STARTER FOR 10...

0. TRANSITION SKILLS Answers

0.1 Basic chemistry competencies

0.1.1. Balancing equations

Accept multiples or appropriate fractions, 1 mark each.

1. $\underline{2}C + ...O_2 \longrightarrow \underline{2}CO$

2. $.....2Ba + ...2H_2O \longrightarrow \underline{2}Ba(OH)_2 + ...H_2$

3. $.....C_2H_6 + \underline{3.5}O_2 \longrightarrow \underline{2}CO_2 + \underline{3}H_2O$

4. $\underline{2}HCl + ...Mg(OH)_2 \longrightarrow .....MgCl_2 + \underline{2}H_2O$

5. $.....N_2 + ...O_2 \longrightarrow \underline{2}NO$

6. $\underline{2}Fe_2O_3 + ...\underline{3}C \longrightarrow \underline{4}Fe + \underline{3}CO_2$

7. $.....CH_3CH_2OH + \underline{2}[O] \longrightarrow .....CH_3COOH + ...H_2O$

8. $\underline{2}HNO_3 + ...CuO \longrightarrow .....Cu(NO_3)_2 + H_2O$

9. $.....Al^{3+} + \underline{3}e^- \longrightarrow .....Al$

10. $\underline{2}Fe(H_2O)_6^{3+} + \underline{3}CO_3^{2-} \longrightarrow \underline{2}Fe(OH)_3(H_2O)_3 + \underline{3}CO_2 + \underline{3}H_2O$

0.1.2. Constructing ionic formulae

1.

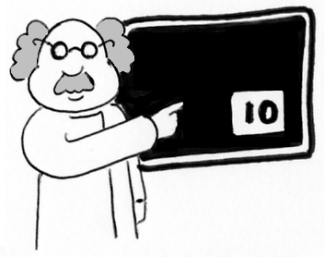
a. $Mg^{2+}\ O^{2-} = MgO$ *(1 mark)*

b. $Na^{+}\ SO_4^{2-} = Na_2SO_4$ *(1 mark)*

c. $Ca^{2+}\ OH^{-} = Ca(OH)_2$ *(1 mark)*

d. $Al^{3+}\ O^{2-} = Al_2O_3$ *(1 mark)*

e. $Cu^{+}\ O^{2-} = Cu_2O$ *(1 mark)*



STARTER FOR 10...

0. TRANSITION SKILLS Answers

2.

a. SO_4^{2-} *(1 mark)*

b. NO_3^- *(1 mark)*

c. PO_4^{3-} *(1 mark)*

d. $HCOO^-$ *(1 mark)*

e. CO_3^{2-} *(1 mark)*

0.1.3. Writing equations from text

1 mark each, accept multiples for all except question 9.

1. $3Si + 2N_2 \longrightarrow Si_3N_4$

2. $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$

3. $B + 1.5Cl_2 \longrightarrow BCl_3$

4. $N_2 + O_2 \longrightarrow 2NO$

5. $C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$

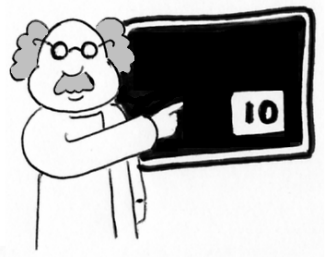
6. $SiO_2 + C + 2Cl_2 \longrightarrow SiCl_4 + CO_2$

7. $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

8. $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

9. $0.5Cl_2 + 1.5F_2 \longrightarrow ClF_3$

10. $2NO_2 + H_2O + 0.5O_2 \longrightarrow 2HNO_3$



STARTER FOR 10...

0. 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 × 10^{-6} to × 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.

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

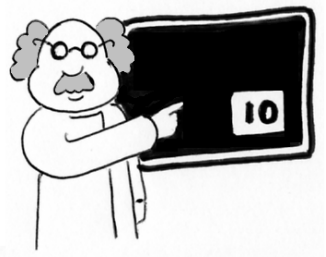
b. 40

c. 8

d. 45

e. 6

f. 40



STARTER FOR 10...

0. TRANSITION SKILLS Answers

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. $g\ cm^{-3}$ *(1 mark)*

2. $mol\ dm^{-3}$ *(1 mark)*

3. $g\ cm^{-3}$ *(1 mark)*

4. $mol\ dm^{-3}\ s^{-1}$ *(1 mark)*

5. $N\ m^{-2}$ *(1 mark)*

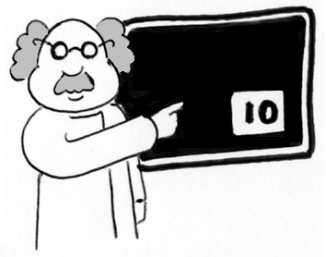
6. a. $mol^{2}\ dm^{-6}$ *(1 mark)*

b. $mol^{-1}\ dm^{3}\ s^{-1}$ *(1 mark)*

c. $kPa^{-0.5}$ *(1 mark)*

d. $mol^{2}\ dm^{-6}$ *(1 mark)*

e. $mol\ dm^{-3}$ *(1 mark)*



STARTER FOR 10...

