(Electrolysis (including of aqueous solutions, half-equations))

Q1. (2018)

solid (zinc chloride) does not conduct (electricity)
or
zinc chloride needs to be in solution **or** molten

(because) ions cannot move in the solid
or
(as) ions can (only) move in liquid / solution

Q2. a). (2018)

use measuring cylinders (instead of test tubes)

(because) test tubes cannot measure volume
or
(because) test tubes have no graduations / scale

Q2.b). (2018)

- the volume of hydrogen collected is directly proportional to the time
- the rate of collection of hydrogen is 0.45 (cm^3/min)
- up to 8 minutes chlorine is collected at an increasing rate
- after 8 minutes the rate of collection of chlorine is the same as that of hydrogen
  or
  after 8 minutes the rate of collection of chlorine is 0.45 (cm^3/min)

Q2. c). (2018)

chlorine reacts with water
or
chlorine dissolves (in the solution)

Q2. d). (2018)

(volume=) $\frac{6.6}{1000}$ (dm^3)

or 0.0066 (dm^3)

(moles=) $\frac{0.0066}{24}$

= 2.75×10^{-4} (mol)

Q3. (2019)

aluminium ions gain electrons

Q4. (2019)

$2O^{2-} \rightarrow O_2 + 4e^-$

Q5. (2019)

hydrogen (gas) would be produced (instead of sodium)

(because) sodium is more reactive than hydrogen

Q6. (2020)

CrO_4^{2-} / chromate ions moved to the positive electrode

(because) opposite charges attract

Q7. (2020)

water

Q8. (2020)

copper ions gain two electrons

(to) form copper (atoms)

Q9. (2020)

(negative electrode) hydrogen

(positive electrode) iodine

Q10. (2021)

electrolysis uses electricity to produce a chemical reaction

(but) cells use a chemical reaction to produce electricity

Q11. (2021)

$2\,Br^- \rightarrow Br_2 + 2\,e^-$

Q12. (2021)

Salt solution	Product at positive electrode	Product at negative electrode
(copper nitrate)	oxygen (1)	(copper)
(potassium iodide)	iodine (1)	hydrogen (1)

Q13. a). (2021)

filter the mixture

wash and dry the copper / residue

weigh the copper collected

add to the increase in mass of the electrode

Q13. b). (2021)

(for given current) straight line through the origin

Q13. c). (2021)

(for given time) when current doubles, mass doubles with supporting data

Q13. d). (2021)

(number of moles = $\frac{0.24}{63.5}$ =)

3.78×10^{-3} **or** 0.00378

(number of atoms =)

$0.00378 \times 6.02 \times 10^{23}$

$= 2.28 \times 10^{21}$

Q14. (2021)

copper ions are discharged
(from the solution)

Q15. a). (2022)

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

Q15. b). (2022)

so the products do not react (to reform sodium chloride)

Q15. c). (2022)

ion

Q16. a). (2022)

hydrogen / H^+ (ions)

hydroxide / OH^- (ions)

Q16. b). (2022)

sodium hydroxide

Q16. c). (2022)

sodium ions and hydroxide ions are left (in solution)

(because) hydrogen ions are discharged / reduced (at the negative electrode to form hydrogen)

(and because) chloride ions are discharged / oxidised (at the positive electrode to form chlorine)

Q17. (2023)

$Al^{3+} + \mathbf{3}\, e^- \rightarrow Al$

Q18. a). (2023)

water (molecules) break down

(to) produce (H^+ and) OH^- (ions)

(so) OH^- (ions) are attracted / move to the positive electrode

(where) OH^- (ions) are discharged / oxidised to give oxygen (molecules)

Q18. b). (2023)

(change)
use measuring cylinders (instead of test tubes)

(reason)
because there is a scale (on the measuring cylinders)

Q19. (2024)

the ions cannot move

Q20. (2024)

hydrogen

Q21. (2024)

$2\,Cl^- \rightarrow Cl_2 + 2\,e^-$

Q22. (2024)

Cu^{2+} / copper ions are blue
and
CrO_4^{2-} / chromate ions are yellow

(because) Cu^{2+} / copper ions move to the negative electrode

(and also) CrO_4^{2-} / chromate ions move to the positive electrode