M1.(a) **B**

1

(b) **D**

1

(c) **E**

1

(d) **C**

1

(e) 92.5 × 6 **and**
7× 7.5

1

$\frac{607.5}{100}$

1

6.075

1

6.08

1

*allow 6.08 with no working shown for **4** marks*

[8]

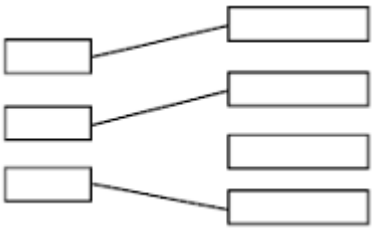
M2.(a) (i) nucleus

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. (i) B **or** 2, 8, 1

for one mark

1

(ii) A **or** 2, 8

for one mark

1

[2]

M4. (a) (i) 27

(ii) 13

each for 1 mark

2

(b) each proton has a/1 positive charge and each electron has a/1 negative charge OR electrons and protons have (equal but) opposite charges
there are equal numbers of protons and electrons in the atom/ so charges cancel or balance (each other)

each for 1 mark

2

(c)

PARTICLE	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Fluorine atom		10	
Fluoride atom	9		10

each for 1 mark

3

[7]

M5. (a) nucleus

1

electron

1

(b) correct number of electrons (12)

accept dots and circles

1

2.8.2

1

[4]

M6. (a) electrons
neutrons
protons

for 1 mark each

3

(b) mass number no. of neutrons
14 8

for 1 mark each

2

[5]

M7. (a) (i) neutron *(name only)*

2

(ii) nucleus / protons and neutrons

each for 1 mark
(do not allow mass number)

(b) Li *(correct cases of letters required)*

for 1 mark

1

[3]

M8. electron
nucleus
neutron

each for 1 mark

[3]

M9. (a) **A** – electron

1

B – nucleus

1

C – proton

1

D – neutron

1

(b) Group 1 / alkali metals

1

has one electron in outer shell

accept 3 protons / 3 electrons / atomic number 3 therefore lithium (so Group 1 / alkali metals)

1

(c) lithium

accept Li

1

[7]

M10.(a) 13 (protons)

The answers must be in the correct order.

*if no other marks awarded, award **1** mark if number of protons and electrons are equal*

1

14 (neutrons)

1

13 (electrons)

1

(b) has three electrons in outer energy level / shell

allow electronic structure is 2.8.3

1

(c) **Level 3 (5–6 marks):**
A detailed and coherent comparison is given, which demonstrates a broad knowledge and understanding of the key scientific ideas. The response makes logical links between the points raised and uses sufficient examples to support these links.

Level 2 (3–4 marks):
A description is given which demonstrates a reasonable knowledge and understanding of the key scientific ideas. Comparisons are made but may not be fully articulated and / or precise.

Level 1 (1–2 marks):
Simple statements are made which demonstrate a basic knowledge of some of the relevant ideas. The response may fail to make comparisons between the points raised.

0 marks:
No relevant content.

Indicative content

Physical
Transition elements
- high melting points
- high densities
- strong
- hard

Group 1
- low melting points
- low densities
- soft

Chemical
Transition elements
- low reactivity / react slowly (with water or oxygen)
- used as catalysts
- ions with different charges
- coloured compounds

Group 1
- very reactive / react (quickly) with water / non-metals
- not used as catalysts
- white / colourless compounds
- only forms a +1 ion

6

[10]

M11. (a) carbon

accept C

1

(b) protons

1

[2]

##

(a) potassium, hydrogen,
carbon, oxygen,
chlorine <u>or</u> iodine

3 correct gains 1 mark
4 correct gains 2 marks
all correct gains 3 marks
(deduct 1 mark for each incorrect answer)

3

(b) potassium (K)

for 1 mark

1

[4]

M13. (a) less dense than air

1

(b) (i) water

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

1

(ii) unreactive

1

(c) atoms

1

(d) electron(s)

1

nucleus

1

[6]

M14. (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]

M15. (a) water (molecules) contain two hydrogen atoms and one oxygen atom

*all water molecules have the formula H_2O for **2** marks*

*water molecules contain hydrogen and oxygen (atoms) for **1** mark*

*water is H_2O for **1** mark*

2

(b) atom A has no <u>neutrons</u> / atom B has one <u>neutron</u>

allow different numbers of <u>neutrons</u>

1

[3]

