

Examination 2

Multiple Choice Questions

Unit Conversions and a Periodic Table of the Elements can be found at the End of the Exam.

1. The SI Unit standard for temperature is the:

- a) Fahrenheit
- b) Celsius
- c) **Kelvin *******
- d) Rankine

2. What quantity is measured using the following unit?

$$\text{g / mL}$$

- a) mass
- b) volume
- c) **density *******
- d) velocity

$$\text{density [g/mL]} = \text{mass [g]} / \text{volume [mL]}$$

3. Perform the following unit conversion:

$$3.5 \mu\text{sec} = ? \text{ sec}$$

- a) $3.5 \times 10^{-2} \text{ sec}$
- b) $3.5 \times 10^{-4} \text{ sec}$
- c) **$3.5 \times 10^{-6} \text{ sec} *****$**
- d) $3.5 \times 10^{-8} \text{ sec}$

$$3.5 \mu\text{s} \times (10^{-6} \text{ s} / 1 \mu\text{s}) = 3.5 \times 10^{-6} \text{ s}$$

4. Perform the following unit conversion:

$$3.1 \text{ nmol} = ? \text{ cmol}$$

- a) $3.1 \times 10^5 \text{ cmol}$
- b) $3.1 \times 10^1 \text{ cmol}$
- c) $3.1 \times 10^{-3} \text{ cmol}$
- d) **$3.1 \times 10^{-7} \text{ cmol} *****$**

$$3.1 \text{ nmol} \times (10^{-9} \text{ mol} / 1 \text{ nmol}) \times (1 \text{ cmol} / 10^{-2} \text{ mol}) \\ = 3.1 \times 10^{-7} \text{ cmol}$$

5. Perform the following unit conversion:

$$175 \text{ cm} = ? \text{ yard}$$

a) 2.71 yard

b) 1.91 yard *****

c) 1.32 yard

d) 0.87 yard

$$175 \text{ cm} \times (1 \text{ in} / 2.54 \text{ cm}) \times (1 \text{ ft} / 12 \text{ in}) \times (1 \text{ yd} / 3 \text{ ft}) \\ = 1.91 \text{ yd}$$

6. Sound travels at 5.4×10^3 cm/s through Rubber. How long will it take sound to travel across a rubber block 3 meters across?

a) 0.056 s *****

b) 0.32 s

c) 1.7 s

d) 24. s

$$300 \text{ cm} / (5.4 \times 10^3 \text{ cm/s}) = 0.056 \text{ s}$$

7. Lead has a density of 11.34 g/cm^3 . What is the mass of a rectangular block of Lead $2.5 \text{ cm} \times 5.0 \text{ cm} \times 10.0 \text{ cm}$?

a) $9.8 \times 10^{-1} \text{ g}$

b) $2.7 \times 10^1 \text{ g}$

c) $4.1 \times 10^2 \text{ g}$

d) $1.4 \times 10^3 \text{ g}$ *****

$$m = d \times V = (11.34 \text{ g/cm}^3) \times (125 \text{ cm}^3) = 1.4 \times 10^3 \text{ g}$$

8. Which of the following measurements will be useful in identifying a substance?

a) volume

b) mass

c) surface area

d) melting point *****

9. A Sand-Water system is a:

a) Heterogeneous system. *****

b) Homogeneous system.

c) Solution.

d) Pure Substance.

10. Gravity filtration is usually used when one wants to:

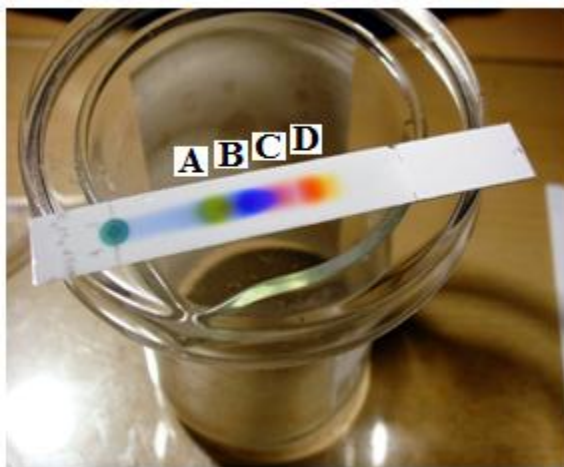
- a) **separate and purify a liquid from a solid. *******
- b) separate and purify a solid from a liquid.
- c) separate two solids from each other.
- d) separate two liquids from each other.

11. Yellow Zinc is a form of Brass with a composition of 34%-37% Copper; with the remainder being Zinc. Yellow Zinc is:

- a) an Element.
- b) a Compound.
- c) **a Solution. *******

The composition is variable.

