**Starters for 10**

**Transition skills answers**

**0.1 Basic chemistry competencies**

**0.1.1. Balancing equations**

*Accept multiples or appropriate fractions, 1 mark each.*

|  |  |  |
| --- | --- | --- |
| **1.** 2C + …..O2 |  | 2CO |
| **2.** …..2Ba + ….2H2O |  | 2Ba(OH)2 + …..H2 |
| **3.** …..C2H6 + 3.5O2 |  | 2CO2 + 3H2O |
| **4.** 2HCl + …..Mg(OH)2 |  | …..MgCl2 + 2H2O |
| **5.** …..N2 + …..O2 |  | 2NO |
| **6.** 2Fe2O3 + …3C |  | 4Fe + 3CO2 |
| **7.** …..CH3CH2OH + 2[O] |  | …..CH3COOH + …..H2O |
| **8.** 2HNO3 + …..CuO |  | …..Cu(NO3)2 + H2O |
| **9.** …..Al3+ + 3e– |  | …..Al |
| **10.** 2Fe(H2O)63+ + 3CO32– |  | 2Fe(OH)3(H2O)3 + 3CO2 + 3H2O |

**0.1.2. Constructing ionic formulae**

**1.**

a. Mg2+ O2– = MgO *(1 mark)*

b. Na+ SO42– = Na2SO4 *(1 mark)*

c. Ca2+ OH– = Ca(OH)2 *(1 mark)*

d. Al3+ O2– = Al2O3 *(1 mark)*

e. Cu+ O2– = Cu2O *(1 mark)*

**2.**

a. SO42– *(1 mark)*

b. NO3– *(1 mark)*

c. PO43–  *(1 mark)*

d. HCOO– *(1 mark)*

e. CO32– *(1 mark)*

**0.1.3. Writing equations from text**

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

|  |  |  |
| --- | --- | --- |
| **1.** 3Si + 2N2 |  | Si3N4 |
| **2.** H2SO4 + 2NaOH |  | Na2SO4 + 2H2O |
| **3.** B + 1.5Cl2 |  | BCl3 |
| **4.** N2 + O2 |  | 2NO |
| **5.** C2H5OH + 3O2 |  | 2CO2 + 3H2O |
| **6.** SiO2 + C + 2Cl2 |  | SiCl4 + CO2 |
| **7.** Fe2O3 + 3CO |  | 2Fe + 3CO2 |
| **8.** CH4 + 2O2 |  | CO2 + 2H2O |
| **9.** 0.5Cl2 + 1.5F2 |  | ClF3 |
| **10.** 2NO2 + H2O + 0.5O2 |  | 2HNO3 |

**0.2 Basic mathematical competencies**

**0.2.1. Rearranging equations**

**1.**

a. *(1 mark)*

b. *(1 mark)*

**2.**

a. *(1 mark)*

b. =

1 mark for both parts of the fraction correct, 1 mark for cancelling down the × 10–6 to × 10–3. *(2 marks)*

**3.**

a. *(1 mark)*

b.

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

*(2 marks)*

**4.**

or

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. *(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.** 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. mol2 dm–6 *(1 mark)*

b.mol–1 dm3 s–1 *(1 mark)*

c.kPa–0.5 *(1 mark)*

d.mol2 dm–6 *(1 mark)*

e.mol dm–3 *(1 mark)*

**0.2.4. Expressing large and small numbers**

**1.** a. 1.06 × 106 *(1 mark)*

b.1.06 × 10–3*(1 mark)*

c. 2.222 × 102 *(1 mark)*

**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 *(1 mark)*

b.1014*(1 mark)*

c. 0.5 × 10–11 or 5 × 10–12 *(1 mark)*

d. 2.4 × 102 *(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 dm3; sugar cube, 1 cm3; washing machine, 1 m3 *(1 mark)*

**2.** To convert a volume in **cm3** into a volume in **dm3**, divide by 1000. *(½ mark)* To convert a volume in **cm3** into a volume in **m3**, divide by 1 000 000. *(½ mark)*

**3.** a. 1.6 dm3 *(1 mark)*

b.5.5 × 10–4 m3 *(1 mark)*

c.1350 cm3 *(1 mark)*

d.375 000 000 cm3 *(1 mark)*

e.0.006 54 m3 *(1 mark)*

**4.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **£ per m3** |  | **p per cm3** |  | **p per dm3** |
| **Cylinder ‘a’** | 7.27 | or | 7.27 × 10–4 | or | 0.727 |
| **Cylinder ‘b’** | 7.87 |  | 7.87 × 10–4 |  | 0.787 |
| **Cylinder ‘c’** | 4.11 |  | 4.11 × 10–4 |  | 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 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. CuCO3*(1 mark)*

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

Cr2(CO3) *(1 mark)*

**BONUS QUESTION**

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

**0.2.9. Moles and concentration**

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

b. 0.25 dm3 × 0.0150 mol dm–3 = 3.75 × 10–3 mol *(1 mark)*

c. 0.125 mol ÷ 0.85 mol dm–3 = 0.15 dm3 *(1 mark)*

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

0.0595 mol ÷ 0.100 dm3 = 0.60 mol dm–3 *(1 mark)*

b. 0.025 dm3 × 3.8 mol dm–3 = 0.095 mol *(1 mark)*

0.095 mol × 40.0 g mol–1 = 3.8 g *(1 mark)*

c. 2.5 g ÷ 129.9 g mol–1 = 0.0192 mol *(1 mark)*

0.0192 mol ÷ 1.3 mol dm–3 = 0.015 dm3 *(1 mark)*

0.0148 dm3 = 15 cm3 (to 2 sig. fig.) *(1 mark)*

**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 cm3 / 250 cm3

b.beaker

100 cm3 / 250 cm3

c. volumetric flask

100 cm3 / 200 cm3 / 250 cm3

d. test tube *or*  boiling tube

10 cm3 *or* 25 cm3

e. burette

50 cm3

f. pipette

various sizes although 20 cm3 or 25 cm3 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.

**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 / cm3** | | |
| 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)*

**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 cm3) *(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)*