

4. You are asked by your supervisor at a USGS internship to measure the volume flux of water at a stream nearby at a certain time of the day.

a. What measurements will you do and how will you use them to obtain the volume flux of water?

b. It turns out that the stream contains many sediment particles that it carries with it to the ocean. What additional information will you need to obtain the sediment flux in the stream and how would you compute it given that this information is collected?

c. What will be an example for the units of sediment flux you would report?

5. In the first class we discussed how the physical aspects of the ocean affect marine organisms. Choose a micro-organism ($<0.1\text{mm}$) and a macro-organism ($>1\text{m}$) and three physical properties of ocean waters. For each physical property describe how it may affect either reproduction or foraging or predation of each organism.

6. Name the three mechanisms for heat transfer. Give one example for each that may be relevant to a marine organism?

Evaluate the statement as true or false (2pts each, circle T for true or F for false):

- a. On the moon, the pressure at the base of a milk carton is smaller than on Earth. T/F
- b. An object whose center of gravity is above its center of buoyancy is unstable. T/F
- c. Rising bubbles expand on their way to the surface. T/F
- d. A solid object that sinks in seawater may float in freshwater (same temperature) T/F
- e. Viscosity is a major contributor to the drag experienced by a swimming tuna. T/F
- f. The no-slip condition implies that swimming organisms will *always* experience drag while swimming. T/F
- g. Streamlining reduces pressure (more than viscous) drag for high Reynolds number swimmers. T/F
- h. Some microorganisms use jet propulsion as a mechanism to propel themselves T/F
- i. The difference between wet and dry bulb thermometers increases with humidity. T/F
- j. Units of energy in MKS are equivalent to $\text{Kg m}^2 \text{s}^{-2}$. T/F
- k. The density of water is approximately $1,000,000 \text{g m}^{-3}$. T/F
- l. As water warms in a cup the hydrostatic pressure at its bottom decreases T/F

Multiple-choice questions (6pts each):

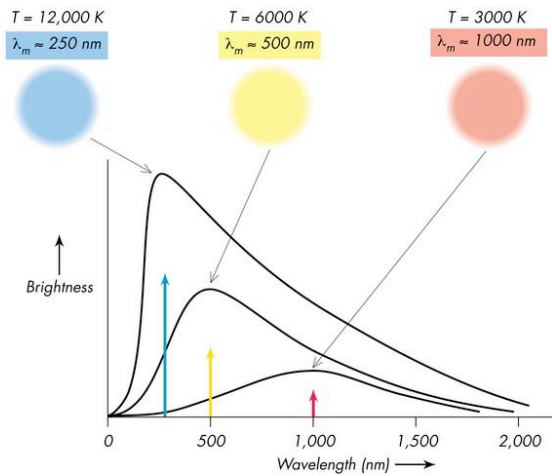
1. Which weighs more on the earth surface, a kg of helium (less dense than air) or a kg of sand?
 - a. They will weigh the same.
 - b. The sand will weigh more, as it displaces less air.
 - c. The helium will weigh more, as its mass is the same but it has more volume.
 - d. None of the above.

2. Turbulence:
 - a. Is the property of the fluid.
 - b. Is the property of the flow.
 - c. Is the property of a body in the flow.
 - d. None of the above.

3. Divers use lift bags to move heavy objects under water. Which underlying physical principle can be used to determine the size of the lift bag needed?
 - a. Archimedes principle.
 - b. Bernoulli's principle.
 - c. Continuity principle.
 - d. Newton's third law.

Please provide short answers to the following questions (5pts for questions associated with each picture):

1. How is the following graph related to heat and temperature?



2. Explain what energy is converted in the setup drawn below? How does the pressure change as the water crosses from within the cylinder to outside the hole? What is the speed of the water leaving the hole?