0. TRANSITION SKILLS Answers

0.2.4. Expressing large and small numbers

1. a. 1.06×10^{6} *(1 mark)*

b. 1.06×10^{-3} *(1 mark)*

c. 2.222×10^{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. 0.5×10^{-11} or 5×10^{-12} *(1 mark)*

d. 2.4×10^{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

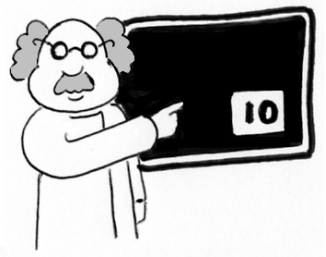
(0.5 mark for each correct answer)

7. a. i. 0.0758 *(1 mark)*

ii. 0.08 *(1 mark)*

b. i. 231 *(1 mark)*

ii. 231.46 *(1 mark)*



STARTER FOR 10...

0. TRANSITION SKILLS Answers

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^3; sugar cube, 1 cm^3; washing machine, 1 m^3 *(1 mark)*

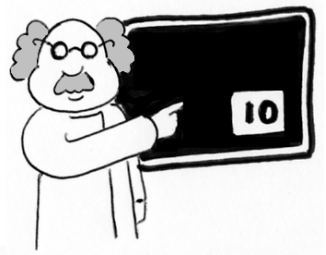
2. To convert a volume in **cm^3** into a volume in **dm^3**, divide by 1000. *(½ mark)*
To convert a volume in **cm^3** into a volume in **m^3**, divide by 1 000 000. *(½ mark)*

3. a. 1.6 dm^3 *(1 mark)*
b. 5.5×10^{-4} m^3 *(1 mark)*
c. 1350 cm^3 *(1 mark)*
d. 375 000 000 cm^3 *(1 mark)*
e. 0.006 54 m^3 *(1 mark)*

4.

	£ per m^3		p per cm^3		p per dm^3	
Cylinder 'a'	7.27	or	7.27×10^{-4}	or	0.727	*(1 mark)*
Cylinder 'b'	7.87		7.87×10^{-4}		0.787	*(1 mark)*
Cylinder 'c'	4.11		4.11×10^{-4}		0.411	*(1 mark)*

Therefore 'c' is the best value for money.



STARTER FOR 10...

0. TRANSITION SKILLS Answers

0.2.8. Moles and mass

1. a. 32.0 g ÷ 16.0 g mol^{-1} = 2 mol *(1 mark)*
b. 175 g ÷ 100.1 g mol^{-1} = 1.75 mol *(1 mark)*
c. 0.2 g ÷ 180.0 g mol^{-1} = 0.0011 mol *(1 mark)*

2. a 20 mol × 180 g mol^{-1} = 3 600 g *(1 mark)*
b 5.00×10^{-3} mol × 63.5 g mol^{-1} = 0.318 g *(1 mark)*
c 42.0 mol × 249.6 g mol^{-1} = 10 500 g *(1 mark)*

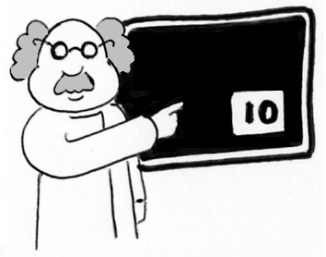
3. a. i. 3.09 g ÷ 0.0250 mol = 123.6 g mol^{-1} *(1 mark)*
ii. $CuCO_3$ *(1 mark)*
b. molar mass of chromium carbonate = 4.26 g ÷ 0.015 mol = 284 g mol^{-1} *(1 mark)*
$Cr_2(CO_3)$ *(1 mark)*

BONUS QUESTION
6.02×10^{23} p ÷ 7 500 000 000 people = 8.03×10^{13} p per person or 803 000 million pounds per person!