M16. (a) 4

1

(b) 9

1

[2]

M17. (a) made of one sort of atom

accept it is in the periodic table

accept it only has lithium atoms

1

(b) nucleus labelled correctly

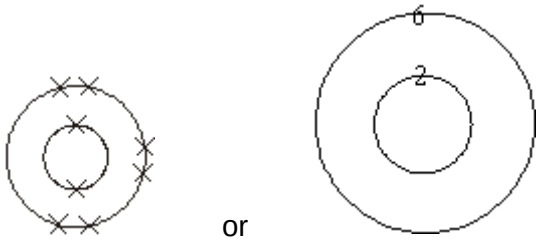
1

electron labelled correctly

1

[3]

M18. (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]

M19.(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]

M20. (a) (i) B

1

(ii) A

1

(iii) C

1

(b) D and E

1

(c) electron

1

[5]

M21.(a) (i) nucleus

1

(ii) protons

1

(b) protons / + / positive

electrons / – / negative

*both words needed in any order for **1** mark*

1

(c) nitrogen

allow N or N_2

1

(d) B **and** C

*both letters needed in any order for **1** mark*
*allow Li **and** Na*

1

(both) have one electron **or** same number of electrons in the outer energy level / shell

*allow both are in Group **1***
allow both are alkali metals
*allow both can lose <u>only</u> one electron **or** become +1 ions*
allow this mark if no letters given in boxes

1

[6]

M22. (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]

M23. (a) electron

1

(b) (i) 5

1

(ii) boron

accept B

1

(c) (i) 11

1

(ii) neutrons

1

[5]

M24. (a) +1/+

*do **not** accept 1 without the +*

1

electron

allow phonetic spelling

1

(b) (i) elements

1

(ii) non-metal

1

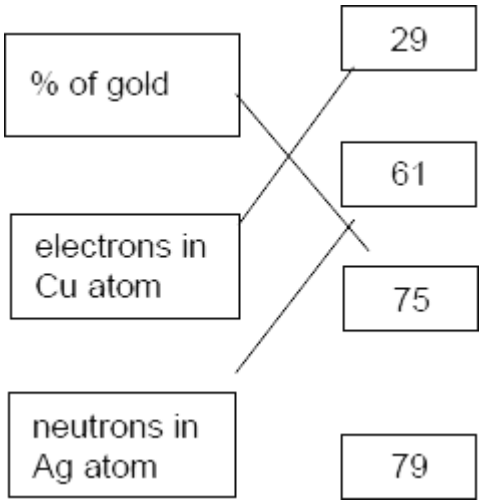
(c) soft

1

an alloy

1

(d)



one *mark for each correct link*
extra lines lose the mark

3

[9]

M25. (a) 2,4

allow electrons in any position on correct shells

1

(b) (electron) 79

1

neutron

allow phonetic spelling

1

118

1

(c) (i) 16 **and** 9

in this order

1

(ii) any **two** from:

ignore reasons about colour / lustre / corrosion / rarity

- (100% / pure) gold is soft

  allow layers can slide in pure gold

- (alloyed) to make the metal hard(er)

  ignore just 'the ring is an alloy'
  allow (alloyed) to stop the layers sliding
  allow (alloyed) to make the metal strong

- gold is expensive **or** alloy is less expensive

2

[7]

M26.(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) $^{18}_{8}O$

1

(d) (i) compound

1

(ii) H-O-H

1

(iii) covalent

1

(iv) sharing

1

[10]

M27.(a) neutron(s)

answers can be in either order

1

proton(s)

1

(b) same number (17) protons **or** same number electrons

if candidate chooses to quote numbers, they must be correct

1

different numbers of neutrons (^{35}Cl has 18 and ^{37}Cl has 20)

1

(c) (i) −184kJ / mol

*correct answer with or without working gains **3** marks*

*allow **2** marks for 184 kJ / mol*

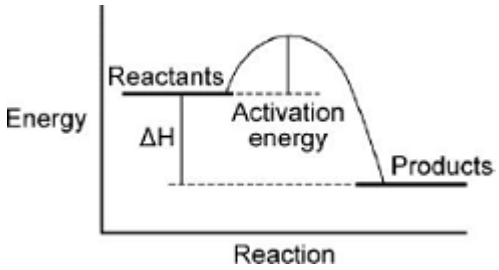
*If answer incorrect award up to **2** marks for any two of the steps below:*

