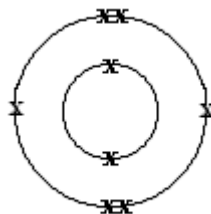




## Mark schemes

- 1** (a) gives out (heat) 1
- (b) D 1
- (c) L 1
- (d) magnesium chloride 1
- [4]**

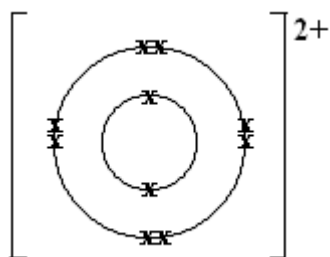
- 2** (a)  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$  1  
*accept correct multiples / fractions*
- (b)



*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]<sup>2+</sup> 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

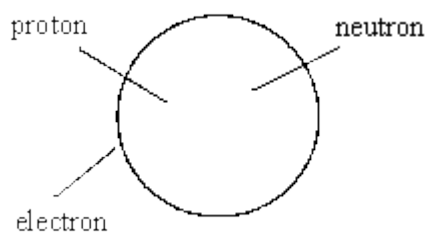
*accept MgCl<sub>2</sub> (if correctly written)*

1

**[6]**

**3**

(a) (i)

*all three correct 2 marks**one correct 1 mark*

2

(ii) 14

1

(b) A

1

**[4]****4**

(a) 157

*correct answer with **or** without working**(2 × 19 + 119) for 1 mark only**allow (119 + 19 =) 138 for 1 mark only**ignore units*

2

(b) 24.2

*accept answers in the range 24 to 24.2038.....**ignore incorrect rounding after correct answer**25 only without working gains 1 mark **or****38/157 × 100 gains 1 mark **or****(19/157 × 100 =) 12 to 12.1 gains 1 mark**allow error carried forward from part(a)**38/(a) × 100 gains 2 marks if calculated correctly**(19/138 × 100 =) 13.8 gains 1 mark*

2

(c) 0.29

*accept answers in the range 0.28 to 0.3**allow error carried forward from part (b)**(b)/100 × 1.2 correctly calculated**ignore units*

1

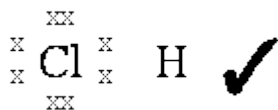
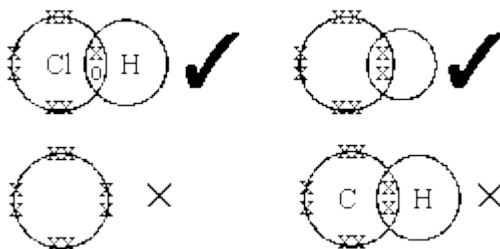
(d) an electron*allow electrons**allow electron shared / lost for 1 mark**apply list principle for additional particles*

1

is gained owtte

*must be linked to electron**accept can hold / take in if in correct context**eg it can hold another electron (in its outer shell) = 2 marks**it can take an electron (from another atom) = 2 marks**ignore reference to fluoride ions**incorrect number of electrons gained does **not** gain the second mark*

1

**[7]****5**(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)  $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$ *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)  $\text{MgCl}_2$ *accept  $\text{Mg}^{2+}(\text{Cl}^-)_2$* 

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]

6

- (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]****8**

- (a) all electrons correct (inner shell need not be shown)

*three bond pairs and two electrons anywhere else**can use dots, crosses or e's in any combination*

1

- (b) covalent

*accept phonetic spelling**do not accept convalent*

1

**[2]****9**

answers apply to:

*accept diagrams and/or descriptions*carbon dioxide CO<sub>2</sub>ammonia NH<sub>3</sub>methane CH<sub>4</sub>water H<sub>2</sub>O

\*outer electronic structure of one atom correct **or** needs correct number of electrons to complete outer shell

1

\*outer electronic structure of other atom correct **or** needs correct number of electrons to complete outer shell

1

\*one shared **pair** of electrons (as one covalent bond)

*use of ions or reference to ionic bonding negates this mark*

1

\*outer electronic structure of compound correct **or** each atom now has a full outer shell/noble gas electron structure

1

[4]

10

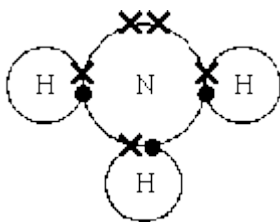
(i) reversible (reaction)

1

(ii) (yield of ammonia) increases

1

(iii)



1

[3]

11

(i) can be from diagram chlorine (2.8).7.

