1 **(a** 3 or III [1]

(b) good conductor and it is a metal/has delocalised (free) electrons [1]

(c) N **or** P **or** As **or** Sb [1]
accept Bi

(d) $\mathbf{M}_2(SO_4)_3$ [1]
accept: $Ga_2(SO_4)_3$

(e) it would react with/dissolves in a named strong acid [1]
it would react with/dissolves in a named alkali [1]
it shows both basic and acid properties =1 [1]
it reacts with both acids and bases/alkalis =1 [1]
[max 2]

[Total: 6]

2 **(a** B $^{39}_{19}K$ [1]
positive charge + [1]

C $^{65}_{30}Zn$ [1]

D $^{16}_{8}O$ [1]
charge 2– [1]

E $^{70}_{31}Ga$ [1]

(b) number of p = number of e [1]

number of p > number of e [1]

number of p < number of e [1]

3 **(a** uranium / plutonium / thorium [1]

(b) graphite / carbon [1]

(c) platinum / titanium / mercury / gold [1]
NOT: carbon / graphite

(d) helium [1]

(e) nitrogen / phosphorus [1]

(f) argon [1]
ACCEPT: any ion 2 + 8 + 8 e.g. K^+ etc.

(g) tellurium [1]
ACCEPT: correct symbol

[Total: 7]

4 **(a) (i)** two atoms per molecule [1]

(ii) 7e in outer shell or level / same number of outer electrons / need to gain one electron [1]

(iii) different number of energy levels / different number of electrons [1]

(iv)

halogen	solid, liquid or gas at room temperature	colour
chlorine	gas	yellow / yellow green / green
bromine	liquid	brown / red-brown / orange-brown not: red / orange
iodine	solid	black / grey / silver-grey / purple / violet **NOT**: blue-black

NOTE: one mark for each vertical column [2]

(b) correct formula, AsF_3 [1]
3nbps and 1bp around all 3 fluorine atoms [1]
3bps and 1nbp around arsenic atom [1]

(c) (increased) light increases / causes forward reaction / light causes AgC*l* reacts with CuC*l* [1]
(increased) light increases the amount of silver (and so darkens glass) [1]
decrease in light reverses reaction / uses up silver / silver reacts (and so reduces darkness) [1]

[Total: 11]

5 **(a** same number of protons [1]
same number of electrons [1]
different number of neutrons [1]

(b) ^{235}U / ^{239}Pu [1]
NOTE: need symbol or name and nucleon number

(ii) treating cancer / chemotherapy / radiographs / tracer studies / x–ray (scans) / sterilise surgical instruments / diagnose or treat thyroid disorders / radiotherapy [1]

paper thickness / steel thickness / radiographs / welds / tracing / fill levels in packages / food irradiation / smoke detectors [1]
ACCEPT: any other uses

(iii) $Zr + 2H_2O \rightarrow ZrO_2 + 2H_2$ [2]
not balanced = (1) only

(iv) hydrogen explodes / fire (risk) [1]

(c)

if the oxide is	predicted result with hydrochloric acid	predicted result with aqueous aqueous sodium hydroxide
acidic		R
neutral		NR
basic		NR
amphoteric		R

(1) per l [4]

[Total: 13]

6 **(a (i)** become darker; [1]

(ii) increase; [1]

(iii) black / dark grey; [1]
not: brown
solid; [1]

(b) (same Z / same number of protons; [1]
accept: atoms of the same element
different number of neutrons / different nucleon number / different mass number; [1]

(ii) 53 protons and 53 electrons; [1]

78 neutrons; [1]

(iii) xenon; [1]

(c) BrF_3 / F_3Br; [1]
BrF_5 / F_5Br; [1]

[Total: 11]

7 **(a (i)** same number of protons and electrons [1]

(ii) all have the same number of protons / same proton number / same atomic number [1]

(iii) more electrons than protons [2]
number of protons and electrons not equal **ONLY** [1]

(iv) same number of protons (and electrons) / same proton number / same atomic number [1]
different number of neutrons / different mass number / nucleon number [1]

(b) 2 + 8 + 5 [1]

(ii) 3 / 5 [1]

(iii) non-metal because it accepts electrons
/ needs 3e to complete outer energy level
/ because it is in Group V or 5e in outer shell [1]
note need both non-metal and reason for [1]

[Total: 9]