0.2.9. Moles and concentration

1. a. 1.5 mol ÷ 0.25 dm^3 = 6.0 mol dm^{-3} *(1 mark)*
b. 0.25 dm^3 × 0.0150 mol dm^{-3} = 3.75×10^{-3} mol *(1 mark)*
c. 0.125 mol ÷ 0.85 mol dm^{-3} = 0.15 dm^3 *(1 mark)*

2. a. 5.0 g ÷ 84.0 g mol^{-1} = <u>0.0595 mol</u> *(1 mark)*
0.0595 mol ÷ 0.100 dm^3 = <u>0.60 mol dm^{-3}</u> *(1 mark)*
b. 0.025 dm^3 × 3.8 mol dm^{-3} = <u>0.095 mol</u> *(1 mark)*
0.095 mol × 40.0 g mol^{-1} = <u>3.8 g</u> *(1 mark)*
c. 2.5 g ÷ 129.9 g mol^{-1} = <u>0.0192 mol</u> *(1 mark)*
0.0192 mol ÷ 1.3 mol dm^{-3} = <u>0.015 dm^3</u> *(1 mark)*
0.0148 dm^3 = <u>15 cm^3</u> (to 2 sig. fig.) *(1 mark)*



STARTER FOR 10...

0. TRANSITION SKILLS Answers

0.3 Basic practical competencies

0.3.1. Laboratory equipment

1. For each part (a)–(e) give ½ mark for the correct name and ½ mark for one or more correct possible volumes depending on what is available in your laboratory.

a. conical flask
100 cm^3 / 250 cm^3

b. beaker
100 cm^3 / 250 cm^3

c. volumetric flask
100 cm^3 / 200 cm^3 / 250 cm^3

d. test tube *or* boiling tube
10 cm^3 *or* 25 cm^3

e. burette
50 cm^3

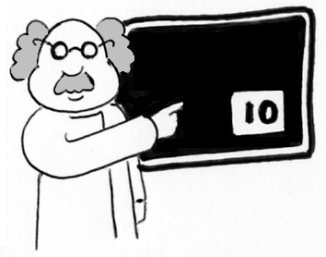
f. pipette
various sizes although 20 cm^3 or 25 cm^3 are the most common at school level

2. a. (gas) syringe *(1 mark)*
b. evaporating basin *(1 mark)*
c. crucible *(1 mark)*
d. pestle and mortar (the mortar is the bowl) *(1 mark)*

0.3.2. Recording results

1. Improvements: *(1 mark for each improvement identified)*

- Units for temperature should be included in the table headings.
- All results should be recorded to the same number of decimal places (the resolution of the thermometer used), in this case 1 d.p.
- The temperature changes are negative and so should be recorded as such, eg –22.1, or the heading should be changed to 'Temperature decrease' or similar.
- The temperature change for Run 3 is anomalous and so should be circled, or similar, to show this. It is correctly not included in the calculation of the mean.
- The mean temperature change should be stated to the same number of significant figures as the values from which it is calculated.



STARTER FOR 10...

0. TRANSITION SKILLS Answers

2. Experiment 1: (2 marks)

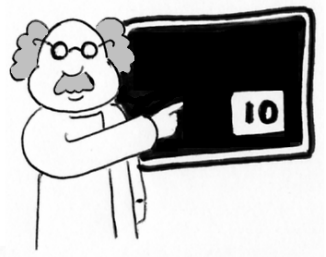
	Mass / g
Crucible empty	
Crucible + magnesium ribbon	
Crucible + magnesium oxide	

1 mark – Units given in table heading
1 mark – Clear description of item of which the mass is being recorded
Use teacher discretion to award marks for other suitable tables

Experiment 2: (3 marks)

Time / s	**Volume of hydrogen gas produced / cm^3**		
	0.5 mol dm^{-3} HCl(aq)	1.0 mol dm^{-3} HCl(aq)	1.5 mol dm^{-3} HCl(aq)
0			
20			
40			
60			
80			
100			
120			
140			
160			
180			

1 mark – Columns clearly labelled with units
1 mark – Dependent variable (volume of hydrogen gas) across columns
Independent variable (time) down rows
1 mark – Time starts at 0 and is in seconds throughout table (ie not 1 min 20 s)



STARTER FOR 10...

0. TRANSITION SKILLS Answers

0.3.3. Drawing scatter graphs

1. Graph plotted with marks allocated as follows:

- Temperature on the *x*-axis, volume on the *y*-axis. *(1 mark)*
- Suitable scales are chosen so that the plotted points cover more than half the graph paper (ie axes do not start at 0). *(1 mark)*
- Axes labelled with value and unit. *(1 mark)*
- Points are plotted accurately with a neat pencil cross and within ±1 square.

  All points plotted accurately 3 marks
  4 points plotted accurately 2 marks
  3 points plotted accurately 1 mark

2. Error bars are added to each plotted point (except 80 °C, 51.0 cm^3) *(1 mark)*
Anomalous values circled in table not included in error bars *(1 mark)*

3. Suitable line of best fit drawn *(1 mark)*

4. As the temperature increases the volume of the gas increases (or suitable similar comparative statement) *(1 mark)*