

# Starters for 10

## Transition skills answers

### 0.2 Basic mathematical competencies

#### 0.2.1. Rearranging equations

1.

a.  $c = \frac{1000n}{v}$  (1 mark)

b.  $v = \frac{1000n}{c}$  (1 mark)

2.

a.  $m = d \times v$  (1 mark)

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

1 mark for both parts of the fraction correct, 1 mark for cancelling down the  $\times 10^{-6}$  to  $\times 10^{-3}$ . (2 marks)

3.

a.  $p = \frac{h}{\lambda}$  (1 mark)

b.  $v = \frac{h}{\lambda m}$

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

(2 marks)

4.

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

1 mark for first rearrangement moving 0.5 m underneath the KE, 1 mark for dealing with the  $v^2$  by addition of the square root. (2 marks)

#### 0.2.2. BODMAS

1. a. 28

b. 40

c. 8

d. 45

e. 6

f. 40

2. a. 180 (1 mark)  
b. 5352 (1 mark)  
c. 180 (1 mark)

Evaluation: Pressing equals after each operation leads to BODMAS errors. (1 mark)

### 0.2.3. Quantity calculus

1.  $\text{g cm}^{-3}$  (1 mark)  
2.  $\text{mol dm}^{-3}$  (1 mark)  
3.  $\text{g cm}^{-3}$  (1 mark)  
4.  $\text{mol dm}^{-3} \text{ s}^{-1}$  (1 mark)  
5.  $\text{N m}^{-2}$  (1 mark)
6. a.  $\text{mol}^2 \text{ dm}^{-6}$  (1 mark)  
b.  $\text{mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$  (1 mark)  
c.  $\text{kPa}^{-0.5}$  (1 mark)  
d.  $\text{mol}^2 \text{ dm}^{-6}$  (1 mark)  
e.  $\text{mol dm}^{-3}$  (1 mark)

### 0.2.4. Expressing large and small numbers

1. a.  $1.06 \times 10^6$  (1 mark)  
b.  $1.06 \times 10^{-3}$  (1 mark)  
c.  $2.222 \times 10^2$  (1 mark)
2. 1 mark for sensible choice of  $\times 10^x$  power, in this case  $\times 10^{-2}$  or  $\times 10^{-3}$  is most sensible. 0.5 marks for each number correctly converted.
3. a.  $10^4$  (1 mark)  
b.  $10^{14}$  (1 mark)  
c.  $0.5 \times 10^{-11}$  or  $5 \times 10^{-12}$  (1 mark)  
d.  $2.4 \times 10^2$  (1 mark)

### 0.2.5. Significant figures, decimal places and rounding

		Significant figures	Decimal places
1	3.131 88	6	5
2	1000	1	0
3	0.000 65	2	5
4	1006	4	0
5	560.0	4	1
6	0.000 480	3	6

(0.5 mark for each correct answer)

7. a. i. 0.0758 (1 mark)  
ii. 0.08 (1 mark)  
b. i. 231 (1 mark)  
ii. 231.46 (1 mark)

### 0.2.6. Unit conversions 1 – Length, mass and time

1. 12 mm (1 mark)
2. 72.00 m (1 mark)
3. 270 s (1 mark)
4. 154 s (1 mark)
5. 2 h 25 min (1 mark)
6. 15.5 t (1 mark)
7. 26.5 g (1 mark)
8. 75 mg/tablet = 0.075 g/tablet  
1 g ÷ 0.075 g/tablet = 13.3 tablets  
Minimum number of tablets needed = 14 (1 mark)
9. 30 g/min (1 mark)  

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 (1 mark)

### 0.2.7. Unit conversions 2 – Volume

1. drinks bottle, 1 dm<sup>3</sup>; sugar cube, 1 cm<sup>3</sup>; washing machine, 1 m<sup>3</sup> (1 mark)
2. To convert a volume in **cm<sup>3</sup>** into a volume in **dm<sup>3</sup>**, divide by 1000. (½ mark)  
To convert a volume in **cm<sup>3</sup>** into a volume in **m<sup>3</sup>**, divide by 1 000 000. (½ mark)
3. a. 1.6 dm<sup>3</sup> (1 mark)  
b. 5.5 × 10<sup>-4</sup> m<sup>3</sup> (1 mark)  
c. 1350 cm<sup>3</sup> (1 mark)  
d. 375 000 000 cm<sup>3</sup> (1 mark)  
e. 0.006 54 m<sup>3</sup> (1 mark)
- 4.