*accept chlorine needs one more electron*

1

can be from diagram shares a pair of electrons

1

shared pair of electrons is a covalent bond

*do **not** accept ionic bond*

1



- (ii) can be from diagram and appropriately annotated sodium (2.8). 1.  
and chlorine (2.8).7
- sodium loses one electron and chlorine gains one electron
- Na<sup>+</sup> and Cl<sup>-</sup> formed
- bond formed between oppositely charged ions **or** ionic bond is formed  
*do not accept covalent bond*

1

1

1

1

[7]

12

- (a) (i) 78-80%
- (ii) proteins  
*accept amino acids*
- (b) (i) natural gas  
*accept methane (CH<sub>4</sub>)*  
*accept water (H<sub>2</sub>O)*
- (ii) carbon dioxide
- (c) (i) N<sub>2</sub> + H<sub>2</sub>
- correct balancing 1 + 3 → 2  
*award only if reactants are correct*
- (ii) iron  
*accept Fe*
- (iii) at low temperatures rate of reaction is too slow  
*accept very few collisions at low temperatures*  
*accept converse*
- particles need enough (activation) energy to react  
*accept particles need enough energy for bonds to break*  
*accept converse*

1

1

1

1

1

1

1

1

(d) all three covalent bonds displayed correctly as electron pairs

1

two lone electrons displayed not necessarily as a pair

1

[11]

13

(a) (i)  $\text{H}_2\text{SO}_4$  **or** red (acidic) pH < 7

*accept names of compounds*

*accept correct use of acidic*

1

NaOH **or** purple (alkaline) pH > 7

*alkaline and neutral without any mention of pH for 1 mark only*

1

NaCl **or** green (neutral) pH 7

*ignore high **or** low pH*

1

(ii) hydrogen (ion)

*accept proton*

*accept hydroxonium ion*

1

$\text{H}^+$

*accept  $\text{H}_3\text{O}^+$  for hydroxonium ion*

1

(b) (i) neutralisation

1

(ii)  $\text{NaOH} + \text{HCl}$

*ignore state symbols*

1

$\text{NaCl} + \text{H}_2\text{O}$

*ignore state symbols*

*maximum of 1 mark if incorrectly balanced*

1

(c) (i) sodium – 2 . 8 . 1

*accept 2.8.1 written*

1

chlorine – 2 . 8 . 7

*accept 2.8.7 written*

1

- (ii) ion(s) 1
- (iii) attraction between oppositely charged particles (ions)  
*accept attraction between + and - particles (ions)*  
*accept electrostatic attraction* 1
- (d) chloride ions lose electrons to form chlorine  
 $Cl^- - e^- \rightarrow Cl$  1
- hydrogen ions gain electrons to form hydrogen  
 $H^+ + e^- \rightarrow H$  1
- sodium hydroxide remains in solution  
*Na + and OH<sup>-</sup> remain in solution to form sodium hydroxide* 1

[15]

15

- (a) 2 2 multiples of ½ allowed  
*for 1 mark* 1
- (b) (i) 2. 8. 1 and 2. 8. 7  
*gains 3 marks*
- 1 mark for 2 electrons in each inner shell  
 1 mark for 8 electrons in each second shell  
 1 mark for 1 electron in sodium outer shell  
 and 7 in chlorine outer shell 3
- (ii) sodium atom loses;  
 electron;  
 chlorine atom gains;  
 electron  
*for 1 mark each*
- inversion = 2 marks  
 lose negative charge = 1 mark 4

- (c) (i) KCl (accept 2KCl)  
*for 1 mark* 1
- (ii) both have one electron in outer shell/same number of electrons/  
lose same number of electrons in compound formation/  
both lose one electron  
*for 1 mark* 1
- (d) 0 amps;  
the ions;  
cannot move in the solid  
solid Na chloride does not conduct  
*for 1 mark each* 3
- (e) (i) water (H<sub>2</sub>O)  
*for 1 mark* 1
- (ii) (1) chlorine;  
(2) hydrogen  
*for 1 mark* 1

**[15]****16**

- (a) any (must be named) 1
- (b) F<sub>2</sub> 1
- (c) -/F<sup>-</sup> 1
- (d) (i) covalent 1
- (ii) made of molecules etc.  
type of bonding when non-metals react. 1

**[5]**

17

(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]

18

(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]

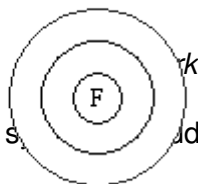
19

(a) 2, 8, 8, 1

*for 1 mark*

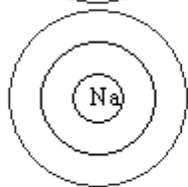
1

(b) (i)

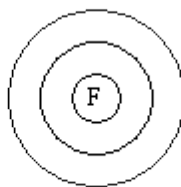


Ignore s... but structure must be drawn NOT 2,7

(ii)



