

Name: _____ Period: _____ Date: _____

Metric System WS

Part A: Choose the most appropriate metric unit (including the prefix) for each of the following.

Object	Metric Unit	Object	Metric Unit
1) Volume of shampoo for 1 wash	mL	7) Mass of a stapler	g
2) Mass of a pencil	g	8) Volume of gas in a car	L
3) Length of a tunnel through a mountain	km	9) Mass of a small motorcycle	kg
4) Width of a shoe	cm	10) Height of a house	m
5) Length of your hair	cm	11) Volume of a fish tank	L
6) Mass of a loaf of bread	g or kg	12) Mass of a grain of sand	mg

Part B: Write the equivalent measure for the problem.

- | | |
|----------------------------------|------------------------------------|
| 13) 40 L = <u>40,000</u> mL | 25) 6 m = <u>6,000</u> mm |
| 14) 5000 L = <u>5</u> kL | 26) 1000 cm = <u>10</u> m |
| 15) 4000g = <u>4</u> kg | 27) 11 km = <u>11,000</u> m |
| 16) 8 g = <u>8,000</u> mg | 28) 80 mg = <u>.00008</u> kg |
| 17) 12000 L = <u>12</u> kL | 29) 3 m = <u>3,000</u> mm |
| 18) 50 mg = <u>.050</u> g | 30) 470 mL = <u>.47</u> L |
| 19) 6000 m = <u>6,000,000</u> cm | 31) 2000 L = <u>2,000,000</u> mL |
| 20) 200 kg = <u>200,000</u> g | 32) 83 g = <u>0.083</u> kg |
| 21) 10000 g = <u>10</u> kg | 33) 41300 L = <u>41.3</u> kL |
| 22) 500 mL = <u>.5</u> L | 34) 5340 mg = <u>5.34</u> g |
| 23) 1 L = <u>1000</u> mL | 35) 2000 m = <u>2</u> km |
| 24) 4000 L = <u>4</u> kL | 36) 13200 kg = <u>13,200,000</u> g |

Part C: Answer the questions.

37. Order the following lengths from largest to smallest: m km mm cm

km m cm mm

38. Circle the measurement that is larger.

a) 63 cm or 6 m

b) 5 g or 508 mg

c) 1500 mL or 1.49 L

WS Metric Units II (Conversions)

Convert each of the following using the metric prefix number line (on reference sheet):

- 1) 25.2 cm = .252 m 2) 25.2 cg = .252 g 3) 25.2 km = 25,200 m

- 4) 25.2 mL = .0252 L 5) 25.2 cm = 252 mm 6) 25.2 g = 25,200,000 µg

- 7) 0.023 µL = .0000023 cL
~~.0000023~~
.0000023 8) 0.023 kg = 2300 cg 9) 0.023 m = 23 mm

- 10) 4500 µm = 4.5 × 10⁷ Mm
~~4500~~
4500 11) 4500 dL = 4.5 × 10⁸ µL
~~4500~~
4500 12) 4 dg = .45 kg

- 13) 6 × 10⁹ mm = 6 × 10⁶ m 14) 6 × 10⁹ m = 6 × 10¹¹ cm 15) 6 × 10⁹ kg = 6 × 10¹² g
- 6 × 10⁹ × 1 × 10⁻³ 6 × 10⁹ × 1 × 10² 6 × 10⁹ kg × 1 × 10³

- 16) 4 × 10³ dg = 4 × 10⁸ µg 17) 4 × 10³ L = 4 × 10⁶ mL 18) 4 × 10³ mg = 4 × 10⁻⁶ Mg
- 4 × 10³ dg × 1 × 10⁵ 4 × 10³ × 1 × 10³ 4 × 10³ × 1 × 10⁻⁹
- 400,000,000 4,000,000 .000004000

- 19) 7 × 10⁻⁶ mg = 7 × 10⁻⁷ cg 20) 7 × 10⁻⁶ cL = 7 × 10⁻² µL 21) 7 × 10⁻⁶ g = 7 × 10⁻³ mg
- 7 × 10⁻⁶ × 1 × 10⁻¹ 7 × 10⁻⁶ × 1 × 10⁴ 7 × 10⁻⁶ × 1 × 10³
- 000007 000007 = .07 000007 = .007

