**Chapter 1 – Atoms and Separating Techniques – Mark scheme**

**M1.**(a)     Y

**1**

(b)     W

**1**

(c)     V

**1**

(d)     W

**1**

(e)     X

**1**

**[5]**

**M2.**(a)     (i)       nucleus

**1**

(ii)     an energy level (shell)

**1**

(b)

**3**

(c)     2 / two(%)

**1**

(d)     (i)      10 / ten

**1**

(ii)     (group) 0

*accept noble gasesignore (group) 8*

**1**

**[8]**

**M3.**(a)     gold

**1**

(b)     atom (s)

**1**

(c)     (i)      protons

*any order*

*allow proton*

**1**

neutrons

*allow neutron*

**1**

(ii)     3 / three

**1**

(d)     (i)      Al

*ignore any numbers / charges*

**1**

(ii)     any **two** from:

•        limited resource

•        expensive in terms of energy / mining

•        effects on the environment, such as, landfill, atmospheric pollution, quarrying

*allow uses a lot of energy to extract.*

**2**

(e)     resistant to corrosion

**1**

does not react (with water or food)

*allow* ***one*** *mark for low density with a suitable reason given*

**1**

**[10]**

**M4.**          (a)    base line drawn in ink

*explanation must match problem*

**1**

which will run (and confuse the spots)

**or**

spots under water will dissolve into water / wash off

**1**

(b)     (i)     copper(II) and iron (III)

**1**

(ii)     orange / brown

*accept rusty*

**1**

(iii)    Fe(OH)3

*accept formula of complex [Fe(H2O)3(OH)3] or any other formula for hydrated iron oxide,such as Fe2O3.9H2O*

**1**

(c)     (i)     distance moved by spot **X**: 2.1,

*both needed for mark*

distance moved by solvent from baseline: 5.0

*allow ± 0.1 cm*

*accept answers in mm (21 and 50 ± 1 mm) and units stated as mm*

**1**

cm

*correct unit used at least once*

**1**

(ii)     2.1 / 5.0

*allow ecf from table*

= 0.42

*ignore units given in answer for Rf*

**1**

(d)     (i)     substances **B** and **D**

*both required*

**1**

(ii)     do chromatography on mixture using ethanol **or** propanone as the solvent

*accept conducting chromatography using any other solvent, but such answers cannot score second mark*

**1**

result gives different Rf values

ie if ethanol solvent, **B** gives 0.62, **D** gives 0.45; if propanone, **B** gives 0.84,**D** gives 0.31

**or**

do chromatography on pure samples of **B**, **D** and mixture in ethanol orpropanone (1)

*allow water under same conditions as solvent*

position of unknown spot will match that of either pure **B** or pure **D** inchromatogram (1)

**1**

**[11]**

**M5.**(a)    proton 1

*ignore ±*

**1**

electron very small owtte

*allow zero*

*allow values from 1 / 1800 to 1 / 2000* ***or*** *0.0005 – 0.00055*

**1**

(b)     8

**1**

16

**1**

(c)     (i)      Isotopes

**1**

(ii)      

**1**

(d)     (i)      compound

**1**

(ii)     H-O-H

**1**

(iii)    covalent

**1**

(iv)    sharing

**1**

**[10]**

**M6.**(a)     (i)      protons

*allow “protons or electrons”, but do not allow “protons and electrons”*

**1**

(ii)     protons plus / and neutrons

**1**

(b)     (because the relative electrical charges are) −(1) for an electron and +(1) for a proton

*allow electrons are negative and protons are positive*

**1**

and the number of electrons is equal to the number of protons

*if no other mark awarded, allow 1 mark for the charges cancel out*

**1**

(c)     (the electronic structure of) fluorine is 2,7 and chlorine is 2,8,7

*allow diagrams for the first marking point*

**1**

(so fluorine and chlorine are in the same group) because they have the same number of or 7 electrons in their highest energy level or outer shell

*if no other mark awarded, allow 1 mark for have the same / similar properties*

**1**

(d)     S

**1**

(e)     (i)      ions

**1**

(ii)     molecules

**1**

**[9]**

**M7.**(a)    any **two** from:

*ignore reference to taste / shelf-life / sales etc*

•        improve the colour / appearance

•        additives are permitted / not banned / listed on the label

•        link between additives and hyperactivity not proved

•        maintain the low cost of the drink **or** natural colours would make the drink cost more

*allow cheaper if qualified*

**2**

(b)     have a control group / placebo **or** test children before any drink given