+



-

(1) for charges

(1) for each structure

If covalent; can score mark for charges but not for diagram

Arrow showing electron transfer from metal atom to non-metal atom = 2 marks

If the ions are not identified then cannot score mark for charges

4

[5]

<b>20</b>	(a) $C_{16}H_{34}$ <i>for 1 mark</i>	1	
	(b) electron <i>gains 1 mark</i>		
	<b>but</b> shared electrons <i>gains 2 marks</i>	2	<b>[3]</b>
<b>21</b>	(a) potassium / K <i>for 1 mark</i>	1	
	(b) carbon dioxide / $CO_2$ <i>for 1 mark</i>	1	
	(c) losing electrons gaining electrons <i>for 1 mark each</i>	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) <i>for 1 mark each</i>	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  
and/or positive ions move to the negative electrode  
 negative ions lose electrons  
and/or positive ions gain electrons  
*any 3 for 1 mark each*

3

**[13]****22**

- (a) Group 2 / Alkaline Earth Metals  
*for 1 mark*

1

- (b) (i)  $\text{MgCl}_2/\text{Mg}^{2+} (\text{Cl}^-)_2$   
 (or equation with correct answer)  
*for 1 mark*

1

- (ii) ionic / electrovalent  
*for 1 mark*

1

**[3]****23**

- (a) covalent/description of covalent  
*for 1 mark*

1

- (b) forces/bonds between the molecules/particles (not 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]**



**24**

- (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*

or 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]****25**

- (a) gas

*for 1 mark*

1

- (b)  $AlX_3$

*for 1 mark*

1

- (c) 7 / halogens

*for 1 mark*

1

**[3]**

- 26** (i) B or 2, 8, 1  
for one mark  
1
- (ii) A or 2, 8  
for one mark  
1 [2]
- 27** 8 electrons in outer shell  
accept anywhere in outer shell  
accept dots or crosses  
1
- negative sign outside bracket  
1 [2]
- 28** (a) (i)  $2 \text{Mg} + \text{O}_2 \rightarrow 2 \text{MgO}$   
both 2s needed  
allow  $\text{O}_2$  or any correct multiple  $\frac{1}{2}$   
1
- (ii) solid  
1
- gas  
1
- (b)  $\text{MgCl}_2 / \text{Cl}_2\text{Mg}$   
do **not** accept MG mg mG CL cl cL  
ignore charges  
1 [4]

29

- (a) LHS lithium + water  
*accept Li and H<sub>2</sub>O*  
*accept hydrogen oxide for water*

1

RHS hydrogen + lithium hydroxide  
*accept H<sub>2</sub> and LiOH*  
*ignore attempts at balancing*  
*ignore charges*

1

- (b) **Quality of written communication**

One mark for the correct use of any **three** of the terms atom, covalent, bond(ing), saturated, hydrocarbon or alkane

1

any **three** from:

one / the carbon (atom)

*reject molecules once*

four hydrogen (atoms)

*shape / properties neutral*

CH<sub>4</sub>

hydrocarbon

saturated / single bond

covalent bond / shared electrons

alkane

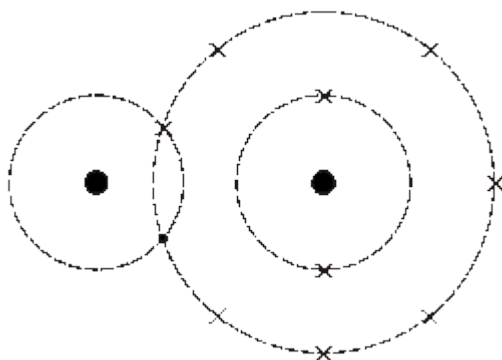
*reject ionic bond*

3

**[6]**

30

(i) 1



(ii) weak forces

*accept weak bonds*

1

between molecules / intermolecular*reject intramolecular*

1

**[3]**

31

(a) (i) gas

*accept they are all gases*

1

(ii) reversible (reaction)

*accept can go either way**accept ammonia can be decomposed (to nitrogen and hydrogen)**accept could be (an) equilibrium**do not credit just 'equilibrium'*

1

(iii) (liquid) air **or** atmosphere

1

(iv) same number **or** amount **or** weight (of atoms) on each side (of the equation)*accept "sums" for each side**accept same amounts of elements on each side**do not credit molecules **or** compounds**do not credit both sides are the same unless explained*

1

of the same type

***or** gives a correct example 'e.g. six hydrogen atoms' (on each side)*

1

- (b) (i) nitrate
- or**
- sulphate
- or**
- phosphate

*if first left blank, second may be awarded**do not credit chloride*nitric **or** sulphuric **or** phosphoric