	£ per m <sup>3</sup>		p per cm <sup>3</sup>		p per dm <sup>3</sup>
<b>Cylinder 'a'</b>	7.27	or	7.27 × 10 <sup>-4</sup>	or	0.727
<b>Cylinder 'b'</b>	7.87		7.87 × 10 <sup>-4</sup>		0.787
<b>Cylinder 'c'</b>	4.11		4.11 × 10 <sup>-4</sup>		0.411

(1 mark)

(1 mark)

(1 mark)

Therefore 'c' is the best value for money.

### 0.2.8. Moles and mass

1. a.  $32.0 \text{ g} \div 16.0 \text{ g mol}^{-1} = 2 \text{ mol}$  (1 mark)  
b.  $175 \text{ g} \div 100.1 \text{ g mol}^{-1} = 1.75 \text{ mol}$  (1 mark)  
c.  $0.2 \text{ g} \div 180.0 \text{ g mol}^{-1} = 0.0011 \text{ mol}$  (1 mark)
2. a.  $20 \text{ mol} \times 180 \text{ g mol}^{-1} = 3\,600 \text{ g}$  (1 mark)  
b.  $5.00 \times 10^{-3} \text{ mol} \times 63.5 \text{ g mol}^{-1} = 0.318 \text{ g}$  (1 mark)  
c.  $42.0 \text{ mol} \times 249.6 \text{ g mol}^{-1} = 10\,500 \text{ g}$  (1 mark)
3. a. i.  $3.09 \text{ g} \div 0.0250 \text{ mol} = 123.6 \text{ g mol}^{-1}$  (1 mark)  
ii.  $\text{CuCO}_3$  (1 mark)  
b. molar mass of chromium carbonate =  $4.26 \text{ g} \div 0.015 \text{ mol} = 284 \text{ g mol}^{-1}$  (1 mark)  
 $\text{Cr}_2(\text{CO}_3)$  (1 mark)

### BONUS QUESTION

$6.02 \times 10^{23} \text{ p} \div 7\,500\,000\,000 \text{ people} = 8.03 \times 10^{13} \text{ p per person}$  or 803 000 million pounds per person!

### 0.2.9. Moles and concentration

1. a.  $1.5 \text{ mol} \div 0.25 \text{ dm}^3 = 6.0 \text{ mol dm}^{-3}$  (1 mark)  
b.  $0.25 \text{ dm}^3 \times 0.0150 \text{ mol dm}^{-3} = 3.75 \times 10^{-3} \text{ mol}$  (1 mark)  
c.  $0.125 \text{ mol} \div 0.85 \text{ mol dm}^{-3} = 0.15 \text{ dm}^3$  (1 mark)
2. a.  $5.0 \text{ g} \div 84.0 \text{ g mol}^{-1} = \underline{0.0595 \text{ mol}}$  (1 mark)  
 $0.0595 \text{ mol} \div 0.100 \text{ dm}^3 = \underline{0.60 \text{ mol dm}^{-3}}$  (1 mark)  
b.  $0.025 \text{ dm}^3 \times 3.8 \text{ mol dm}^{-3} = \underline{0.095 \text{ mol}}$  (1 mark)  
 $0.095 \text{ mol} \times 40.0 \text{ g mol}^{-1} = \underline{3.8 \text{ g}}$  (1 mark)  
c.  $2.5 \text{ g} \div 129.9 \text{ g mol}^{-1} = \underline{0.0192 \text{ mol}}$  (1 mark)  
 $0.0192 \text{ mol} \div 1.3 \text{ mol dm}^{-3} = \underline{0.015 \text{ dm}^3}$  (1 mark)  
 $0.0148 \text{ dm}^3 = \underline{15 \text{ cm}^3}$  (to 2 sig. fig.) (1 mark)