Ans (IRO+6): ~~252~~ 0.0252 ~~0.252~~ 25,200,000 2.52 ~~0.252~~ ~~25200~~
 2300 ~~25~~ 0.0000023 2300
 450 0.0000000045 450,000,000 0.45 ~~6 × 10⁶~~ ~~6 × 10¹¹~~ ~~6 × 10¹²~~ 6 × 10⁴
 4 × 10² 4 × 10⁶ 4 × 10⁻⁶ 4 × 10⁸ 7 × 10⁻⁷ 7 × 10⁻⁵ ~~7 × 10⁻²~~ ~~7 × 10⁻³~~

WS 2.2 E: Density Calculations

$$1 \text{ cm}^3 = 1 \text{ mL}$$

$$D = \frac{M}{V}$$

$$M = D \times V$$

$$V = \frac{M}{D}$$

(SHOW ALL WORK)

1. A 13.2 mL rock weighs 47.6 g. Determine its density.

$$\frac{47.6 \text{ g}}{13.2 \text{ mL}}$$

Ans: 3.61 g/mL

2. 138.42 g of salt water has a volume of 117.0 mL. Determine its density.

$$\frac{138.42 \text{ g}}{117.0 \text{ mL}} =$$

Ans: 1.183 g/mL

3. 0.446 g of hydrogen gas fills a 5.0 L bag. Determine hydrogen's density.

$$D = \frac{0.446 \text{ g}}{5.0 \text{ L}} =$$

Ans: 0.089 g/L

4. 25.2 mL of water are placed in a graduated cylinder. A 22.6 g stone is dropped in, and the water level rises to 32.4 mL. Find the stone's density.

$$\begin{array}{r} 32.4 \text{ mL} \\ - 25.2 \text{ mL} \\ \hline 7.2 \text{ mL} \end{array}$$

$$D = \frac{22.6 \text{ g}}{7.2 \text{ mL}} = 3.1 \text{ g/mL}$$

Ans: 3.1 g/mL

5. A graduated cylinder is placed on an electronic balance, and the scale reads 78.32 g. 10.0 mL of glycerine are added, and the scale reads 91.78 g. What is the density of glycerine?

$$\begin{array}{r} m = 91.78 \text{ g} \\ - 78.32 \text{ g} \\ \hline 13.46 \text{ g} \end{array}$$

$$D = \frac{13.46 \text{ g}}{10.0 \text{ mL}} = 1.35 \text{ g/mL}$$

Ans: 1.35 g/mL

6. A 3.0 cm x 4.5 cm x 6.7 cm brick has a mass of 985 g. a> What is its density, and... b> from what material is it most likely made?

$$V = l \times w \times h = 90. \text{ cm}^3$$

$$D = \frac{985 \text{ g}}{90 \text{ cm}^3} = 11 \text{ g/cm}^3$$

Ans: a> 11 g/cm³ b> lead
11 g/mL

7. A cylinder has a mass of 528.6 g, a length of 14.2 cm, and a diameter of 2.30 cm. Of what is the cylinder most likely made of?

$$V = \pi r^2 h = (3.14)(1.15 \text{ cm})^2 (14.2 \text{ cm}) = 59.0 \text{ cm}^3$$

$$D = \frac{528.6 \text{ g}}{59.0 \text{ cm}^3} = 8.96 \text{ g/cm}^3$$

Ans: copper

8. A ball has a mass of 753 g and a radius of 5.62 cm. a> Will the ball float or sink in water? b> Will it float or sink in salt water? (see #2)

$$V = \frac{4\pi r^3}{3} = \frac{4(3.14)(5.62 \text{ cm})^3}{3} = 743 \text{ cm}^3$$

$$D = \frac{753 \text{ g}}{743 \text{ cm}^3} = 1.01 \text{ g/cm}^3$$

Ans: a> sink b> float

9. a> How much would a 15.2 mL chunk of styrofoam weigh? b> How much would the same size chunk of osmium weigh?

$$a> M = D \times V = (0.145 \text{ g/mL})(15.2 \text{ mL}) = 2.20 \text{ g}$$

$$b> M = D \times V = (22.6 \text{ g/mL})(15.2 \text{ mL}) = 344 \text{ g}$$

Ans: a> 2.20 g

Ans: b> 344 g

(answers are on bottom of next page...)

