# Transition skills - basic mathematical competencies answer sheet

## Rearranging equations

1.

a. $c =\frac{1000n}{v}$

b. $v= \frac{1000n}{c}$

2.

a. $m =d ×v$

b. $d = \frac{m x 10^{-3}}{v x 10^{-6}}$ = $\frac{m}{v x 10^{-3}}$

1 mark for both parts of the fraction correct, 1 mark for cancelling down the × 10–6 to × 10–3.

3.

a. $p= \frac{h}{λ}$

b. $v= \frac{h}{λm}$

1 mark for substitution of p = mv into the first equation and 1 mark for successful rearrangement.

4.

 $v =\sqrt{\frac{KE}{0.5m}}$ or $v= \sqrt{\frac{2KE}{m}}$

 1 mark for first rearrangement moving 0.5 m underneath the KE, 1 mark for dealing with the v2 by addition of the square root.

## BODMAS

1.a. 28

b. 40

c. 8

d. 45

e. 6

f. 40

**2.** a. 180

b.5352

 c.180

Evaluation: Pressing equals after each operation leads to BODMAS errors.

## Quantity calculus

1. g cm–3
2. 2.mol dm–3
3. 3.g cm–3
4. 4.mol dm–3 s–1
5. 5.N m–2
6. mol2 dm–6
7. mol–1 dm3 s–1
8. kPa–0.5
9. mol2 dm–6
10. mol dm–3

## Expressing large and small numbers

**1.** a. 1.06 × 106

b.1.06 × 10–3

 c. 2.222 × 102

**2.** 1 mark for sensible choice of × 10x power, in this case × 10–2 or × 10–3 is most sensible. 0.5 marks for each number correctly converted.

**3.** a. 104

b.1014

 c. 0.5 × 10–11 or 5 × 10–12

 d. 2.4 × 102

## Significant figures, decimal places and rounding



**7.** a. i. 0.0758

ii. 0.08

 b. i. 231

ii. 231.46

## Unit conversions 1 – Length, mass and time

**1.** 12 mm

**2.** 72.00 m

**3.** 270 s

**4.** 154 s

**5.** 2 h 25 min

**6.** 15.5 t

**7.** 26.5 g

**8.** 75 mg/tablet = 0.075 g/tablet

 1 g ÷ 0.075 g/tablet = 13.3 tablets

 Minimum number of tablets needed = 14

**9.** 30 g/min

NOTE In this example, as you are converting 1/the unit, you need to do the inverse of what is described in the diagram eg instead of ÷ 60, × 60.

**10.** 10.44 kg/h = 10 440 g/h = 174 g/min = 2.9 g/s

## Unit conversions 2 – Volume

**1.** drinks bottle, 1 dm3; sugar cube, 1 cm3; washing machine, 1 m3

**2.** To convert a volume in **cm3** into a volume in **dm3**, divide by 1000.

To convert a volume in **cm3** into a volume in **m3**, divide by 1 000 000.

**3.** a. 1.6 dm3

b.5.5 × 10–4 m3

c.1350 cm3

d.375 000 000 cm3

e.0.006 54 m3

Therefore ‘c’ is the best value for money.

## Moles and mass

**1.** a. 32.0 g ÷ 16.0 g mol–1 = 2 mol

 b. 175 g ÷ 100.1 g mol–1 = 1.75 mol

 c. 0.2 g ÷ 180.0 g mol–1 = 0.0011 mol

**2.** a 20 mol × 180 g mol–1 = 3 600 g

 b 5.00 × 10–3 mol × 63.5 g mol–1 = 0.318 g

 c 42.0 mol × 249.6 g mol–1 = 10 500 g

**3.** a. i. 3.09 g ÷ 0.0250 mol = 123.6 g mol–1

ii. CuCO3

b. molar mass of chromium carbonate = 4.26 g ÷ 0.015 mol = 284 g mol–1

 Cr2(CO3)

**BONUS QUESTION**

6.02 × 1023 p ÷ 7 500 000 000 people = 8.03 × 1013 p per person or 803 000 million pounds per person!

## Moles and concentration

**1.** a. 1.5 mol ÷ 0.25 dm3 = 6.0 mol dm–3

 b. 0.25 dm3 × 0.0150 mol dm–3 = 3.75 × 10–3 mol

 c. 0.125 mol ÷ 0.85 mol dm–3 = 0.15 dm3

**2.** a. 5.0 g ÷ 84.0 g mol–1 = 0.0595 mol

 0.0595 mol ÷ 0.100 dm3 = 0.60 mol dm–3

 b. 0.025 dm3 × 3.8 mol dm–3 = 0.095 mol

 0.095 mol × 40.0 g mol–1 = 3.8 g

 c. 2.5 g ÷ 129.9 g mol–1 = 0.0192 mol

 0.0192 mol ÷ 1.3 mol dm–3 = 0.015 dm3

 0148 dm3 = 15 cm3 (to 2 sig. fig.)