**M1.**(a)    1 / one

**1**

(b)     (i)      protons

**1**

(ii)     neutrons

**1**

(iii)    7

**1**

(c)     (i)      losing

**1**

(ii)     a positive

**1**

(iii)    electrostatic

**1**

(d)     high melting points

**1**

strong bonds

**1**

(e)     (i)      58.5

**1**

(ii)     mole

**1**

(f)     very small (particles) **or**

*ignore tiny / small / smaller / microscopic etc.*

1-100nm in size **or**

(particle with a) few hundred atoms

**1**

**[12]**

**M2.**(a)    layers

which have weak forces / attractions / bonds between them

*second mark must be linked to layers*

**1**

**or**

which can slide over each other **or** separate

*ignore references to rubbing*

**1**

(b)     covalent

**1**

**[3]**

**M3.**(a)     (i)      14

**1**

(ii)     isotope

**1**

(iii)    (very) small

*accept smaller / tiny / (very) little*

**1**

(b)     (i)      C

**1**

(ii)     NH3

**1**

(c)     (i)      nitric (acid)

**1**

(ii)     indicator

**1**

(iii)    crystallisation **or** evaporation

*allow by heating* ***or*** *cooling* ***or*** *leave (on windowsill)*

*do not accept freezing*

**1**

(iv)    any **one** from:

•        grass grows faster

•        grass grows taller **or** thicker

*allow grass grows better / greener*

**1**

(d)     potassium (atom) loses (an electron)

*reference to incorrect bonding or particle = max* ***3***

**1**

chlorine (atom) gains (an electron)

*ignore references to full outer shells*

**1**

1 (electron)

**1**

electron

**1**

**[13]**

**M4.**(a)    a layer a few hundred atoms thick

**1**

(b)     any **two** from:

*any* ***two*** *ideas*

•         less materials or save resources

•         less energy

•         less fuel

•         less pollution / greenhouse effect / global warming

•         less waste

*ignore references to cost / recycling*

**2**

**[3]**

**M5.**(a)     (i)      high

**1**

(ii)     hundred

**1**

(b)     hard

**1**

(c)     (i)      carbon

**1**

(ii)     four

**1**

(iii)    covalent

**1**

(iv)    all

**1**

**[7]**

﻿

**M6.**         (a)      (i)     nucleus

**1**

(ii)     neutron

**1**

(iii)    electron

**1**

(b)     (i)      6

**1**

(ii)     12

**1**

(c)     

**1**

(d)     (i)      CH4

**1**

(ii)     compound

**1**

(iii)    covalent

**1**

**[9]**

**M7.**(a)     giant structure / lattice / layers / close packed

*first 3 marks can be obtained from a suitably labelled diagram*

*incorrect structure or bonding or particle = max 3*

**1**

made up of atoms / positive ions

**1**

with delocalized / free electrons

**1**

so electrons can move / flow through the metal

*accept so electrons can carry charge through the metal*

*accept so electrons can form a current*

**1**

(b)     an alloy (is a metal which) has different types / sizes of atoms

*accept converse for pure metal throughout*

*both marks can be obtained from suitable diagrams*

*allow made of different metals*

*allow mixture of metals / atoms / elements*

*ignore particles*

*ignore properties*

*do* ***not*** *accept compound*

**1**

alloy has distorted layers

*allow layers are unable to slide*

**1**

(c)     (i)      can return to its original shape

*accept shape memory alloy*

*accept smart alloy*

*ignore other properties*

**1**

(ii)     (pure copper is too) soft

*accept converse*

*accept malleable or bends*

*accept copper is running out*

*ignore references to strength and weakness*

**1**

(iii)    aluminium oxide

*accept alumina*

*accept Al2O3*

*ignore bauxite / aluminium ore*

**1**

(iv)    any **one** from:

•        different conditions

•        different catalyst

•        different pressure

*allow different concentration*

•        different temperature.

*do* ***not*** *accept different monomers*

**1**

(d)     any **two** from:

•        accurate

•        sensitive

•        rapid

•        small sample.

*both needed for 1 mark*

**1**

**[11]**

**M8.**         (a)      (i)     *ionic / molecules / metallic / (inter)molecular = max* ***2***

because graphene / it has a giant structure / lattice / macromolecular

*accept all / every / each atom is bonded to 3 other atoms*

**1**

because graphene / it has covalent bonds / is covalent

**1**

because in graphene / the bonds are strong **or**a lot of energy needed / hard to break the bonds

**1**

(ii)     there are delocalised / free electrons

**1**

because one (delocalised / free) electron per atom linked to first marking point

*accept because three electrons per atom used (in bonding)*

*accept because one electron per atom not used (in bonding)*

**1**

(b)     opaque (owtte)

*eg could not see through them*

**or** layers slide  
**or** layers not aligned

*ignore thick*

**1**

**[6]**

**M9.**          (a)     C16 H34

*for 1 mark*

**1**

(b)     electron

*gains 1 mark*

**but** shared electrons

*gains 2 marks*

**2**

**[3]**

**M10.**          (a)     **Graphite:**

because the layers (of carbon atoms) in graphite can move / slide

*it = graphite*

**1**

this is because there are only weak intermolecular forces **or** weak forces between layers

*accept Van der Waals’ forces allow no covalent bonds between layers*

**1**

**Diamond:**

however, in diamond, each carbon atom is (strongly / covalently) bonded to 4 others

