

- 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) $M_2(SO_4)_3$ [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 ${}_{19}^{39}K$ [1]
positive charge + [1]
- C ${}_{30}^{65}Zn$ [1]
- D ${}_{8}^{16}O$ [1]
charge 2- [1]
- E ${}_{31}^{70}Ga$ [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 | <u>brown</u> / red- <u>brown</u> / orange- <u>brown</u> 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, AsF₃ [1]

3nbp and 1bp around all 3 fluorine atoms [1]

3bps and 1nbp around arsenic atom [1]

(c) (increased) light increases / causes forward reaction / light causes AgCl reacts with CuCl [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) $^{235}\text{U} / ^{239}\text{Pu}$ [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) $\text{Zr} + 2\text{H}_2\text{O} \rightarrow \text{ZrO}_2 + 2\text{H}_2$ [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 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) (i) 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) $\text{BrF}_3 / \text{F}_3\text{Br}$; [1]
 $\text{BrF}_5 / \text{F}_5\text{Br}$; [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]