- *bonds broken: (436 + 242) = 678 (kJ)*
- *bonds formed: (2 × 431) = 862 (kJ)*
- *bonds broken − bonds formed*

allow ecf for arithmetical errors

3

(ii)



the reactants and the products at the correct level

ignore labels on the axes

1

ΔH correctly labelled

allow −538 if in correct place

1

E_a correctly labelled

*correctly labelled endothermic reaction gains max. **2** marks*

1

[10]

M28.(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]

M29.(a) (i) 7

1

(ii) –1

1

(iii) neutrons

1

(b) number of protons

1

(c) atom **Y**

1

(d) (i) Ne

allow neon

1

(ii) has a full outer shell

allow in Group 0

allow a noble gas

or

full outer energy level

allow the shells are full

or

has 8 electrons in its outer shell

ignore in Group 8

1

[7]

M30.(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]

M31.(a) (i) electronic structure 2,3 drawn

allow any representation of electrons, such as, dots, crosses, or numbers (2,3)

1

(ii) nucleus

1

(iii) protons and neutrons

*do **not** allow electrons in nucleus*

1

(relative charge of proton) +1

allow positive

1

(relative charge of neutron) 0

allow no charge/neutral

1

ignore number of particles

(b) too many electrons in the first energy level or inner shell

allow inner shell can only have a maximum of 2 electrons

1

too few electrons in the second energy level or outer shell

*allow neon has 8 electrons in its outer shell **or** neon does not have 1 electron in its outer shell*

allow neon has a stable arrangement of electrons or a full outer shell

1

neon does not have 9 electrons **or** neon has 10 electrons

allow one electron missing

allow fluorine has 9 electrons

1

ignore second shell can hold (maximum) 8 electrons or 2,8,8 rule or is a noble gas or in Group 0

max 2 marks if the wrong particle, such as atoms instead of electrons

if no other mark awarded allow 1 mark for the electronic structure of neon is 2,8

[8]

E2.(a) (i) The majority of students achieved the mark for knowing that at the centre of an atom is the nucleus.

(ii) Many students achieved the mark for knowing that around the centre of an atom are energy levels (shells).

(b) Most students scored full marks for understanding numbers of protons and electrons in atoms and for knowing the term mass number. The most common problem was that students scribbled out link lines and drew new link lines but did not always make it clear which lines were their final choice. Students must read and analyse the information provided, then plan their answer before drawing the link lines. A few students had drawn only one link line because they had not understood the instruction to draw one line from each question to its correct answer. Note that no credit can be given when two or more lines are drawn from a question to two or more answers.

(c) The majority of students worked out that the percentage of the rest of the elements in the Sun was 2%. The most common incorrect responses were either 98% or 12%.

(d) (i) Students were advised to use the Chemistry Data Sheet to help them answer this question. From the periodic table most students did realise that a neon atom has 10 protons, however, 20 protons was a common incorrect answer.

(ii) Students were advised to use the Chemistry Data Sheet to help them answer this question. From the periodic table most students did realise that helium and neon are in group 0. Noble gases was an acceptable answer. Common answers not gaining credit included ‘non-metals’ and ‘gases’.

E3. Part (i) was quite well answered. Part (ii) as might be expected, was less well answered.

E4. A surprisingly large proportion of candidate failed to correctly look up the mass number of aluminium or give the number of electrons.

In (b) many candidates discussed the number of neutrons instead of comparing the numbers of positively charge protons and negatively charged electrons.

In (c) only the more able candidates correctly gave the number of protons and neutrons and of those, only a small number were able to give correctly the number of electrons in the fluoride ion.

E5. Part (a) gave the vast majority of candidates a good start to the examination and most candidates gained both marks. In part (b) most of the candidates inserted twelve electrons on the diagram but only about half of them were able to arrange the electrons correctly. A variety of arrangements was seen, with a popular answer being 4, 4, 4.

E9. (a) Relatively few candidates were able to name all four parts of the atom labelled but most could name some. Several candidates merely labelled them as positive or negative particles, ignoring the fact that the question asked them for *names.*

(b) Although many candidates could identify the atom as belonging to group 1, few were able to give a correct reason.