1

(only if correct above, exception is for ammonium chloride followed by hydrochloric acid (1 mark))

*as appropriate if only the formula is given this should be credited**only if it is correct in every detail i.e.  $\text{NH}_4\text{NO}_3$   $\text{HNO}_3$   $(\text{NH}_4)_2\text{SO}_4$*  *$\text{H}_2\text{SO}_4$* *accept correct name with an incorrect version of the formula**do not credit a correct formula with an incorrect version of the name**e.g. 'nitrate/sulphite' etc*

1

any **one** of\* (solution) can be sprayed (on the fields **or** crops)*accept more even distribution*\* dissolves in soil water **or** rain (water)*accept soaks into soil (because soaks implies water)*

\* can be taken up by (plant) roots

*do not credit can be added to water to "feed" the plants*

1

- (c) (i) elements
- or**
- different
- atoms are bonded or joined
- or**
- combined
- or**
- reacted

*do not credit just 'atoms'**do not credit added **or** mixed*

1

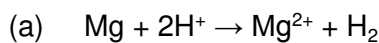
- (ii) (pairs of) electrons are shared

*do not credit an electron is shared*

1

**[10]**

32

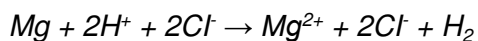


\* reactants correct in every detail

\* products correct in every detail

*if the spectator ions are shown then (1) mark should be credited but only if they are shown correctly on both sides*

*e.g.*



2

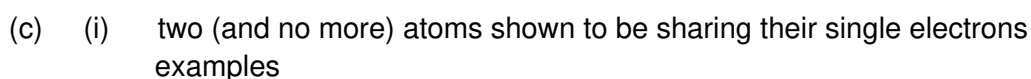


1

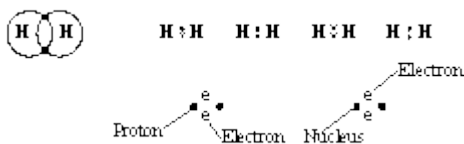
of hydrogen **or** equally clear working (so) 6 grams/g (are needed)

1

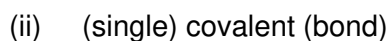
*unit required*



*do not credit if anything which contradicts the impression that these are hydrogen atoms*



1



1

(d)  $\frac{2}{34} (\times 100) = 6$  (just 6 is worth (1) mark)

1

$$\frac{2}{32} \times 100 = 6 \text{ or similar is (0)}$$

*do not credit 5.8823529 and the like*

1

**[8]**

33

(a)

*both correct in each row*

electron ...- (1)

*allow negative*

1

1 ..... 0

*allow neutral or none*

1

proton .....+ (1)

*allow positive*

1

(b) (i) protons...electrons

*both correct in correct order*

1

(ii) protons....neutrons

*both correct in either order*

1

(c) (i) sodium fluoride

*do not credit sodium fluorine*

1

NaF

*must be correct in every detail**do not credit NAF and the like*

1

(ii) ionic

*accept ion (bonding)**do not credit ionic **or** iron (bonding)*

1

(iii) electron transferred from sodium to fluorine

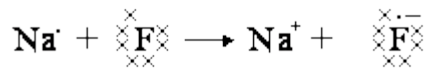
*accept electron transferred from metal to non-metal***either** positive sodium ion and negative fluoride ion***or** correctly identified by the symbols Na<sup>+</sup> and F<sup>-</sup> accept 'positive sodium ion and negative fluorine ion'*

1

or attracted because have opposite charge(s)

or (atoms/ions) form an (ionic) lattice or (atoms/ions) form a crystal

e.g.



or both marks may be gained by a suitable dot and cross diagram

1

[10]

34

(i) two

or 2

1

(ii) magnesium **and** chloride*either order***not** positive / negative*do not credit 'chlorine'**accept Mg<sup>++</sup> **and** Cl<sup>-</sup>**do not credit just Mg and Cl<sup>-</sup>**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]****35**

(a) (i) rings of 2, 8 and 3 electrons

*credit 2, 8, 3 pay particular attention to the outer shell in diagrams*

1

(ii) rings of 2, 8 and 7 electrons

*credit 2, 8, 7 pay particular attention to the outer shell in diagrams*

1

(b) (i)

*labels not required on atoms*

*charges need to be shown on ions*

*reference to outer shell is required otherwise a maximum of two marks*

*structure of atoms/ions marks*

(ring of 2, 8, 1 for sodium) **or** the outer shell of sodium only contains 1 electron

