Question No. 1 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

1. The SI unit for mass is kilogram, but in chemistry, gram or milligram is more common for the smaller amount of chemicals. Convert 24.7 grams to milligrams.

(A) 24700 mg
(B) 2470 mg
(C) 24.7 mg
(D) 0.247 mg

Feedback

A. Correct!
Good job! Apply the metric system's prefix milli = 10^{-3}x. 1 mg = 0.001 g.

B. Incorrect!
Apply the conversion factor 1 mg = 0.001 g. This is a one step process.

C. Incorrect!
Apply the conversion factor 1 mg = 0.001 g. This is a one step process.

D. Incorrect!
Apply the conversion factor 1 mg = 0.001 g. This is a one step process.

Solution

Before doing the calculation, THINK about whether you will have more milligrams than grams, or fewer milligrams than grams, then do the calculation.

1 mg = 0.001 g

$$\frac{24.7\ \text{g}}{\phantom{0.001\ \text{g}}}$$

$$\frac{24.7\ \text{g}}{\phantom{0.001\ \text{g}}} = \_\_\_\_\_\ \text{mg}$$

$$\frac{24.7\ \text{g}}{0.001\ \text{g}} = \_\_\_\_\_\ \text{mg}$$

$$\frac{24.7\ \text{g}}{0.001\ \text{g}} = 24700\ \text{mg}$$

The correct answer is (A).

Question No. 2 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

2. The SI unit for length is meter (m). Convert 334 m to km.

(A) 33.4 km
(B) 3.34 km
(C) 0.334 km
(D) 33400 km

Feedback

A. Incorrect!
Apply the equality 1000 m = 1 km.

B. Incorrect!
Apply the equality 1000 m = 1 km.

C. Correct!
Good job! Apply the metric prefix kilo- = 1000x. 1000 m = 1 km. Keep the same significant figures.

D. Incorrect!
Apply the equality 1000 m = 1 km.

Solution

1000 m = 1 km

$$\frac{334\ \text{m}}{\phantom{1000\ \text{m}}}$$

$$\frac{334\ \text{m}}{\phantom{1000\ \text{m}}} = \_\_\_\_\_\ \text{km}$$

$$\frac{334\ \text{m}}{1000\ \text{m}} = \_\_\_\_\_\ \text{km}$$

$$\frac{334\ \text{m}}{1000\ \text{m}} = 0.334\ \text{km}$$

The correct answer is (C).

Question No. 3 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

3. Joule (J) is a SI derived unit for energy, work and heat, which is derived from standard SI units of meter, kilogram and second, where J = Nm = m^2kg/s^2. Joule and calorie (or kcal) are typical energy units in chemistry. However, the nutritional calorie (symbol: Cal or C) is not the same as this thermochemical calorie (symbol: cal), 1 Cal (nutrition) = 1000 cal or 1 kcal (science). Convert 19.87 J to kcal.

(A) 0.004754 kcal
(B) 0.08306 kcal
(C) 4.754 kcal
(D) 4754 kcal

Feedback

A. Correct!
Good job! Apply the conversion factors 4.18 J = 1 cal and 1000 cal = 1 kcal.

B. Incorrect!
Use 4.18 J = 1 cal and 1000 cal = 1 kcal

C. Incorrect!
Use 4.18 J = 1 cal and 1000 cal = 1 kcal

D. Incorrect!
Use 4.18 J = 1 cal and 1000 cal = 1 kcal

Solution

4.18 J = 1.00 cal
1000 cal = 1 kcal

$$\frac{19.87\ \text{J}}{\quad} = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} = \_\_\_\_\_\ \text{kcal}$$

$$\frac{19.87\ \text{J}}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} = \_\_\_\_\_\ \text{kcal}$$

$$\frac{19.87\ \text{J}}{\quad} \cdot \frac{1.00\ \text{cal}}{4.18\ \text{J}} \cdot \frac{1\ \text{kcal}}{1000\ \text{cal}} = \_\_\_\_\_\ \text{kcal}$$

$$\frac{19.87\ \text{J}}{\quad} \cdot \frac{1.00\ \text{cal}}{4.18\ \text{J}} \cdot \frac{1\ \text{kcal}}{1000\ \text{cal}} = 0.004754\ \text{kcal}$$

The correct answer is (A).

Question No. 4 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

4. Density is defined as the mass of a substance per unit volume. Convert a density of 15.7 g/L to kg/mL.

(A) 0.0157 kg/mL
(B) 1.57 kg/mL
(C) 15.7 kg/mL
(D) 1.57×10^{-5} kg/mL

Feedback

A. Incorrect!
Put the grams on top and the liters on bottom of the first "given" step.
1000 g = 1 kg and 0.001 L = 1 mL.

B. Incorrect!
Put the grams on top and the liters on bottom of the first "given" step.
1000 g = 1 kg and 0.001 L = 1 mL.

C. Incorrect!
Put the grams on top and the liters on bottom of the first "given" step.
1000 g = 1 kg and 0.001 L = 1 mL.

D. Correct!
Good job! Put the grams on top and the liters on bottom of the first "given" step. Apply the conversion factors 1000 g = 1 kg and 0.001 L = 1 mL. Make the unit cancellation to reach the desired unit.

