attractive forces between atoms/particles *(not 'ions')*
- each carbon atom forms covalent bonds with neighbouring atoms

each for 1 mark

2

[7]

35 (a) (i) *idea that*

- two hydrogen atoms share one pair of electrons
- linked by a covalent bond
- each then has two outer electrons / a full outer shell / two
- electrons in the highest (occupied) energy level

(2 marks may be awarded for a correct electron diagram i.e. with electrons on boundary of or within marked area).

any two for 1 mark each

2

(ii) *idea that*

- helium atoms do not give / take / share electrons / react
- because the (outer) shell / orbit is full

or

- highest (occupied) energy level is full

(*but not just* "contains two electrons")

for 1 mark each

2

(b) *idea that*

- the (attractive) forces between molecules are weak

(*not* bonds between atoms)

- so little energy is required / it is easy for molecules to escape from the liquid* / escape from other molecules*

(*allow* evaporate / change into a gas)

for 1 mark each

2

[6]

36 (a) *idea that*

- copper has free electrons / electrons that move throughout the structure

gains 1 mark

but

- in copper, electrons from the highest (occupied) energy level /outer shell, are free / can move throughout the structure

gains 2 marks

2

(b) *idea that*

- in graphite, only three bonds are formed by each carbon atom

for 1 mark

- one outer electron (per atom), free to move

for 1 mark

- an electric current is a flow of (free) electrons*

for 1 mark

(this mark to be given in **either** (a) **or** (b) but not in both)*

3

[5]