Kirkcaldy High School

Chemistry

Higher

Unit 3 – Chemistry in Society

TUTORIAL ANSWERS

(a) Getting the most from reactants

1. A
2. C
3. C
4. A
5. D
6. B
7. D
8. A
9. D
10. B
11. B
12. C
13. D
14. B
15. B
16. A
17. B
18. A
19. D
20. C
21. 177 l
22.

    (a) moles cinnamic acid = $\frac{6.5}{148}$= 0.0439 mol

    moles methanol = $\frac{2}{32}$ = 0.0625 mol

    should be 1:1 ratio so methanol is in excess by 0.186 mol.

    (b) 52 %

    (c) £24.59

23. 0.97 l
24. 89 %
25. 82.3
26. 3.84 g

27.

(a) 75 %

(b) 40 %

28. C
29. 0.286 g
30.

(a) 58.4 %

(b) 70 %

31. 0.512 l
32. 615 l
33. 66.7 %
34. 0.02 mol
35. 3.78 l
36. 0.033 g
37. 70 %
38. 0.286 g
39. D
40. A
41. D

(b) Controlling the rate

1. C
2. A
3. A
4. C
5. B
6. D
7. A
8. A
9. C
10. A
11. B
12. D
13. D
14. A
15. B
16. D
17. C
18. B
19. D
20. C
21. B
22. B
23. D
24.

    (a) 15 °C

    (b) Correct geometry

    Energy above the activation energy

25.

    (a) It provides an alternative pathway for the reaction and thus lowers the activation energy.

    (b) 0.0015 mol l^{-1}min

    (c) Steeper curve but starts and ends at the same point s the original

26. C
27. C

28. Because increasing the temperature speeds up the particles resulting in more collisions. They also collide with more energy so are more likely to have energy above the activation energy.

29.

(a) To prevent mass loss through "splattering" (or similar)

(b) 0.017 gs^{-1}

(c) 0.014 gs-

(d) Impure $CuCO_3$ leads to fewer reactive particles available for collisions.

30.

(a) Use different volumes of the potassium iodide solution made up to 25 cm^3 with water.

(b) Use more accurate equipment (burettes/pipettes)
Repeat each experiment and take an average

(c) Correct geometry of collision
Energy above the activation energy.

31. B

32.

(a) 59 °C

(b) Slow reaction time means vague end-point as colour change is slow.

(c) More particles have energy above the activation energy so more collisions are successful.

33.

(a) Steeper curve ending at 60 cm^3

(b) Gas syringe or upturned measuring cylinder in water

(c) So that the concentration of hydrogen peroxide is the only variable changed.

34.

(a) Use different volumes of the potassium iodide solution made up to 25 cm^3 with water.

(b) 23.26 s

35.

(a) Upturned measuring cylinder in water.

(b) Measure change in mass of flask and reactants over time

(c) Chemical Energy

1. C
2. A
3. A
4. A
5. C
6. C
7. C
8. B
9. A
10. D
11. A
12. C
13. A
14. D
15. B
16. A
17.

    (a) 2650-2750 $kJmol^{-1}$

    (b) -2475 $kJmol^{-1}$

    (c) -3300 $kJmol^{-1}$

18. -278 $kJmol^{-1}$
19. -545 $kJmol^{-1}$
20. -16 kJ
21. 34 $kJmol^{-1}$
22. -672 $kJmol^{-1}$
23.

    (a) 0.125 moles

    (b) Incomplete combustion and heat loss to the surroundings

24.

    (a) To be able to predict the quantity of heat energy required or released by an industrial process.

    (b) 191 $kJmol^{-1}$

25. -115 $kJmol^{-1}$

26. -188 $kJmol^{-1}$

27. -297 $kJmol^{-1}$

28.

(a)

(i) Measure the temperature of the water

(ii) To prevent heat loss to the surroundings.

(iii)-50.5 $kJmol^{-1}$

(b) The energy change is independent of the route taken.

29. B

30.

(a) The molten iron flows into the crack

(b) -851 $kJmol^{-1}$

31.

(c) To prevent heat loss to the surroundings.

(d) -54.5 $kJmol^{-1}$

32. 53.8 °C

33. -202.6 $kJmol^{-1}$

34.

(a)

(i) Temperature of water before
Highest temperature of water after heating
Volume/mass of water heated

(ii) -334 $kJmol^{-1}$

(b) Complete combustion will occur since it is in an atmosphere of oxygen.

35.