(c) Rather more candidates could identify the atom as being lithium, even if they were wrong in part (b).

E11. Most answers were correct. A few candidates identified the element as helium.

E12. (a) Many candidates gained full marks. The printing of the symbol for chlorine on this paper was not clear and many candidates included carbon and iodine in their list of elements. Since the fault was in the printing these answers were accepted.

(b) A large number of candidates who correctly identified the elements in part (a)failed to name the metal in part (b). Many gave metals which did not appear in their answer to part (a).

E13. (a) Most candidates appreciated that the gases hydrogen and helium must be less dense than air to allow the airship to float in air.

(b) (i) It was surprising that about only half of the candidates were able to correctly name the product H_2O. The acceptable answers were 'water' and 'hydrogen oxide'. The most common incorrect answer was 'hydroxide'.

(ii) The majority of candidates knew that helium does not burn in oxygen because it is 'unreactive'.

(c) Most candidates knew that a hydrogen molecule is made up of two hydrogen 'atoms'.

(d) The majority of candidates correctly labelled the 'nucleus' and an 'electron' in a helium atom.

E14. Most of the candidates completed the diagram correctly in part (a).

Some vague answers were seen in part (b) such as, the atoms are close together, and

these did not gain credit. However, most of the candidates were able to gain credit for the idea that electrons are delocalised and free to move around the structure.

E15. Foundation Tier

(a) Candidates found this question difficult. A simple answer such as ‘all water molecules contain 2 hydrogen atoms and one oxygen atom’ was all that was required.

(b) Only the more able candidates gained the mark.

E16. The question aimed to give the candidates a friendly start to the examination. This worked for the vast majority of candidates who gained the marks in both parts.

(a) The most common incorrect answer in this part was 9.

(b) Incorrect answers were evenly split between 4 and 12.

E17. The description of an element proved difficult for the majority of candidates, but most were able to label correctly the parts of a lithium atom.

E18. Foundation Tier

The majority of candidates completed the electronic structure correctly in part (a)(i). A few candidates gave the structure as 2.4 or 2.8. Some candidates added an extra shell.

Part (a)(ii) was answered correctly by the majority of the candidates. A few candidates gave 'neutron' instead of 'nucleus'.

Foundation candidates found part (b) difficult. A simple answer such as 'the O-18 nucleus contains two more neutrons' was all that was required for the 2 marks. Some candidates thought that the nucleus contains electrons or gave vague answers such as 'it contains more protons and neutrons', 'they have different sized particles' or 'they have different relative atomic masses'.

Higher Tier

Most candidates completed the electronic structure correctly in part (a)(i). A few candidates gave the structure as 2.4 or 2.8.

Part (a)(ii) was answered correctly by almost all of the candidates. A few candidates gave 'neutron' instead of 'nucleus'.

Many candidates gained both marks in part (b). A simple answer such as 'the O-18 nucleus contains two more neutrons' was all that was required for the 2 marks. Some candidates thought that the nucleus contains electrons or gave vague answers such as 'it contains more protons and neutrons'.

E19.(a) A majority of students knew that gold was an unreactive metal found in the Earth as the metal itself.

(b) Most students did not know that elements, such as aluminium, are made of only one type of atom.

(c) (i) Most students knew that the nucleus of an atom contains protons and neutrons.

(ii) The vast majority of students used the periodic table of elements to state correctly that aluminium is in Group 3.

(d) (i) Most students achieved the mark for writing the correct symbol for aluminium. There were a few 'AL' and other incorrect answers that indicated that these students had not used the periodic table provided.

(ii) This question was poorly answered. Only a few students gained both marks because most of the reasons were vague such as 'can be used again', 'would be wasted' or 'could harm the environment'. A common correct response was the idea that aluminium is a limited resource. Few students were specific

about the fact that recycling would be cheaper in terms of energy or extraction. Many students just stated that aluminium is useful or gave a list of uses for aluminium.

(e) Many students were able to select the resistant to corrosion option for the first marking point but most were unable to give the reason that aluminium does not react with food or water. Typical responses that did not gain credit were 'keeps food fresh', 'does not rust', 'does not wear away' or 'keeps food warm'. The alternative response of low density was frequently chosen although there were very few ideas of 'lightweight' applications given. Several students referred to the aluminium foil as 'tin foil'.