Substance:	Density:
osmium	22.6 g/mL
gold	19.3 g/mL
mercury	13.6 g/mL
lead	11.4 g/mL
copper	8.96 g/mL
aluminum	2.70 g/mL
water	1.00 g/mL
alcohol	0.781 g/mL
styrofoam	0.145 g/mL
air	1.28 g/L
helium	0.179 g/L

Volume Equations	
block:	$V = lwh$
cylinder:	$V = \pi r^2 h$
sphere:	$V = \frac{4\pi r^3}{3}$

10. How much would a 15.9 cm x 11.6 cm x 7.3 cm block of aluminum weigh?

$$V = l \times w \times h = 1300 \text{ cm}^3 \quad m = D \times V = (2.70 \text{ g/mL}) (1300 \text{ mL})$$

$= 1300 \text{ mL}$

Ans: 3500g

11. A piece of gold wire has a diameter of 0.175 cm.

How much will precisely 1.00×10^5 cm (about 2/3 mile) of the wire weigh? (hint: think of the wire as a tiny cylinder)

$$m = D \times V \quad V = \pi r^2 h$$

$$= (3.14) (0.0875 \text{ cm})^2 (1.00 \times 10^5 \text{ cm}) = 2400 \text{ cm}^3 \times 19.3 \text{ g/cm}^3$$

Ans: 46400g

12. What volume would 62.4 g of mercury have?

$$V = \frac{m}{D} = \frac{62.4 \text{ g}}{13.6 \text{ g/mL}} = 4.59 \text{ mL}$$

Ans: 4.59 mL

13. How large would a balloon be when filled with: a) 17.8 g of air? b) With 17.8 g of helium? (find the volume!)

$$V = \frac{m}{D} \quad \text{a) } \frac{17.8 \text{ g}}{1.28 \text{ g/L}} = 13.9 \text{ L} \quad \text{b) } \frac{17.8 \text{ g}}{0.179 \text{ g/L}} = 99.4 \text{ L}$$

Ans: a) 13.9 L b) 99.4 L

14. What volume of alcohol would have a mass of 10.0 g?

$$V = \frac{m}{D} = \frac{10.0 \text{ g}}{0.786 \text{ g/mL}} = 12.8 \text{ mL}$$

Ans: 12.8 mL

15. A 187.3 g lead block has dimensions 3.20 cm x 2.95 cm x Z cm. Find Z (the thickness of the block) (remember $V = l \times w \times h$)

$$V = \frac{m}{D} = \frac{187.3 \text{ g}}{11.4 \text{ g/cm}^3} = 16.4 \text{ cm}^3 = 3.20 \text{ cm} \times 2.95 \text{ cm} \times Z \text{ cm}$$

Ans: 1.74 cm

16. A rectangular piece of aluminum foil measures 13.72 cm x 8.63 cm and has a mass of 3.1 g. Find how thick it is. (remember $V = l \times w \times h$)

$$V = \frac{m}{D} = \frac{3.1 \text{ g}}{2.70 \text{ g/cm}^3} = 1.1 \text{ cm}^3$$

$$\frac{1.1 \text{ cm}^3}{(13.72 \text{ cm})(8.63 \text{ cm})} = W = 9.7 \times 10^{-3} \text{ cm}$$

Ans: $9.7 \times 10^{-3} \text{ cm}$

* (challenge) At a cost of \$1200/oz, how much would you have to pay for a solid cubic foot of gold? (1 oz = 28.4 g; 1 in = 2.54 cm) hint: your starting point should be: $1 \text{ ft}^3 \times \dots$ * (answer not in ans. bank...)

1 ft^3	$(12 \text{ in})^3$	$(2.54 \text{ cm})^3$	19.3 g	1 oz	$\$1200$	=
1 ft^3	1 in^3	1 cm^3	28.4 g	1 oz	1 oz	

Ans: \$23,000,000

ANS (IRO+1): ~~9.7×10^{-3}~~ 0.089 1.788 1.35 1.74 280 8.1 3.61 4.55 N 128 128
99.4 \$44 435 3520 46,400 lead copper sink float

UNITS (IRO+1): ~~g/mL~~ ~~g/L~~ g g mL mL ~~L~~ ~~L~~ cm cm \$ g/oz g/L g/mL g/mL