*credit 2, 8, 1 or an ion 2, 8 or two circles and 1 electron in outer shell*

1

(ring of 2, 6 for oxygen) **or** outer shell only contains 6 electrons

*credit 2, 6 or an ion 2, 8 or two circles*

1

*transfer of electrons mark*

two sodiums needed to supply two outer electrons to oxygen to complete the (one oxygen's) outer shell

*award maximum of two marks if a covalent structure is given  
credit two rings of electrons for sodium showing outer electrons  
transferring to outer shell of one oxygen for three marks  
do not accept diagrams showing overlapping rings for third mark*

1

(ii) loses an electron

*credit atoms lose electrons **or** oxygen takes the electron ignore oil  
rig*

1

**[6]****36**

(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)  $2\text{Ca} + \text{O}_2 \rightarrow 2\text{CaO}$   
*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]****37**

- (a) (i) ammonia and hydrogen chloride  
*both required either order*  
*accept formulae if correct in every detail* 1
- (ii) ammonium chloride /  $\text{NH}_4\text{Cl}$   
*do not credit ammonia chloride* 1

- (iii) the fumes / gases / are poisonous / toxic  
*or ammonia and hydrogen chloride are  
 poisonous / toxic / lethal  
 accept just ammonia is poisonous / toxic  
 accept just hydrogen chloride is  
 poisonous / toxic  
 accept vapour is poisonous / toxic  
 do not credit just fumes are dangerous  
 or harmful* 1
- (iv) nitrogen  
*do not credit N/N<sub>2</sub>* 1
- hydrogen  
*do not credit H/H<sub>2</sub>* 1
- molecule  
*do not credit compound or mole* 1
- covalent  
*accept single / molecular* 1
- (b) (i) proton  
 neutron  
 electron  
*either all three correct  
 or one or two correct  
 however do not credit a response  
 which is repeated* 2
- (ii) protons and neutrons  
*both required in either order* 1

[10]

- 38** (a) positive  
*for 1 mark* 1
- (b) any reference to loss of electrons  
*for 1 mark*
- reference to charge being +2 (in (a)) **or** to loss of 2 electrons (in (b))  
*for 1 mark* 2
- [3]**
- 
- 39** (a) covalent bonds  
*for 1 mark* 1
- (b) any reference to shared electrons  
*gains 1 mark*
- but** idea that bond is shared pair of electrons  
*gains 2 marks* 2
- [3]**
- 
- 40** (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]

41

- (a) (i) A calcium hydroxide/limewater/ $\text{Ca}(\text{OH})_2$  *not*  $\text{CaOH}$   
(ii) B calcium oxide/Quicklime/ $\text{CaO}$   
(iii) C hydrogen/ $\text{H}_2$  (*accept correct formulae*)/ *not*  $\text{H}_2/\text{H}$   
*each for 1 mark*

3

- (b) (i) *idea that*  
electrons are lost (by the calcium atom)  
*gains 1 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 (+/-)

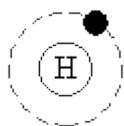
- (c) *idea that*  
they are held together by many/strong forces/bonds  
a lot of energy/high temperature is required to break these forces/bonds  
*each for 1 mark*

2

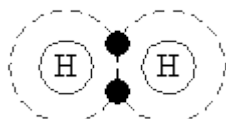
[11]

42

- (a) correct representation of 1 atom of hydrogen e.g.

*gains 1 mark*

**but** correct representation of 1 molecule of hydrogen e.g. or H-H

*gains 2 marks*

2

- (b) *idea that:*  
hydrogen/metals form positive ions/lose electrons  
*gains 1 mark*

**but** hydrogen and the metals form positive ions/lose electrons  
*gains 2 marks*

hydrogen/non-metals form covalent bonds/share electrons  
*gains 1 mark*

**but** hydrogen and the non-metals form covalent bonds/share electrons  
*gains 2 marks*

4

[6]

43

- (a) (i)  $2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$  (allow  $\text{H}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{H}_2\text{O}$ )  
*both circled for 1 mark*

1

- (ii)  $4 \text{Al} + 3 \text{O}_2 \rightarrow 2 \text{Al}_2\text{O}_3$   
*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]

44

(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)  $\text{Ca}^+$   
*gains 1 mark*

**but** superscript only  $\text{Ca}^{2+}$  /  $\text{Ca}^{++}$   
*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]****45***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  $\text{NH}_3$
- for 1 mark each*

**[4]**

**46**

(a) positive / + / 2  
gains 1 mark

**but** 2<sup>+</sup> / ++ / +2  
gains 2 marks

2

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

2

**[4]****47**

(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]**