E20. (a) Were well answered with students being able to interpret the information given in the atomic structure diagrams.

(b) Were well answered with students being able to interpret the information given in the atomic structure diagrams.

(c) Protons and neutrons were the most common incorrect responses given for a particle with a negative charge.

E21.(a) (i) The majority of students achieved the mark for knowing that the nucleus is at the centre of an atom.

(ii) The majority of students achieved the mark for knowing that the centre of an atom contains neutrons and protons.

(b) About half the students managed to gain the mark here. The most common incorrect answer was to state that there is no overall electrical charge on an atom because the number of protons is equal to the number of neutrons.

(c) More students than expected did not attempt this question; however of those that answered the question most got the element, nitrogen, correct. A common error was to confuse mass number and atomic number so a common incorrect answer was lithium.

(d) Surprisingly, very few of the students related the number of electrons on the outer energy level to the group of the periodic table. Many of the students who correctly

identified B and C simply repeated the stem of the question stating that they were in the same group, so only gained one mark. The answer B and D was the most common incorrect option; the explanation was that they both had 'two rings' or they are 'the same size'.

E22. (a) The majority of students achieved the mark for knowing that the centre of an atom contains neutrons and protons.

(b) Many answers were disappointing, with charges the wrong way round on protons and electrons or charges attributed to neutrons. Some students, who did get the charges correct, omitted to mention that the opposite charges cancelled each other out.

(c) Nearly all students realised that atom A was unreactive because it had a full outer shell. Others mentioned that A is in group 0 or is a noble gas.

(d) Students who identified the correct pair of atoms usually went on to explain why they had similar chemical properties. The most common incorrect pair was B and D, with the reason given that they were in the same period.

E23. Fairly well answered – most gained at least 3 marks. In (c)(ii) some students guessed the answer and electrons and protons were common responses.

E24. (a) Most students knew the name electron. The charge on the proton was less well known.

(b) (i) The majority of students knew that gold and carbon are elements.

(ii) It was surprising that most students did not understand that carbon is a non-metal.

(c) Only one third of students gained both marks for knowing that gold is alloyed because pure gold is too soft to make a ring.

(d) The majority of students scored one or two marks on this question. Less than half of the students gained all three marks.

E25. (a) Nearly every student could draw the electronic structure of a carbon atom.

(b) This question was a good discriminator. Most knew that the missing sub-atomic particle was a neutron. Again, most students could give the number of each particle, but a significant minority did not gain full marks here.

(c) (i) The percentages of silver and copper were well read from the bar chart, although a few struggled with the scale. 8.5% was the most common incorrect response. It was good to see many adopting the strategy of marking horizontal lines on the bar chart to read off the values.

(ii) The last part gave a good spread of marks. Most knew that pure gold was too soft and too expensive, and that gold was alloyed to make it less so. However, common incorrect answers were to do with corrosion, reactivity, brittleness and appearance. Some students simply referred to the presence of the other two metals in the gold.

E26.(a) The relative mass of a proton particle was usually correctly given as 1. A common incorrect answer for the mass of the electron was also 1. Indications of plus or minus were ignored by the examiners.

(b) The majority of students realised that the atomic number of the oxygen atom was 8 and that the mass number was 16. Some guesses were evident.

(c) Generally well answered. The identification of the correct symbol in part(ii) posed most problems.

(d) This question was generally well answered.

E27.(a) Students found this part easy and were familiar with sub-atomic particles.

(b) Most students used same number of protons and different number of neutrons to gain two marks, while a small proportion made reference to electrons. Some students made comments about the similarities in chemical properties and the differences in physical properties. A reference to atomic number, proton number and mass number was seen on many papers. Many quoted the correct number of particles.

(c) (i) This part discriminated well. A pleasing number of students scored 3 marks by correctly calculating enthalpy change of –184 kJ per mole. The most common answer that scored 2 marks was +184 kJ per mole. Many students were confused about the subscript numbers in the equation and thought that H_2 and Cl_2 would involve the breaking of two H–H bonds and two Cl–Cl bonds, which gave an answer of +494 kJ per mole. Many other students gave an answer of +247 kJ per mole by failing to recognise that 2HCl involved breaking 2H–Cl bonds. +494 kJ per mole and +247 kJ per mole scored 2 marks. A lot of students who had calculated a positive value for the answer then quoted the answer as a negative value, presumably by confusing this method with $Q = mc \triangle T$

(ii) Students seemed well prepared for this question. Many scored full marks by producing a well-constructed diagram whereas others thought a calculation was required. A lot of students thought that –538 kJ per mole referred to an endothermic process and lost a mark by having the reactants at a lower energy than the products. Incorrect or imprecise labelling of the activation energy and $\triangle H$ also cost many students marks.