(a) 37.9 g

(b) -147 $kJmol^{-1}$

36. -484 $kJmol^{-1}$

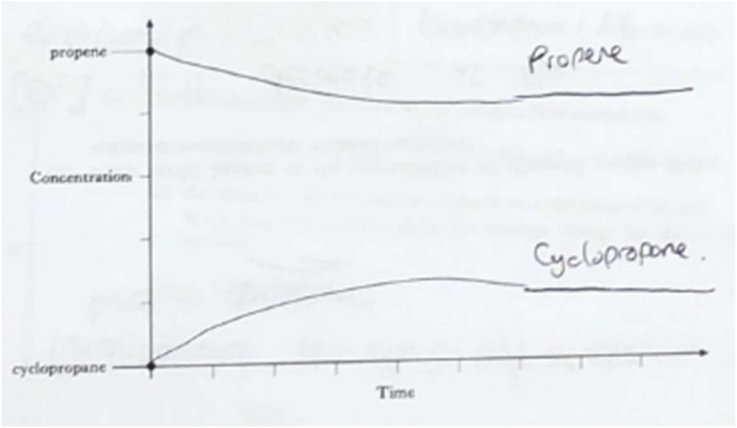
(d) Equilibria

1. C
2. B
3. B
4. C
5. D
6. B
7. C
8. A
9. B
10. B
11. C
12. C
13. A
14. D
15. A
16. A
17. C
18. C
19. B
20. D
21. C
22. C
23. Yield increases
24. NaOH reduces H^+ concentration. Due to Le Chatelier's Principle, the equilibrium will act to increase the concentration of H^+ so equilibrium will move left. Therefore colour shifts towards yellow.
25. D
26. B
27. D
28.

    (a) Point at which each line flattens.

    (b) 1 mole of gas on either side of the reaction.

(c)



29. NaOH reduces H^+ concentration. Due to Le Chatelier's Principle, the equilibrium will act to increase the concentration of H^+ so equilibrium will move left. Therefore colour shifts towards yellow.

30.

(a) As temperature increases, endothermic processes will be favoured and as temperature decreases, exothermic process will be favoured. High yield of ammonia at low temperature implies the production of this must be exothermic.

(b) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$. Lower number of moles of gas in products means that this reaction will be favoured by a high pressure.

31.

(a) The rates of the forward and reverse reaction are the same

(b) The concentration of oxygen will decrease as the reverse (endothermic) process is favoured at a higher temperature.

32.

(a) The forward reaction is exothermic as the production of C_2F_4 is favoured by a lower temperature.

(b) Graph with steeper downward curve.

33. Shift to the righ – ammoni reduced the concentration of H^+

34.

(a)

(i) $K = \frac{[NH_3]^2}{[N_2][H_2]^3}$

(ii) No effect

(b) The NH_3 is condensed away as a liquid, therefore the concentration of NH_3 drops and constantly moves the position of equilibrium to the right (not specific higher knowledge now)

35.

(a) Same/usually different

(b)

(i) Forward reaction is exothermic

(ii) No effect

36.

(a) Moves to the left

(b) There are 0 moles of gas on the left and 1 mole on the right – equilibrium will move to increase gas pressure when pressure is lowered.

(c) Moves left

(e) Chemical Analysis

1. B
2. D
3. D
4. D
5. C
6. D
7.

(a)

(i) $C_6H_8O_6 + I_2 \rightarrow C_6H_6O_6 + 2H^+ + 2e^-$

(ii) Pipette – rinse with fruit drink
Burette – rinse with iodine
Conical flask – rinse with water

(iii) Allow several repeats on the same carton

(iv) 0.2794 g

(b) 80 %

8.

(a) 70 mgl^{-1}

(b) Diluted accurately.

9.

(a) $I_2 + 2e^- \rightarrow 2I^-$

(b)

(i) Sample 1 is rough titre OR sample 1 is not concordant with others

(ii) 0.1815 mol l^{-1}

10.

(a) $H_2O_2 + 2H^+ + 2I^- \rightarrow 2H_2O + I_2$

(b) 0.038 g

11.

(a) $2S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2e^-$

(b) Starch

(c) 0.0126 moles

12.

(a) Citronellol OR geraniol OR anisyl alcohol

(b) Perfume compounds are higher concentration in brand name perfume

(c)

(i) Inert, non-polar

(ii) Size of molecules.

13.

(a) $(COOH)_2 \rightarrow 2CO_2 + 2H^+ + 2e^-$

(b) It is self-indicating

(c)

(i) Rough titre OR not concordant

(ii) 0.054 mol

14. 3.3×10^{-3} mol l^{-1}

15. 0.0147 mol l^{-1}

16.

(a) As an indicator

(b) Allow several repeats for same carton

(c) 0.185 g

17. A

18.

(a) Use of pipette or burette/meniscus bottom of graduation/pre-rinse glassware/slow addition near end-point (dropwise)

(b)

(i) 0.0324 mol l^{-1}

(ii) $NO_2^-(aq) + 2H^+(aq) + 2e^- \rightarrow NO_3^-(aq) + H_2O(l)$

19.

(a) A solution of accurately known concentration

(b) 0.125 mol

(c) 0.05 mol

(d)

(i) HCl (by 0.025 mol)

(ii) Titration

20.

(a) Lower GFM/smaller molecule

(b) The peaks overlap, so the caffeine peak might “crowd out” the lidocaine peak.