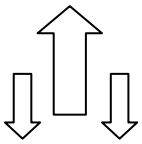
ST/STE PreTest 3.4 2012 SOLUTIONS

1. Which of the following is **not** a thermoplastic?

(A) polyethylene
(B) polypropylene
(C) polystyrene
(D) melamine

2. Which twisting constraint is experienced by buildings during earthquakes?

(A) Shearing
(B) Torsion
(C) Tension
(D) Compression

3. What constraint is symbolized by  ?

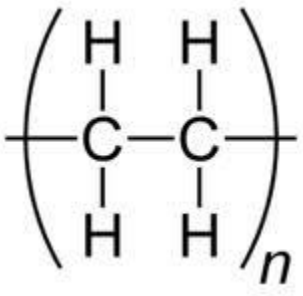
deflection

4. List two elements with an atomic number less than 4 that have poor thermal conductivity.
   He and H
5. What third period material has decent electrical conductivity but lousy thermal conductivity?
   Si
6. All ceramic materials contain oxides that include Al_2O_3. What charge does aluminum have? Show why using simple algebra. (STE)
   2Al + 3(-2) = 0.
   2Al = 6
   Al = 3
7. Complete the table revealing the composition and uses of composite materials.

Composite	Matrix material	Reinforcing material	Uses
wood	lignin	Cellulose *fiber*	House construction; furniture; floors
Carbon fiber	epoxy	Carbon *fiber*	Car bumpers, bicycles
Plastic- fiberglass	Various Plastics	*Fibers of* glass	Surfboards, gliders, boats

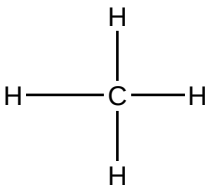
8. Explain what is meant by a monomer in the context of plastics?

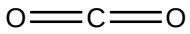
A monomer is the repeating link in the molecular chain that is called a plastic.

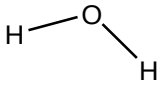


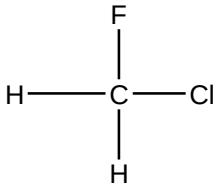
In this case(polyethylene) the monomer is C_2H_4

9. Draw a dot structure for 4 different greenhouse gases. (STE)









10. When ice melts, mass is conserved. Use this fact to derive an expression for the volume of water in terms of density ratios and the volume of ice. Then show that this is the same as the buoyancy formula, which proves that when ice melts the volume of water created is the same as the volume of submerged ice. The density of ice is about 0.912 g/ml. (STE)

Since mass is conserved during melting,

$d_{ice} * V_{ice} = d_{water} * V_{water,}$ where V_{water} is the volume created by the melted ice

$$V_{water} = \frac{V_{ice}(d_{ice})}{d_{water}}$$

But if you rearrange the buoyancy formula:

$$\frac{V_{ice}}{V_{dw}} = \frac{d_{dw}}{d_{ice}}$$

$$V_{dw}(d_{dw}) = V_{ice}(d_{ice})$$

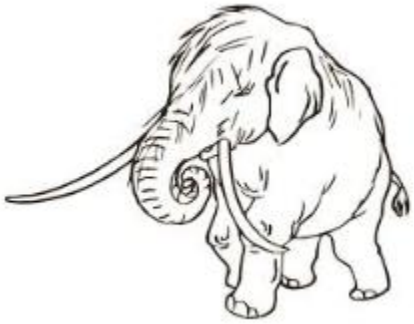
$$V_{dw} = \frac{V_{ice}(d_{ice})}{d_{dw}}$$

Since both are equal to the same thing, it follows that $V_{water} = V_{dw}$

11. List two countries whose northern areas and mountain tops are dominated by permafrost.

Russia and Canada

12. What biome exists in the active layer of permafrost?

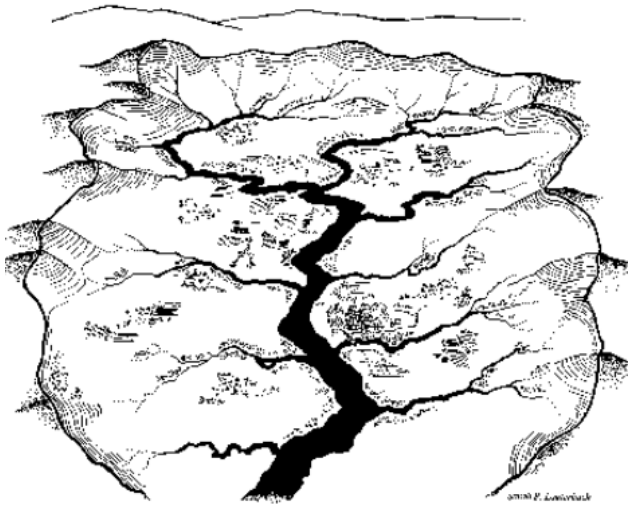


tundra

13. What greenhouse gas is released by permafrost during periods warm enough to melt upper layers?

methane

14. How do vegetation and topography impact watersheds?



The slope will determine where the water ends up. Lack of vegetation will cause more water to flow from a watershed into a river.

15. What term is used to describe the quantity of organic matter produced by plants in a given territory?

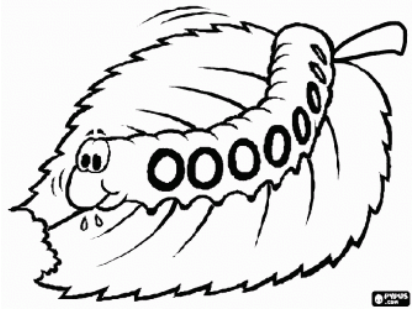
Primary productivity

16. Why aren't energy transfers between trophic levels 100% efficient?

Not all energy from the food is stored or used by the animal
Some is lost to the environment as heat.

17. To which trophic level does a leaf-eating caterpillar belong?

First order consumer



18. Soil originally with a concentration of 8 ppm of Cr^{6+} was tested a month later and the concentration dropped by 75%. (STE)
    a) If there was cabbage growing on the land and the roots' concentration of the same ion increased, what do you think happened?
    It's an example of phytoremediation in which a toxin gets stuck in plant tissue.
    b) Calculate the final concentration of Cr^{6+} in the soil.
    8ppm – 0.75(8ppm) = 2 ppm

19. What do artificial modern methods of plant cloning have in common with animal cloning? Differences? (STE)

Common: both produce genetically identical offspring.

Differences:

(1) In plants, eggs are not stripped of their DNA. Parts of plants are removed, subjected to nutrients and/or hormones in test tubes and then transplanted to soil.

(2) For animals, an egg cell is stripped of its nucleus and given the DNA of an animal to be cloned. A surrogate mother's uterus is then used to allow the clone egg to develop.

FLASHBACKS: all STE flashback questions will be based on theoretical aspects of whatever was covered by the STE lab exams: stoichiometry, circuits, phosphorus cycle etc. ST flashback questions will be on guiding controls and tides only.