E28.(a) The question was well answered with most students gaining two or three marks. The number of protons and electrons in hydrogen and helium was well understood; as was the fact the hydrogen had no neutrons. Students often gained limited credit because their response only matched the compensatory mark ‘helium has more electrons or protons or neutrons’.

(b) (i) This question was very well answered, with most students gaining credit by showing the correct electronic structure of a neon atom. Small numbers of students only had eight electrons in total, while some confused the atomic number and mass number and had a large number of extra electrons in each energy level.

(ii) Most students gained full credit, although very few made reference to a stable arrangement of electrons. The most common correct answer made reference to a full outer shell or energy level, although it was noticeable that this statement did not always include a mention of electrons. A common error was that they both had eight electrons in their outer shells.

E29.(a) (i) Most students understood that the mass number of lithium is seven.

(ii) The majority of students knew that the charge of an electron is –1.

(iii) The majority of students knew that the nucleus contains protons and neutrons.

(b) Most students did not know that the number of protons is always different for atoms of different elements.

(c) The majority of students used the diagrams to establish that atom Y is an element from Group 3 of the periodic table.

(d) (i) Several students did not attempt this question. Most students did identify that the electron arrangement was that of an atom of neon.

(ii) Several students did not attempt this question and it was poorly answered. Some students inferred that because the element was not a metal then it was not reactive or alternatively it was unreactive because it was a non-metal or because it was a gas. One of the most common incorrect reasons was that the number of electrons was equal to the number of protons so it was neutral. Another incorrect idea was that this element was low in the reactivity series. There was a wide variety of good answers based on a full outer shell or reference to neon being in Group 0 or being a noble gas.

E30.(a) (i) Most students knew that the atomic number was the number of protons. Whilst ‘protons or electrons’ was allowed, quite a few stated, incorrectly, ‘protons and electrons’.

(ii) The mass number was less well known with a substantial number of students including electrons in their answer.

(b) The first marking point that protons are positive and electrons are negative was well known, but many students failed to recognise the importance of having equal numbers of these positive and negative particles. Several students stated that electrons are negatively charged and protons positively charged, but then simply stated that the charges cancel out without referring to equal numbers. Occasionally there was some confusion with the identity of particular particles, for example 'protons are positively charged ions and electrons are negatively charged ions'. Some answers were confused and mentioned loss and gain of electrons and a surprising number of students thought that neutrons were charged.

(c) The majority of responses gained at least one mark for correctly stating that chlorine and fluorine had the same number of outer electrons; this was often linked to them having similar properties. A poor attempt or no attempt was made at giving their electronic structure; clearly some students had not read the question. Incorrect responses included: same electronic structure, having eight outer electrons and being non-metals.

(d) The majority of students were able to link the electronic structure to the correct chemical symbol.

(e) (i) Less than half of the students identified the particles as ions.

(ii) Few knew that compounds formed from only non-metals consist of particles called molecules. Common responses made reference to the type of compound, 'covalent', rather than the particles formed. Nearly one in ten students did not attempt an answer, more than on any other question.

E31.(a) (i) The question was generally well answered, with a small percentage giving incorrect electron configurations. However, a significant number of students did not attempt the question.

(ii) The vast majority of students correctly identified the nucleus.

(iii) Although most students had a good understanding of the charges and masses of particles in the atom, many had problems in selecting information to answer the question. Far too often students included information related to electrons. However, most students gained all three marks.

(b) Nearly all students gained credit for recognising that atoms should only have two electrons in the first energy level. Many students treated this as a general question about the electron configuration of atoms and did not apply it to neon in particular. Some students continued their answer by just referring to the 2.8.8 rule rather than indicating that neon should have 8 electrons in the second shell. Many gained credit for recognising that the total of 9 electrons was incorrect and that neon should have 10.