**Answers Chapter 1**

**1.01 Numbers and units**

1. 1.000 g. (Keep in mind that I use the Dutch notation so this is one thousand)

2. 1.000 mm.

3. 1.000.000 µs.

4. Area = length x width

Area = 3m x 2m (to solve this, first do the number part (3 x 2) and then the unit part (m x m)

Area = 6m2

5. 2 km 0,2 km 20 km

6. 5 s 50 s

7. 1,5.103 m 1,5.106 m 1,5.10-1 m 1,5.10-2 m.

**1.02 A system of units**

1. m

2. kg

3. s

4. gram milligram tonne (1000 kg) micrometer millisecond

5. a. 1,564 m b. 1,750 kg

 c. 26000 kg d. 0,000062 s

 e. 36,5 kg f. 0,000000000616 m

6. 500 pages 2,50 kg

 : 500

 : 500

 1 page 0,005 kg

7.

|  |  |  |
| --- | --- | --- |
| Mass | Length | Time |
| t | km | s |
| kg | m | ms |
| g | mm | µs |
| mg | µm | ns |
| µg | nm |  |

**1.04 Volume and density**

1. 1 m3 = 1000 dm3 = 1.000.000 cm3.

2. 1 L = 1 dm3 = 1000 cm3.

3. 1 m3 = 1000 dm3 = 1000 L = 1.000.000 mL

4. a. 0,2 m3 = 200 dm3 = 200 L

 b. 0,2 m3 = 200 dm3 = 200.000 cm3

 c. 1 cm3 = 1 mL so take answer b and replace the unit by mL

5. a. 2,7 g/cm3

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| V = 20 cm3$ρ $= 2,7 g/cm3m = ? | $$ρ= \frac{m}{V}$$$$m= ρ ∙V$$ | $$m= 2,7 ^{g}/\_{cm^{3}}∙20 cm^{3}$$ |  m = 54 g |

 b.

 In the formula column you first need to write down the basic, standard formula. Because we don’t need density but mass, we need to rebuild the formula into something else which also must be in the formula column.

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 27 g$ρ $= 2,7 g/cm3V = ? | $$ρ= \frac{m}{V}$$$$V= \frac{m}{ρ}$$ | $$V= \frac{27 g}{2,7 ^{g}/\_{cm^{3}}}$$ |  $ V$ = 10 cm3 |

 c.

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 39 gV = 5 cm3$ρ $= ? | $$ρ= \frac{m}{V}$$ | $$ρ= \frac{39 g}{5 cm^{3}}$$ |  $ ρ$ = 7,8 g/cm3 |

6.

 The substance that has a density of 7,8 g/cm3 is steel (stainless)

7. Volume = length x height x width

 Volume = 5 m x 2 m x 3 m

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| V = 30 m3$ρ $= 1,3 kg/m3m = ? | $$ρ= \frac{m}{V}$$$$m= ρ ∙V$$ | $$m= 1,3 ^{kg}/\_{m^{3}}∙30 m^{3}$$ |  m = 3,9 kg |

 Volume = 30 m3

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 3200 kg$ρ $= 800 kg/m3V = ? | $$ρ= \frac{m}{V}$$$$V= \frac{m}{ρ}$$ | $$V= \frac{3200 kg}{800 ^{kg}/\_{m^{3}}}$$ |  $ V$ = 4 m3 |

8.

9. For lead I only know the density. Mass and volume are unknown.

 For petrol I know density and mass, so I can calculate the volume

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 1600 kg$ρ $= 800 kg/m3V = ? | $$ρ= \frac{m}{V}$$$$V= \frac{m}{ρ}$$ | $$V= \frac{1600 kg}{800 ^{kg}/\_{m^{3}}}$$ |  $ V$ = 2 m3 |

The petrol and lead have the same volume. Because I calculated the volume of the petrol I automatically know the volume of the lead. With volume and density being known for lead we now can calculate mass.

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| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| V = 2 m3$ρ $= 11.400 kg/m3m = ? | $$ρ= \frac{m}{V}$$$$m= ρ ∙V$$ | $$m= 11.400 ^{kg}/\_{m^{3}}∙2 m^{3}$$ |  m = 22.800 kg |

**1.05 Measuring volume and density**

1. For all crowns they give me mass and volume so I’m able to calculate density.

 Crown A

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 3750 gV = 357 cm3$ρ $= ? | $$ρ= \frac{m}{V}$$ | $$ρ= \frac{3750 g}{357 cm^{3}}$$ |  $ ρ$ = 10,5 g/cm3 |

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 3750 gV = 194 cm3$ρ $= ? | $$ρ= \frac{m}{V}$$ | $$ρ= \frac{3750 g}{194 cm^{3}}$$ |  $ ρ$ = 19,3 g/cm3 |

 Crown B

 Crown C

|  |  |  |  |
| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 3750 gV = 315 cm3$ρ $= ? | $$ρ= \frac{m}{V}$$ | $$ρ= \frac{3750 g}{315 cm^{3}}$$ |  $ ρ$ = 11,9 g/cm3 |

 A = Silver, B = Gold, C = Mixture

2. a. Mass of the liquid = (170 g – 90 g) = 80 g.

 Volume of the liquid = 100 cm3

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| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 80 gV = 100 cm3$ρ $= ? | $$ρ= \frac{m}{V}$$ | $$ρ= \frac{80 g}{100 cm^{3}}$$ |  $ ρ$ = 0,8 g/cm3 |

 b. Mass of the stone = (290 – 170) = 120 g.

 Volume of the stone = (148 – 100) = 48 cm3

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| --- | --- | --- | --- |
| Grocery list | Formula | Calculation | Answer + Unit |
| m = 120 gV = 48 cm3$ρ $= ? | $$ρ= \frac{m}{V}$$ | $$ρ= \frac{120 g}{48 cm^{3}}$$ |  $ ρ$ = 2,5 g/cm3 |