Multiple choice

___ When benthic organisms enter the water column with a regular diel periodicity:
   a) catastrophic drift
   b) behavioral drift
   c) constant drift
   d) surface drift
   e) passive drift

___ Stage between molts for all immature aquatic insects:
   a) egg
   b) juvenile
   c) nymph
   d) instar
   e) larva

___ Upward force acting on benthic invertebrate in flowing water:
   a) drag
   b) lift
   c) skin friction
   d) shear stress
   e) turbulence

___ “Natural” (not human-modified) factors that can influence the shape of the hydrograph for a small stream include
   a) topography of the watershed
   b) vegetation cover type in the watershed
   c) soil type in the watershed
   d) a and b
   e) a, b and c

__________ The lotic insect orders most “characteristic” of streams on a global basis
   a) Ephemeroptera, Coleoptera, Odonata
   b) Plecoptera, Ephemeroptera, Diptera
   c) Plecoptera, Trichoptera, Diptera
   d) Ephemeroptera, Trichoptera, Odonata
   e) Plecoptera, Ephemeroptera, Trichoptera
True/False. Please write the word True or False for each question in the space provided.

__________ A meandering stream has a sinuosity < 1.5.

__________ According to the Wentworth scale, boulder is larger than gravel but smaller than cobble.

__________ An increase in shear stress increases stream competence.

__________ The number of generations per year for all species of aquatic insects is fixed across its entire geographic range.

__________ The “magnitude-frequency” principle applied to sediment movement in streams argues that it is the most extreme events, occurring with low frequency, that transports the most sediment load over an annual cycle and thus is most important in maintaining the characteristic channel form of the stream.

__________ In low-gradient streams characterized by fine sediments such as silts and sand, the greatest biomass of aquatic insects is often found on submerged woody debris.

__________ Sand has a lower critical erosion velocity than clay, but once suspended clay is slower to settle back to the streambed.

Definitions. Provide the word whose definition is given.

____________________________ Another term for "watershed."

____________________________ Term for the flood that occurs about once every 1.5 to 2 years in a stream (although the range can be once every 1 – 10 years) and is associated with maintaining the channel dimensions.

____________________________ Name for the kind of aquatic insect that completes two generations in one year.

____________________________ Name for a channel morphology when sinuosity is greater than 1.5.

____________________________ Type of development for an aquatic insect that includes egg, larva, pupa and adult.

____________________________ Term referring to the number of individual organisms per square meter on a streambed.

____________________________ Feeding guild of stream-dwelling fish that primarily eats invertebrates.
Short Answer. Provide short answers to the following. (One to a few key words or concepts will usually suffice. Complete sentences not needed.)

Give 2 reasons for why the invasion of freshwater habitats by terrestrial insects is thought to have occurred in headwater streams.

(1) 

(2) 

Give two reasons why organism abundance and species richness (diversity) is generally lower in sand than in gravel.

(1) 

(2) 

Poff et al. (1997, *BioScience*) indicate that a streamflow regime (i.e., temporal variation in discharge) for any particular river can be described by 5 “components” List 2 of the 5 components here. (Only first 2 listed will count.)

(1) 

(2) 

Give 3 possible morphological adaptations of benthic macroinvertebrates to current velocity. (NOTE: Only your first 3 answers will be counted, so don't list more than 3.)

1) 

2) 

3) 

If an adjacent pool and riffle in a stream have the same width ($W_r = W_p$), but the average velocity in the riffle is twice that in the pool, then what is the average depth of the riffle ($D_r$) compared to the pool ($D_p$)?

During very high flows, large particles such as boulders move along the streambed. Interestingly, these large substrate particles do not end up in pools; rather they get deposited in riffles. Explain how this occurs using your understanding of the relationship between shear stress ($\tau$), water depth (D) and stream slope (S).
For the following stream network,
Strahler stream order at point A = __________.

Shreve link number at point A = __________.

Graphs and Interpretation.

Below are graphs showing 3 velocity profiles measured at 2 mm intervals for 3 stones in a stream. For a benthic invertebrate that protrudes 2 mm off the stone surface, which of the stones presents the greatest shear stress? Explain why.

Draw and label a figure that shows how water velocity (x-axis) changes with depth (y-axis) from the bottom of a stream to the surface. Explain the shape of the relationship and indicate the one point on the line where the average velocity occurs. [4 points]
On the following graph draw the expected pattern of size-specific *Baetis* mayfly drift in two small, high mountain streams in Colorado, one which has no fish (indicate by the symbol “o”) and one that has abundant fish (use symbol “x”).