12. By examining the TLC resulting from a chromatographic separation of an ink dye, we can conclude:



- a) Compound "D" has a high affinity for the solid silica support.
- b) Compound "A" has a low affinity for the solid silica support.
- c) **Compound "B" has a higher affinity for the solid silica support than does Compound "D". *******
- d) **Compound "C" has a lower affinity for the solid silica support than does Compound "B". *******

13. When Caustic Potash is electrolyzed, a silvery molten metal is produced. Based on this observation alone, we can conclude:
- a) the molten metal is a compound.
 - b) the molten metal is an element.
 - c) **nothing about the elemental nature of the molten metal. *******
14. A mixture of Kerosene and Gasoline, both petroleum products, can be separated by:
- a) filtration.
 - b) using a separatory funnel.
 - c) **distillation. *******
 - d) paper chromatography
15. The element Bromine is a:
- a) non-metal solid.
 - b) **non-metal liquid. *******
 - c) metal liquid.
 - d) metal solid.

Short Answer Questions

1. Discuss the progression of events in the establishment of the *meter* as a unit standard. Your discussion should address the following questions:
 - i) Why did the French Academy of Sciences promote the establishment of the *meter*?
 - ii) What was the original definition of the *meter*?
 - iii) Why was the provisional *meter* established?
 - iv) Why did we move away from the 1875 *meter* standard; two marks on a Pt-Ir bar?
 - v) In very general terms, how is the current *meter* defined?

Prior to the metric revolution, the French system of weights and measures was in considerable disarray. Units were not standardized and could vary from town to town and from one point in time to another. To clarify things and to specify distinct unit standards, for both commerce and science, the French Academy of Sciences proposed adopting a "metric system." Not only would this establish specified unit standards, the unit standards would be based on physical quantities and not arbitrary quantities established by royal fiat. As originally conceived, the meter was to be 1/10,000,000 of the distance from the Earth's pole to its equator along a meridian running through Paris. As it would take several years to conduct the required survey to establish the length of the meter, a provisional meter, based on an estimate of this distance, was established. This was marked out on a copper rod. When the survey was complete, the true meter was marked out on a platinum rod. In 1875, the meter was re-defined to be the length between two marks on a Pt-Ir rod. Unfortunately this length was subject to some variation due to environmental conditions. Currently the meter is defined as the distance light travels in a specified period of time.

2. What are the five states of matter discussed in class?

Solid

Liquid

Gas

Plasma

Bose- Einstein Condensate

3. Provide an example of a colloid. What phases are involved in your colloid?

Milk - an emulsion formed from a liquid dispersed into a liquid

4. How might you separate a Salt-Water solution into its components? (Don't make this complicated.)

Distill the Water, re-condensing it and collecting it. This will leave the the solid Salt behind in the distilling pot.

5. How can I distinguish a Solid from a Liquid? Be specific. What physical property will you consider?

Solids are rigid and liquids are fluid. So, a measure of the fluidity (viscosity) will tell us if the substance is a solid or a liquid.

6. An automobile engine has a displacement of 305 cubic inches. What is its displacement in liters?

$$305 \text{ in}^3 \times (2.54 \text{ cm} / 1 \text{ in})^3 \times (1 \text{ mL} / 1 \text{ cm}^3) \times (10^{-3} \text{ L} / \text{mL}) = 5 \text{ L}$$

7. Consider the elements of Group 4A; the Carbon Family. What is the trend in metallic character (metal to non-metal or *vice versa*) as one goes down this group? Provide one example that supports your contention.

Non-metal to Metal

Carbon	=	Non-metal
Silicon	=	Metalloid
Germanium	=	Metalloid
Tin	=	Metal
Lead	=	Metal

Unit Conversions

Length

$$1 \text{ in} = 2.54 \text{ cm}$$

$$1 \text{ mi} = 5280 \text{ ft}$$

$$1 \text{ ft} = 12 \text{ in}$$

$$1 \text{ yd} = 3 \text{ ft}$$

$$1 \text{ cubit} = 18 \text{ in}$$

$$1 \text{ ell} = 45 \text{ in}$$

Volume

$$1 \text{ L} = 10^{-3} \text{ m}^3$$

$$1 \text{ L} = 1.0567 \text{ qt}$$

$$1 \text{ gal} = 4 \text{ qt}$$

$$1 \text{ qt} = 2 \text{ pt}$$

$$1 \text{ pt} = 16 \text{ oz}$$

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

Mass

$$1 \text{ kg} = 2.2046 \text{ lb}$$

$$1 \text{ lb} = 16 \text{ oz}$$

$$1 \text{ amu} = 1.6605 \times 10^{-24} \text{ kg}$$

Energy

$$1 \text{ cal} = 4.184 \text{ J}$$

$$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$$

$$1 \text{ J} = 1 \text{ kg m}^2/\text{s}^2$$

Temperature

$$\text{K} = ^\circ\text{C} + 273.15$$

$$^\circ\text{C} = \left(\frac{5}{9}\right)(^\circ\text{F} - 32)$$

$$^\circ\text{F} = \left(\frac{9}{5}\right)^\circ\text{C} + 32$$

Pressure

$$1 \text{ atm} = 101325 \text{ Pa}$$

$$1 \text{ atm} = 760 \text{ Torr} = 760 \text{ mmHg}$$

$$1 \text{ bar} = 10^5 \text{ Pa}$$

$$1 \text{ psi} = 6894.757 \text{ Pa}$$

$$1 \text{ Pa} = 1 \text{ N/m}^2 = 1 \text{ kg/m s}^2$$