**1**

give a drink to at least 3 groups **or** give a drink at least 3 times

**1**

give each additive to different group / children / at different times

**1**

observe / monitor / compare behaviour of group / children

**1**

(c)     (i)      so that there would be trust / respect / no bias

**1**

(ii)     compare the colours / spots from the orange drink with those of the (three) additives

*accept diagram of chromatogram(s) with spots for E102, 104, 110 and sample from the orange drink*

**1**

there should be no matching colours / spots

**1**

**[9]**

**M8.**(a)     (i)      Neutron (top label)

**1**

Electron (bottom label)

**1**

(ii)     13

**1**

(iii)    electrons

**1**

(b)     (i)      compound

**1**

hydrogen

**1**

bond

**1**

(ii)     C4H10

**1**

**[8]**

**M9.**(a)    additive

**1**

(b)     colour 3 is a mixture of colours 1 and 2

any **two** from:

*accept E-number or additive instead of colour*

*ignore comments about height / level*

**1**

•        colour 1 is made up of only one colour / dye

•        colour 2 is made up of only one colour / dye

•        colour 3 is made up of two colours / dyes
**or**
more colours (than colours 1 and 2)

**2**

**[4]**

**M10.**(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]**

**M11.**(a)     start line drawn in ink

**1**

so it will run / dissolve in the solvent / split up

*allow mixes with the spots*

**1**

spots under solvent **or** solvent above spots / start line

**1**

so they will mix with solvent **or** wash off paper **or** colour the solvent **or** dissolve in the solvent

**1**

(b)     (i)      contains **A** and **E**

**1**

and one other (unknown substance)

*if no other marks awarded, an answer saying it is made up of three colours gains* ***1*** *mark*

**1**

(ii)     45  or  46

*allow any value from 45 to 46*

**1**

18

*allow any value from 16 to 20*

*award* ***1*** *mark if numbers correct but in cm*

**1**

(iii)    0.40

*allow ecf from* ***(b)(ii)***

*ignore units*

**1**

(c)     fast red

*allow ecf from* ***(b)(iii)***

**1**

has same Rf value

*allow none of them, as none has the same Rf value for* ***2*** *marks*

**1**

(d)     any **one** from:

•        more accurate

•        more sensitive

•        uses small quantities of samples

•        quicker / faster / more rapid

•        can link to mass spectrometer (MS)

**1**

**[12]**

**M12.**(a)    hydrogen has one proton whereas helium has two protons

*accept numbers for words*

*accept hydrogen only has one proton*

*ignore references to groups*

**1**

hydrogen has one electron whereas helium has two electrons

*accept hydrogen only has one electron*

*allow helium has a full outer shell (of electrons)*

**1**

hydrogen has no neutrons **or** helium has two neutrons

*if no other mark awarded, allow helium has more electrons / protons / neutrons for* ***1*** *mark*

**1**

(b)     (i)      2 electrons on first shell **and**

8 electrons on outer shell

**1**

(ii)     they have a stable arrangement of electrons

*accept they have full outer energy level / shell of electrons*

*do* ***not*** *accept they have the same number of electrons in their outer energy level / shell*

*allow they are noble gasesignore they are in group 0*

**1**

**[5]**

**M13.**(a)     because this lithium atom has

3 protons

**1**

and 4 neutrons

**1**

mass number is total of neutrons and protons

*accept protons and neutrons have a mass of 1*

*accept number of neutrons = 7 - 3(protons)*

*ignore mass of electron is negligible*

**1**

(b)     grams

*accept g*

**1**

12C

*allow carbon-12* ***or*** *C-12*

*ignore hydrogen* ***or*** *H*

**1**

(c)     any **three** from:

*max* ***2*** *if no numbers given*

*numbers if given must be correct*

•        both have 8 protons

*accept same number of protons*

•        18O has 10 neutrons

•        16O has 8 neutrons

*accept different number of neutrons or 18O has two more neutrons for* ***1*** *mark*

•        both have 8 electrons.

*accept same number of electrons*

**3**

**[8]**

**M14.**         (a)      (i)     chromatography

**1**

(ii)     3 / three

**1**

(iii)    the colour / E104 is not on the same level as any of the colours in the food

*accept E104 does not match*

**1**

(b)     (i)      to improve the appearance of the food

*ignore adds yellow / colour*

*ignore taste / flavour*

**1**

(ii)     further / or different tests (for harmful effects) **or** obtain more evidence
(that it is harmful)

*allow do a survey / study*

**1**

**[5]**