Quant booklet answers

1. –
   a. 28
   b. 40
   c. 34
   d. 64
   e. 62
   f. 102
   g. 78
   h. 148
   i. 159.5
   j. 174
   k. 342
2. - $C_6H_6O_6$
   a. 263
   b. 408
3. –
   a. 24
   b. 36
   c. 3
   d. 54
   e. 288
   f. 1008
   g. 12
   h. 260
4. –
   a. $6.022x10^{23}$
   b. $1.2044x10^{24}$
   c. $4.2154x10^{24}$
   d. $3.011x10^{23}$
   e. $7.2264x10^{24}$
   f. $1.2044x10^{25}$
5. –
   a. $6.022x10^{23}$
   b. $6.022x10^{23}$
   c. $1.5055x10^{24}$
6. Given
7. 
   a. $1.8066x10^{24}$
   b. $7.2264x10^{24}$
   c. $1.32484x10^{25}$
   d. $3.011x10^{24}$
8. 31
9. –
   a. 2.96
   b. 2.08
   c. 2.44
   d. 1.30
   e. 1.34
   f. 0.81
   g. 1.06
   h. 0.56
   i. 0.52
   j. 0.48
   k. 0.24
10. –
    a. 355g
    b. 20.4g
    c. 1.08g
    d. 0.264g
    e. 31.8g
11. 176.06
12. –
    a. 7
    b. 14
    c. 100
    d. 117
    e. 15
    f. 2
    g. 4
    h. $1.004x10^{23}$
13. –
    a. 48
    b. 306
    c. 138
14. –
    a. 6
    b. 28
    c. 63
    d. 22
15. –
    a. 132
    b. 165
    c. 36
    d. 289
16. –
    a. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
    b. 12 moles $O_2$
    c. 12 moles water
17. –
    a. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$
    b. 4 moles $CO_2$
    c. 21 moles $H_2O$
    d. 16.29 moles $H_2O$
    e. 14.33 moles of $C_2H_6$ and 50.17 moles $O_2$
18. –
    a. $S_8 + 12O_2 \rightarrow 8SO_3$
    b. 1.5 moles $S_8$
    c. 204 moles $O_2$
    d. 136 moles $SO_3$
19. –
    a. 115.14g
    b. 123.16g
    c. 23.42g
20. –
    a. 107.14g
    b. 1400g
    c. 2.87g
21. –

a. 98.48g b. 37.28g c. 50.70g

22. –
    a. 3863.89g
23. –
    a. 7.33g
24. 16.55g
25. $2KNO_3 \rightarrow 2KNO_2 + O_2$
26. $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$
27. X = 4, y = 10
28. –
    a. $N_2\ 3H_2 \rightarrow 2NH_3$
    b. –
        i. $N_2$ is excess, $H_2$ is limiting
        ii. $H_2$ limiting
        iii. $N_2$ limiting
    c. –
        i. $H_2$ limiting, 2 moles $NH_3$ produced
        ii. $N_2$ limiting, 6 moles $NH_3$ produced
        iii. $N_2$ limiting, 1 mole $NH_3$ produced
29. –
    a. $2SO_2 + O_2 \rightarrow 2SO_3$
    b. –
        i. $SO_2$ limiting
        ii. $SO_2$ limiting
        iii. $O_2$ limiting
30. Fe limiting
31. CaO limiting
32.
    a. $O_2$ limiting
    b. 13.75g
33.
    a. Fe limiting
    b. 72.21g
34. Mg limiting, mass of Ti = 100g
35. $SO_2$ limiting, 1250g $SO_3$ produced
36. NaOCl limiting, 42.95g $N_2H_4$
37. All in $dm^3$
    a. 0.01
    b. 0.1
    c. 0.2
    b. 151.86g
    b. 0.38g
    d. 0.00003
    e. 0.73
    f. 1.9
38. All in $cm^3$
    a. 1000
    b. 10,000
    c. 70,000
    d. 800
39. All in $g/dm^3$
    a. 114.29
    b. 1298.70
    c. 4
40.
    a. 115.38
41. All in $g/dm^3$
    a. 1095
    b. 1514.67
    c. 840
    d. 303.61
42. All in $dm^3$
    a. 2.44
    b. 830
    c. 1
    d. 1.05
43. All in g
    a. 0.0575
    b. 17.75
    c. 140.3
44. $2Al(OH)_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 6H_2O$
45. $778.81g/dm^3$
46. 0.449 moles
47. 0.224 moles
48. 4.41g
49. $H_2SO_4$ limiting

Summary problem

1. $3Na + AlCl_3 \rightarrow 3NaCl + Al$
2. Reactants: sodium, aluminium chloride, Products: sodium chloride, aluminium
   Elements: sodium, aluminium, compounds aluminium chloride and sodium chloride
3. When a more reactive element takes the place of a less reactive element in a compound
4. That sodium is more reactive than aluminium
5. –
   a. Sodium: 2,8,1
      Potassium: 2,8,8,1
   b. Potassium has more shells
      Outer electron further away from the nucleus
      More shielding
      Weaker electrostatic force of attraction nucleus → outer shell
      Easier to lose the electron
6. It is a metal
   Positive ions (in layers)
   With delocalised electrons
   Which can move and carry charge
7. It is a giant ionic lattice
   Ions are fixed in positions
   Not free to move and carry charge
8. Dissolve it in water or melt it

9. Ions are free to move
   and carry charge
10. –
    a. Simple molecular/covalent/small molecules
       covalent bonds between chlorine atoms
       intermolecular force between molecules
    b. Two electrons in the bond, one from each chlorine,
       must be shared (only outer shell required)
    c. It is a simple molecular substance
       Weak intermolecular forces between molecules
       Does not require a lot of energy to break
    d. Giant ionic lattice
       aluminium ions and chloride ions held together by
       the electrostatic force of attraction
       Which is strong
       requires a lot of energy to break
11. Aluminium loses three electrons, gives one to each
    of three chlorine atom
12. Aluminium needs to lose three electrons but
    sodium only loses one
13. $Na^{+}$, $Al^{3+}$
14. 10
15. 150
16. $6.022 \times 10^{24}$
17. Na: 23, $AlCl_3$: 133.5, NaCl: 58.5, Al: 27
18. Ratio
    Na:$AlCl_3$

3:1

1:1/3

5:1.667

5 moles Na requires 1.667 moles $AlCl_3$, but I have 5 moles so it is in excess and Na is limiting

19. 30g Na → moles = mass/Mr = 30/23 = 1.3

25g $AlCl_3$ → moles = mass/ Mr = 25/133.5 = 0.18

Na:$AlCl_3$

3:1

1:1/3

1.3:0.43

I need 0.43 moles aluminium chloride, I have 0.18 so it is limiting

20. –

a. Moles = mass/Mr = 90/23 = 3.9

   3:1

   1:1/3

   3.9:1.3

   Mass = moles x Mr = 1.3x27 = 35.1g

b. 1.3 moles

   Mass = moles x Mr = 1.3 x 133.5 = 173.55g

c. 3.9 moles NaCl

   mass = moles x Mr = 3.9 x 58.5 = 228.15g