(Extraction of metals (carbon and electrolysis))

Q1. a). (2018)

chlorine is toxic

Q1. b). (2018)

any **one** from:

- very exothermic reaction
- produces a corrosive solution
- produces hydrogen, which is explosive / flammable

Q1. c). (2018)

argon is unreactive / inert

oxygen (from air) would react with sodium / titanium
or
water vapour (from air) would react with sodium / titanium

Q1. d). (2018)

metal chlorides are usually ionic

(so)(metal chlorides) are solid at room temperature
or
(so)(metal chlorides) have high melting points

(because) they have strong (electrostatic) forces between the ions
or
(but) must be a small molecule or covalent

Q1. e). (2018)

sodium (atoms) lose electrons

Q1. f). (2018)

$Na \rightarrow Na^+ + e^-$

Q1. g). (2018)

(M_r of $TiCl_4$ =) 190

$$\text{(moles Na)} = \frac{20\,000}{23} =) \quad 870 \text{ (mol}$$

$$\left(\text{moles } TiCl_4 = \frac{40\,000}{190} =\right) \quad 211 \text{ (mol)}$$

either
(sodium is in excess because) 870 mol Na is more than the 844 mol needed
or
(because) 211 mol $TiCl_4$ is less than the 217.5 mol needed

Q1. h). (2018)

(actual mass =) $\frac{92.3}{100} \times 13.5$

or

(actual mass =)
0.923×13.5

= 12.5 (kg)

Q2. (2019)

mixture has a lower melting point (than aluminium oxide)

(so) less energy needed

Q3. (2019)

the electrode reacts with oxygen

the electrode is carbon / graphite

(so) carbon dioxide is produced

Q4. a). (2021)

($3 \times M_r$ $H_2O = 3 \times (2 + 16)$ =) 54

(A_r **R** = 150 – 54 =) 96

Q4. b). (2021)

(R =) molybdenum / Mo

Q5. (2021)

- carbon and iron are the cheapest reactants
- hydrogen is the most expensive reactant

- separating solid products is expensive
- separating solid products is time consuming

- in method 1, tungsten needs to be separated from tungsten carbide
- in method 1, some tungsten is lost as tungsten carbide
- in method 1, the carbon dioxide produced will escape

- in method 2, the water vapour produced will escape
- in method 2, no separation of solids is needed

- in method 3, tungsten needs to be separated from iron oxide

Q6. (2022)

both products are solid

Q7. (2023)

(substance reduced) Fe_2O_3

(reason)
(Fe_2O_3) loses oxygen