Mark schemes

1 (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]

2 (a) (i) central block

1

(ii) conducts electricity

1

(b) any **two** from:
- visual pollution
- noise pollution
- dust pollution
- habitat destruction.

2

(c) (i) to concentrate the ore / copper carbonate
or
to remove / separate the rock

1

(ii) 12 (tonnes)

If answer is incorrect allow one mark for (127 + 132) − 247 or 259 - 247

2

(iii) any **one** from:
- so no reactant is wasted / left unreacted
- so they know how much product they will make
- need to record / compensate for the carbon dioxide produced

allow so they can work out their carbon footprint.

1

[8]

3 (a) The ore is not pure or contains impurities or the ore does not contain 100% of the metal compound

allow to concentrate the metal or metal compound

1

rock / other compounds need to be removed / separated

1

(b) (i) (cast iron is) brittle

allow not strong

ignore weak

1

(ii) the oxygen reacts with carbon

allow carbon burns in oxygen or is oxidised

1

reducing the percentage of carbon in the mixture
or producing carbon dioxide

1

(c) (i) aluminium has a low density

1

(ii) (because copper) is in the central / middle (block of the periodic table)

1

whereas aluminium is in Group 3 (of the periodic table)

1

(iii) iron is more reactive (than copper)

ignore cost

1

so copper is displaced / reduced

1

[10]

4

(a) (i) **A**

1

(ii) **F**

1

(iii) **E**

1

(iv) **C**

1

(v) **A or B**

1

(b) (i) Rb K Na

allow rubidium, potassium, sodium

*do **not** accept RB or NA*

1

(ii) decrease

or

become lower / smaller / less

allow from 180° C to 27° C

1

(c) They are harder than Group 1 metals.

1

They have higher melting points than Group 1 metals.

1

They often form coloured compounds but Group 1 compounds are usually white.

1

[10]

5

(a) (i) UI / solution turns blue / purple

allow violet / lilac

1

any **two** from:

- floats
- melts / forms a sphere
- moves
  *note: moves on surface = **2** marks (points 1 and 3)*
- effervescence / fizz / bubbles / gas
  ignore the name of the gas
- (yellow) flame
  ignore sparks / ignites / burns
  allow dissolves
- reduces in size
  ignore 'reacts violently' unqualified
  ignore reference to exothermic / heat evolved

2

(ii) **2**Na + **2**H_2O → **2NaOH** + H_2

*correct equation = **2** marks*
allow correct multiples / fractions
if this equation is unbalanced,
*allow **1** mark for NaOH*

2

(b) *it = francium*
*<u>outer</u> electron / shell / energy level must be mentioned once for all **3** marks*

biggest atom **or** (outer) shell / energy level / electron furthest from nucleus **or** most (number of) shells

1

least attraction (to nucleus) **or** most shielding
allow the attraction is <u>very</u> weak
*do **not** allow less magnetic / gravitational attraction*

1

(outer) electron more easily lost / taken
ignore francium reacts more easily / vigorously

1

(c) any **two** from:

ignore other properties / specific reactions

they / it = transition elements

transition elements:

allow if state group 1 elements

- high melting point **or** high boiling point
  - *low melting point or low boiling point*
- high density
  - *low density*
- strong / hard
  - *weak / soft*
- not very reactive
  - *reactive*
- catalysts
  - *not catalysts*
- ions have different charges
  - *+1 ions*
- coloured compounds
  - *white compounds*

2

[10]

6

(a) (i) elements

1

(ii) atomic weight

1

(iii) atomic (proton) number

1

(b) (i) transition metals

1

(ii) has a higher melting point is harder

2

[6]

7 (a) tungsten

1

has the high(est) melting point

accept that metals other than tungsten are likely to melt

1

(b) argon

1

is an unreactive gas

accept that gases other than argon are reactive

accept that argon is a noble gas or in Group 0

1

[4]

8 (a) (good)conductor of electricity

conductor of electricity and heat (+/–) = 0

*accept can be drawn into wires **or** ductile*

ignore flexible

1

(b) strong

*accept tough **or** hard **or** high tensile strength*

1

(c) reference to <u>colour</u>

1

[3]

9 conducts heat

list principle applies after 4 ticks

1

forms coloured compounds

1

high melting point

1

strong

1

[4]

10 (a) colour

1

(b) Fe_2O_3 or $(Fe^{3+})_2\ (O^{2-})_3$

2 and 3 should be below halfway on Fe and O

1

(c) (i) 4 4

or correct multiples

1

(ii) any **two** from:

ignore references to malleable / ductile / conductivity / stiff / boiling point / density

- high melting point
  accept can withstand high temperatures
- strong / tough
  accept <u>not</u> brittle
- hard
  *do **not** accept flexible*
- not (very) reactive

2

[5]

11 (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]

12 (a) 75% Cu, 25% Ni
for 1 mark

1

(b) 70% segment shaded
for 1 mark

1

(c) (i) copper

for 1 mark

1

(ii) zinc

for 1 mark

1

(d) 1. hard so will not wear away/scratch

for 1 mark

1

2. unreactive
so does not corrode/dissolve/or other
acceptable reason
(not does not react unless acceptable reason)

(If given hard and unreactive allow 1 mark)

for 1 mark

1

[6]

13 (a) transition / transitional metals / elements / d-block

for one mark

1

(b) coloured
catalyst

(*accept* high melting point)

for 1 mark each

2

[3]

14 (i) zinc

accept Zn

1

iron only

accept Fe

1

copper

accept Cu

do not credit iron

1

(ii) iron

1

(iii) copper **or** iron or manganese

*accept Cu **or** Fe **or** Mn*

1

[5]