*allow diamond has three dimensional / tetrahedral structure*

**1**

so no carbon / atoms able to move / slide

*allow so no layers to slide* ***or*** *so diamond is rigid*

**1**

(b)     because graphite has delocalised electrons / sea of electrons

*allow free / mobile / roaming electrons*

**1**

which can carry charge / current **or** move through the structure

**1**

however, diamond has no delocalised electrons

*accept however, diamond has all (outer) electrons used in bonding*

**1**

**[7]**

**M11.**          (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]**

**M12.**          (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]**

**M13.**(a)    (Chromium =) 20

*in correct order*

**1**

(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

*allow too soft* ***or*** *too 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)    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]**

**M14.**(a)     nanotubes can slide (over each other)

*allow nanotubes can roll (over each other)*

**1**

because no (covalent) bonds between the nanotubes

*accept weak forces between the nanotubes* ***or*** *weak intermolecular forces*

*allow layers for nanotubes throughout*

**1**

(b)     delocalised electrons

*accept free electrons*

**1**

*so (delocalised) electrons* can move through the graphite

*accept so (delocalised) electrons can carry charge through the graphite*

**1**

**[4]**

**M15.**(a)     lattice / giant structure

*max* ***3*** *if incorrect structure or bonding or particles*

**1**

ionic **or** (contains) ions

**1**

Na+ **and** Cl-

*accept in words or dot and cross diagram: must include type and magnitude of charge for each ion*

**1**

electrostatic attraction

*allow attraction between opposite charges*

**1**

(b)     hydrogen

*allow H2*

**1**

sodium hydroxide

*allow NaOH*

**1**

(c)     any **one** from, eg:

•        people should have the right to choose

•        insufficient evidence of effect on individuals

•        individuals may need different amounts.

*allow too much could be harmful*

*ignore religious reasons*

*ignore cost*

*ignore reference to allergies*

**1**

(d)     (i)      one bonding pair of electrons

*accept dot, cross or e or − or any combination, eg  
*

**1**

6 unbonded electrons on each atom

**1**

(ii)     simple molecules

*max* ***2*** *if incorrect structure or bonding or particles*

*accept small molecules*

*accept simple / small molecular structure*

**1**

with intermolecular forces

*accept forces between molecules*

*must be no contradictory particles*

**1**

which are weak **or** which require little energy to overcome − must be linked to second marking point

*reference to weak covalent bonds negates second and third marking points*

**1**

(iii)    iodine has no delocalised / free / mobile electrons or ions

**1**

so cannot carry charge

*if no mark awarded iodine molecules have no charge gains* ***1*** *mark*

**1**

**[14]**

**M16.**(a)     (i)      C

**1**

(ii)     B

**1**

(iii)    A

**1**

(iv)    D

**1**

(b)     (i)      SO2

**1**

(ii)     shared

**1**

(iii)    covalent

**1**

**[7]**

**M17.**(a)     (i)      giant lattice

*allow each carbon atom is joined to three others*

**1**

atoms in graphene are covalently bonded

*max.* ***2*** *marks if any reference to wrong type of bonding*

**1**

and covalent bonds are strong **or** need a lot of energy to be broken

*allow difficult to break*

**1**

(ii)     because graphene has delocalised electrons

*allow each carbon atom has one free electron*

**1**

which can move throughout the structure

*do* ***not*** *accept just electrons can move.*

**1**

(b)     because there are weak forces between molecules

*allow no bonds between the layers*

**1**

so layers / molecules can slip / slide.

**1**

**[7]**

**M18.**(a)     (i)      neutrons

*this order only*

**1**

electrons

**1**

protons

**1**

(ii)     box on the left ticked

**1**

(b)     (i)      effervescence / bubbling / fizzing / bubbles of gas

*do* ***not*** *accept just gas alone*

**1**

magnesium gets smaller / disappears

*allow magnesium dissolves*

*allow gets hotter* ***or*** *steam produced*

*ignore references to magnesium moving and floating / sinking and incorrectly named gases.*

**1**

(ii)     Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a ‘best–fit’ approach to the marking.

**0 marks**No relevant content

**Level 1 (1−2 marks)**There are simple statements of some of the steps in a procedure for obtaining magnesium chloride.

**Level 2 (3−4 marks)**There is a description of a laboratory procedure for obtaining magnesium chloride from dilute hydrochloric acid and magnesium.

The answer must include a way of ensuring the hydrochloric acid is fully reacted **or** a method of obtaining magnesium chloride crystals.

**Level 3 (5−6 marks)**There is a well organised description of a laboratory procedure for obtaining magnesium chloride that can be followed by another person.

The answer must include a way of ensuring the hydrochloric acid is fully reacted **and** a method of obtaining magnesium chloride crystals.

**examples of the points made in the response:**

•        hydrochloric acid in beaker (or similar)

•        add small pieces of magnesium ribbon

•        until magnesium is in excess or until no more effervescence occurs \*

•        filter using filter paper and funnel

•        filter excess magnesium

•        pour solution into evaporating basin / dish

•        heat using Bunsen burner

•        leave to crystallise / leave for water to evaporate / boil off water

•        decant solution

•        pat dry (using filter paper).

\*Student may choose to use a named indicator until it turns a neutral colour, record the number of pieces of magnesium added then repeat without the indicator.

**6**

**[12]**