Appendix A Exercises

Basic skills / elements

1. Arrange each of the following sets of elements in order of increasing atomic mass.
   a) phosphorus, sodium, iron, carbon
   b) manganese, potassium, fluorine, copper
   c) selenium, beryllium, arsenic, iron
   d) chlorine, zinc, scandium, helium
2. How many moles of titanium are contained in 15.5 g of titanium?
3. How many grams of sodium are contained in 1.25 moles of sodium?
4. How many moles of vanadium does 6.02×10^{22} vanadium atoms represent?
5. How many grams of magnesium are contained in 0.52 moles of magnesium?
6. How many moles of cobalt are contained in 66 kg of cobalt?
7. How many nickel atoms are contained in 0.50 moles of nickel?
8. How many moles of carbon are contained in 2.85 g of carbon?
9. How many moles of nitrogen does 7.5×10^{21} nitrogen atoms represent?
10. How many moles of germanium are contained in 25 mg of germanium?
11. How many oxygen atoms are contained in 6.25 moles of oxygen atoms?
12. How many grams of chromium are contained in 2.5×10^{-4} moles of chromium?
13. How many krypton atoms are contained in 1.22 moles of krypton?
14. How many kilograms of phosphorus atoms are contained in 38 moles of phosphorus atoms?
15. How many moles of silicon does 8.8×10^{24} silicon atoms represent?

Combined skills / elements

16. How many lithium atoms are contained in 1.0 g of lithium?
17. What is the mass of 2.5×10^{21} argon atoms?
18. How many aluminum atoms are contained in 1.5 kg of aluminum.
19. What is the mass of 3.5×10^{25} iron atoms?
20. What is the mass, in grams, of 8.25×10^{23} silver atoms?
21. How many barium atoms are contained in 0.050 g of barium?

Basic skills / compounds

22. Calculate the molar mass of the following compounds:
   a) hydrazine, N_2H_4
   b) acetic acid, $HC_2H_3O_2$
   c) pyridine, C_5H_5N
   d) succinic acid, $C_4H_6O_4$
   e) TNT, $C_7H_5N_3O_6$
   f) calcium nitrate, $Ca(NO_3)_2$
   g) potassium chromate, K_2CrO_4
   h) cobalt(II)citrate, $Co_3(C_6H_8O_7)_2$
23. Use the following molar masses to answer these questions:
   cobalt(II) iodide, CoI_2 : 312.74 g/mol
   morphine, $C_{17}H_{19}NO_3$: 285.35 g/mol
   a) How many moles of CoI_2 are contained in 10.0 g of CoI_2?
   b) How many grams of morphine are contained in 2.0×10^{-5} moles of morphine?
   c) How many moles of morphine are contained in 35 mg of morphine?
   d) How many kilograms of CoI_2 are contained in 12.0 moles of CoI_2?
24. What is the % carbon in each of the following compounds:
   a) CH_4 b) $C_6H_{12}O_6$ c) C_7H_8

Combined skills / compounds

25. How many grams of potassium are contained in 8.00 g of KCl?
26. How many chloride ions are contained in 8.00 g of KCl?
27. How many grams of sulfur are contained in 1.00 kg of thiophene, C_4H_4S
   (M_m = 84.14 g/mol)?
28. How many sulfur atoms are contained in 3.55 g of C_4H_4S?
29. How many carbon atoms are contained in 3.55 g of C_4H_4S?
30. If you wanted to obtain 1.00×10^5 g of nitrogen, what mass of NH_3 would you need?
31. If you wanted to obtain 1.00×10^5 g of nitrogen, what mass of NH_4NO_3 would you need?
32. How many oxygen atoms are contained in 5.25 g of $Fe(NO_3)_3$?
33. How many carbon atoms are contained in 65 g of quinine, $C_{20}H_{24}N_2O_2$ (M_m = 324.41 g/mol)?
34. How many grams of carbon are contained in 65 g of quinine?

ANSWERS:

1. **a)** C(12) < Na(23) < P(31) < Fe(56)
   b) F(19) < K(39) < Mn(55) < Cu(64)
   c) Be(9) < Fe(56) < As(75) < Se(79)
   d) He(4) < Cl(35) < Sc(45) < Zn(65)
2. 0.324 mol Ti
3. 28.8 g Na
4. 0.100 mol V
5. 13 g Mg
6. 1.1×10^{3} mol Co
7. 3.0×10^{23} atoms of Ni
8. 0.237 mol C
9. 0.012 mol N (or 0.0062 mol N_2
10. 3.4×10^{-4} mol Ge = 0.34 mmol Ge
11. 3.76×10^{24} atoms of O
12. 0.013 g Cr
13. 7.35×10^{23} atoms of Kr
14. 1.2 kg of P atoms
15. 15 mol Si
16. 8.7×10^{22} atoms of Li
17. 0.17 g Ar
18. 3.3×10^{25} atoms of Al
19. 3.2 kg Fe
20. 148 g Ag
21. 2.2×10^{20} atoms of Ba
22. **a)** 32.05 **b)** 60.34 **c)** 79.1 **d)** 118.1
    e) 227.1 **f)** 164.1 **g)** 194.2 **h)** 560.9
23. **a)** 0.0320 mol CoI_2 **b)** 0.0057 mol morphine
    c) 1.2×10^{-4} g morphine **d)** 3.75 kg CoI_2
24. **a)** 75.0% **b)** 40.0 % **c)** 91.3 %
25. 4.19 g K
26. 6.46×10^{22} Cl^{1-} ions
27. 381 g S
28. 2.54×10^{22} atoms of S
29. 1.02×10^{23} atoms of C
30. 122 kg NH_3
31. 286 kg NH_4NO_3
32. 1.18×10^{23} atoms of O
33. 2.4×10^{24} atoms of C
34. 48 g C