Name Date

Worksheet 4.1: Calculations involving the amounts of substances

All the questions on this worksheet can be done without a calculator.

Avogadro constant = 6.02 × 1023 mol−1.

Give your answers to three significant figures if they are non-divisible.

**1** Convert the following units:

1. 75.1 g to kg \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 0.433 tonne to g \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 19.9 kg to g \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 84 cm3 to dm3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 0.604 dm3 to cm3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. 2.35 × 10−3 m3 to cm3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. 0.41 ml to dm3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. 1.06 g dm−3 of Na2CO3 to mol dm−3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. 0.05 mol dm−3 of CuCl2 to g dm−3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. 0.7 mol dm−3 HCl to kg m−3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2** Calculate the number of particles in the following questions; give your answers in standard forms:

1. the number of molecules in 3 mol of carbon dioxide

1. the number of sulfate(VI) ions in 0.002 mol of sodium sulfate(VI)

1. the number of oxygen atoms in 0.75 mol of H2O2 molecule

1. the number of hydrogen atoms in 12 mol of ethyl ethanoate molecules

1. the number of P4 molecules in 12.388 g of phosphorus

1. the number of potassium ions in 69.105 g of potassium carbonate

1. the number of H atoms in 1443.4 g of pentane

1. the number of H+ ions in 5 cm3 of 0.1 mol dm−3 HNO3

1. the number of OH− ions in 200 cm3 of 0.5 mol dm−3 Ba(OH)2

1. the number of Fe2+ ions when 11.17 g of Fe reacts with excess H2SO4

**3** Calculate the mass of the following substances:

1. 10 mol of propane \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 1 × 10−3 mol of calcium carbonate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 0.0005 mol of potassium manganate(VII) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 1 molecule of ethanol in g \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 60 molecules of N2H4 in g \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4** Calculate the mass of the solute required to make each of the following solutions:

1. 50 cm3 of 0.1 mol dm−3 LiCl \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 2 dm3 of 1.5 mol dm−3 (COOH)2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 100 cm3 of 40 g dm−3 NaOH \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 1000 ml of 0.05 mol dm−3 magnesium sulfate(IV) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 25 cm3 of 0.0002 mol dm−3 MnCl2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_