Solution

1000 g = 1 kg
0.001 L = 1 mL

$$\frac{15.7\ \text{g}}{\text{L}}$$

$$\frac{15.7\ \text{g}}{\text{L}} = \_\_\_\_\_\ \text{kg/mL}$$

$$\frac{15.7\ \text{g}}{\text{L}} \cdot \frac{1\ \text{kg}}{1000\ \text{g}} \cdot \frac{0.001\ \text{L}}{1\ \text{mL}} = \_\_\_\_\_\ \text{kg/mL}$$

$$\frac{15.7\ \text{g}}{\text{L}} \cdot \frac{1\ \text{kg}}{1000\ \text{g}} \cdot \frac{0.001\ \text{L}}{1\ \text{mL}} = \underline{0.0000157}\ \text{kg/mL}$$

Convert the result into a scientific notation: 1.57×10^{-5} kg/mL.

The correct answer is (D).

Question No. 5 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

5. Metric prefixes are typically used in unit conversion with the base unit. The base unit of length is meter (m). Convert 45.2 cm to mm.

(A) 0.00452 mm
(B) 0.452 mm
(C) 4.52 mm
(D) 452 mm

Feedback

A. Incorrect!
Use two steps. 1 cm = 0.01 m and 0.001 m = 1 mm

B. Incorrect!
Use two steps. 1 cm = 0.01 m and 0.001 m = 1 mm

C. Incorrect!
Use two steps. 1 cm = 0.01 m and 0.001 m = 1 mm

D. Correct!
Good job! Use the conversion factors 1 cm = 0.01 m and 0.001 m = 1 mm.

Solution

1 cm = 0.01 m
0.001 m = 1 mm

$$\frac{45.2\text{ cm}}{}$$

$$\frac{45.2\text{ cm}}{} = \_\_\_\_\_\text{ mm}$$

$$\frac{45.2\text{ cm}}{} \times \frac{0.01\text{ m}}{1\text{ cm}} \times \frac{1\text{ mm}}{0.001\text{ m}} = \_\_\_\_\_\text{ mm}$$

$$\frac{45.2\text{ cm}}{} \times \frac{0.01\text{ m}}{1\text{ cm}} \times \frac{1\text{ mm}}{0.001\text{ m}} = 452\text{ mm}$$

The correct answer is (D).

Question No. 6 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
 Question	**6.** The standard SI unit for time is second (s). How many seconds are in 2.0 years? (A) 200000 s (B) 63072000 s (C) 1051200 s (D) 6.3 x 10^7 s
 Feedback	A. Incorrect! Use the conversion factors 1 year = 365 days, 1 day = 24 hours, 1 hour = 60 minutes and 1 minute = 60 seconds.
	B. Incorrect! The final number is correct. However, since the given original data has two significant figures, the final answer must be in the format of two significant figures, expressed in scientific notation.
	C. Incorrect! Good try. This is in fact the total minutes in 2 years.
	D. Correct! Good job! Use the conversion factors 1 year = 365 days, 1 day = 24 hours, 1 hour = 60 minutes and 1 minute = 60 seconds.
 Solution	Apply the dimensional analysis one quantity at a time. Total Seconds = 2.0 yr x (365 day/yr) x (24 hr/day) x (60 min/hr) x (60 s/min) = 6.3 x 10^7 s (to 2 significant figures). **The correct answer is (D).**

Question No. 7 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

7. One of the most useful numbers in chemistry is the Avogadro constant, which is the conversion factor between moles and number of molecules (1 mole = 6.02×10^{23} molecules). How many atoms of hydrogen can be found in 0.25 moles of H_2O?

(A) 3.0×10^{23} atoms
(B) 3.01×10^{23} atoms
(C) 2.1×10^{22} atoms
(D) 2.5×10^{23} atoms

Feedback

A. Correct!
Good job! There are two pieces of information needed to solve this problem – the conversion factor between moles and molecules, and the number of atoms (2 hydrogen atoms) in one H_2O molecule.

B. Incorrect!
Apply the mole-molecule conversion factor. Every H_2O molecule has two hydrogen atoms. There are only two significant figures in the original moles, hence the final answer should have 2 not 3 significant figures.

C. Incorrect!
Apply the mole-molecule conversion factor. Every H_2O molecule has two hydrogen atoms.

D. Incorrect!
Apply the mole-molecule conversion factor. Every H_2O molecule has two hydrogen atoms.

Solution

First we need to convert the moles to #molecules, and then convert to #atoms. Use the equality 1 mole = 6.02×10^{23} molecules and 2H in every H_2O.

List all conversion factors and cancel the units to obtain the final answer.

