Mark schemes

(a) B 1

(b) D 1

(c) E 1

(d) C 1

(e) $92.5 \times 6$ and $7 \times 7.5$ 1

$607.5$

$100$

6.075 1

6.08 1

allow 6.08 with no working shown for 4 marks

(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

(a) **any one** from:

- heat
- stir
(b) filter

accept use a centrifuge
accept leave longer (to settle)

(c) any one from:

- wear safety spectacles
- wear an apron

(d) evaporation at A

condensation at B

(e) 100

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

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

(ii) nucleus

(iii) protons and neutrons
do not allow electrons in nucleus

(relative charge of proton) +1
allow positive

(relative charge of neutron) 0
allow no charge/neutral

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

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
neon does not have 9 electrons or neon has 10 electrons
allow one electron missing
allow fluorine has 9 electrons

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

(a) (i) (mass number = 16) because there are 8 protons and 8 neutrons (in the nucleus)
accept mass number is total number of protons and neutrons for 1 mark

(ii) same number of protons or both have 6 protons
accept same atomic number

12C has 6 neutrons
14C has 8 neutrons
accept different number of neutrons for 1 mark
numbers, if given, must be correct
incorrect reference to electrons = max 2 marks

(b) (i) 2 bonding pairs
additional unbonded electrons negates this mark
4 unbonded electrons around oxygen
accept dot, cross or e or – or any combination

(ii) covalent

(iii) any one from:
• no delocalised / free electrons
ignore mobile electrons
• no overall electric charge
accept no charge (carriers)
• no ions

do not accept any implications of the presence of ions
(c) (i) larger

  accept the size of a few hundred atoms
  accept atoms are smaller (than nanoparticles)
  allow up to 1000 atoms

(ii) (nanoparticles have) large(r) surface area

(a) (i) atomic weights

  allow atomic masses

(ii) proton

  allow proton number

(b) (i) F/fluorine

  allow F₂

(ii) any one from:
  • copper has a higher density
  • copper is stronger
  • copper is harder
  • copper is less reactive

  allow named property
  ignore colour, conductivity, melting point and boiling point
  allow converse for potassium

(iii) relative distance from nucleus

  allow more / fewer energy levels / shells or larger / smaller atom

  relative attraction to nucleus

  allow more / less shielding

  relative ease of gain or loss of electron

  opposite explanation of ease of gain or loss of electron for other group

  max 3 marks if ‘outer’ not mentioned
(a) (i) Proton
(ii) Neutron

(b) In order of increasing atomic number

(c) (i) 9
(ii) Gas

(d) (i) gains (one) electron

(to gain a) full outer energy level or noble gas configuration
allow because it has seven outer electrons

(ii) add sodium hydroxide (solution)
allow ammonia (solution) or ammonium hydroxide or any other
soluble hydroxide or flame test

(forms a) blue precipitate
second mark dependent on suitable reagent being added
allow blue-green / blue / green if flame test given

(a) gold

(b) atom (s)

(c) (i) protons
any order
allow proton

neutrons
allow neutron

(ii) 3 / three

(d) (i) Al
ignore any numbers / charges
(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.*

(e) resistant to corrosion

does not react (with water or food)

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

9

(a) (i) protons

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

(ii) protons plus / and neutrons

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

  *allow electrons are negative and protons are positive*

  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*

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

  *allow diagrams for the first marking point*

  (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*

(d) S

(e) (i) ions

(ii) molecules

[9]
must be in this order

very small

accept negligible, 1/2000
allow zero

The mass number

C

(i) 2
(ii) 3

(i) 28
(ii) 42.9

accept ecf from (e)(i)
accept 42 - 43

(i) 0.9
(ii) any one from:
• accurate
• sensitive
• rapid
• small sample.