# of H atoms = 0.25 mole x (6.02×10^{23} molecule/mole) x (2 atoms/molecule) = 3.0×10^{23} atoms of hydrogen (to 2 significant figures as given in the original data).

The correct answer is (A).

Question No. 8 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

8. Pound for mass is a customary unit, not an SI unit or metric unit. When given such a unit in a chemistry problem, you will need to convert it to an SI or metric unit first before setting up to solve the problem. Convert 0.25 pounds (lbs) to milligrams.

(A) 250000 mg
(B) 0.25 mg
(C) 113636363 mg
(D) 1.1×10^8 mg

Feedback

A. Incorrect!
Apply the equalities 1 kg = 2.2 lbs, 1kg = 1000 g and 1 g = 1000 mg.

B. Incorrect!
Apply the equalities 1 kg = 2.2 lbs, 1kg = 1000 g and 1 g = 1000 mg.

C. Incorrect!
The absolute number is correct but not the significant figures. It should be written in scientific notation.

D. Correct!
Good job! Apply the equalities 1 kg = 2.2 lbs, 1kg = 1000 g and 1 g = 1000 mg.

Solution

This conversion requires a multi-step process. First convert the pounds to kg (SI unit), and then convert it to milligrams.

#mg = 0.25 lbs x (1 kg/2.2 lbs) x (1000 g/1kg) x (1000mg/1 g) = 1.1×10^8 mg.

Apply the dimensional analysis process with conversion factors and unit cancellation. Round it up to the two significant figures as the original.

The correct answer is (D).

Question No. 9 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

9. Tire pressure represents the inflation level of a car tire, typical in Psi (pounds per square inch). The standard SI unit is pascal (1 Pa = 1 Nm^{-2} and 1 kg force = 9.8 Newton or N). If the recommended pressure is 29.0 Psi, what is the pressure in the standard SI unit kPa?

(A) 29 kPa
(B) 200 kPa
(C) 100 kPa
(D) 129 kPa

Feedback

A. Incorrect!
Use the conversion factors to convert lb/in^2 to N/m^2. This is a six-step conversion. Be aware of the square for the area and the significant figures. The pressure unit is force per area.

B. Correct!
Good job! Use the conversion factors to convert lb/in^2 to N/m^2. This is a six-step conversion. Be aware of the square for the area and the significant figures. The pressure unit is force per area. All equalities are provided in the problem statement and the tutorial table.

C. Incorrect!
Use the conversion factors to convert lb/in^2 to N/m^2. This is a six-step conversion. Be aware of the square for the area and the significant figures. The pressure unit is force per area.

D. Incorrect!
Use the conversion factors to convert lb/in^2 to N/m^2. This is a six-step conversion. Be aware of the square for the area and the significant figures. The pressure unit is force per area.

Solution

Let's do this conversion from the beginning.

There are a number of conversion factors needed to carry the conversion step by step: 1 kg = 2.2 lbs, 1 in = 2.54 cm, 1 cm = 10^{-2} m, 1 kg = 9.8 N, 1Pa = 1 Nm^{-2} and 1Pa = 10^{-3} kPa.

Tire Pressure = 29.0 Psi = 29.0 (lb/in^2) x (kg/2.2 lbs) x (9.8N/kg) x (1 in/2.54 cm)^2 x (1cm/10^{-2}m)^2 x (1 Pa/Nm^{-2}) x (10^{-3} kPa/Pa) = 200 kPa

The correct answer is (B).

Question No. 10 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

10. The lowest pressure ever recorded at sea level inside a Typhoon tip is 652.5 mmHg. The non-SI pressure unit atm is one of the more common units used in chemistry with 1 atm as the standard pressure. STP in chemistry refers to the **S**tandard **T**emperature and **P**ressure (273.15 K and 1 atm). What is the lowest pressure in atm?

(A) 1 atm
(B) 0.8586 atm
(C) 0.85 atm
(D) 1.021atm

Feedback

A. Incorrect!
Use the pressure equality 1 atm = 760 mmHg to make this one step conversion. Be aware of the significant figures.

B. Correct!
Good job! Apply the pressure equality 1 atm = 760 mmHg to make this one step conversion. Pay attention to the significant figures.

C. Incorrect!
Use the pressure equality 1 atm = 760 mmHg to make this one step conversion. Be aware of the significant figures.

D. Incorrect!
Use the pressure equality 1 atm = 760 mmHg to make this one step conversion. Be aware of the significant figures.

Solution

Use one of the equalities given to make the conversion 1atm = 760 mmHg

652.5 mmHg = 652.5 mmHg x (1 atm/760mmHg) = 0.8586 atm.

It should be mentioned that the significant figures should be 4 (not 3). The original data 652.5 mmHg has 4 significant figures. Although the conversion factor 760 has only 3 significant figures, this equality is exact. Therefore the equality does not determine the significant figures of the final result. This practice goes with many unit conversions when the exact equalities are involved.

The correct answer is (B).