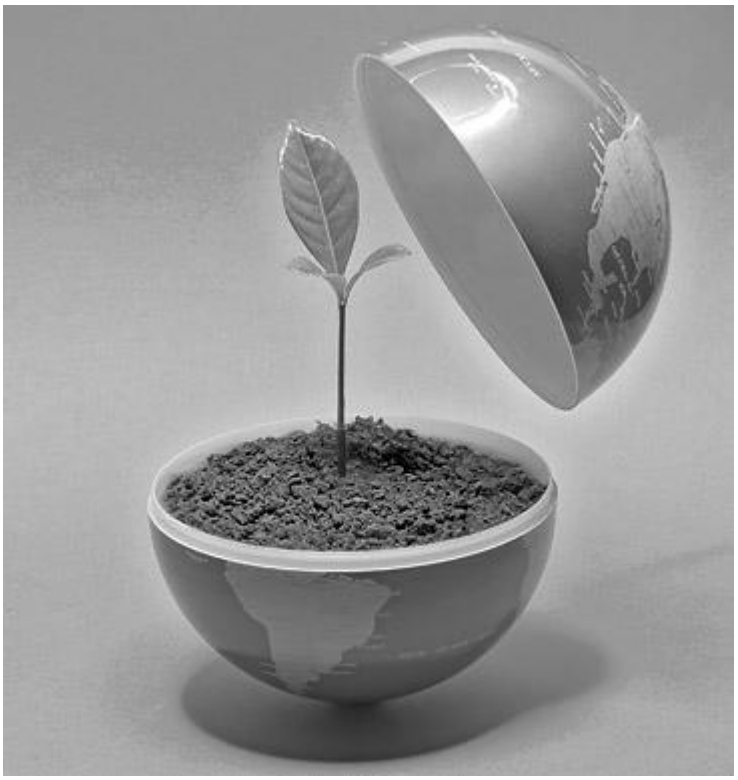
Environmental Chemistry



ANSWER KEY

PART 1: SOIL

1. Match the soil separates with their size:

_B__ silt	A. 2.0 mm to 0.02 mm
_A__sand	B. 0.02 mm to 0.002 mm
_C__clay	C. finer than 0.002 mm

2.

   a. Which type of soil is 40% sand, 40% silt, and 20% clay?

      loam

   b. Which type of soil is 10% sand, 30% silt, and 60% sand?

      Sandy loam

   c. Which type of soil is 30% sand, 60% silt, and 10% sand?

      Silty clay loam

   d. Of a., b., or c., which is the best soil for growing plants?

      a.

   e. Of a., b., or c., which soil has the poorest water infiltration?

      c.

   f. Of a., b., or c., which soil has the poorest nutrient holding capacity?

      b.

3. Match the descriptions below to their position on the soil profile shown. Use the Horizon letters O, A, B, and C to fill in the blanks.

   __A__ topsoil

   __C__parent mineral material originally occupying the site of the soil

   __B__high in Fe, Al, Ca, and other minerals

   __O__litter layer

4. Mineral nutrients, water, air/oxygen

5. Any 3 of these will do:

   good supply of nutrients, good nutrient holding capacity, good water holding capacity, allow infiltration of water, porous for good aeration, pH near neutral, low salt content

6. a. overcultivation, overgrazing, deforestation

   b. any 2: plant a border, cover the land with green plants, alley cropping, strip cropping, terracing, contour plowing, conservation tillage, cover crop, shelter belt

7. any 2: replenish soil of nutrients, prevent erosion, control diseases, control pest population

8. a. $SO_2 + H_2O \rightarrow H_2SO_3$; $SO_3 + H_2O \rightarrow H_2SO_4$

   b. calcium and magnesium

   c. $CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + H_2O + CO_2$ (or Mg instead of Ca)

   d. Negative log of hydrogen activity

   e. pH=4.46, acidic, add lime/$CaCO_3$, CaO

   f. pH=8.17, alkaline, add sulfur

PART 2: FERTILIZER

9. a. micro e. micro

   b. macro f. micro

   c. macro g. macro

   d. micro h. macro

10. a. 20%N, 5%P, 10%K by mass

    b. 50kg potassium

       100kg nitrogen

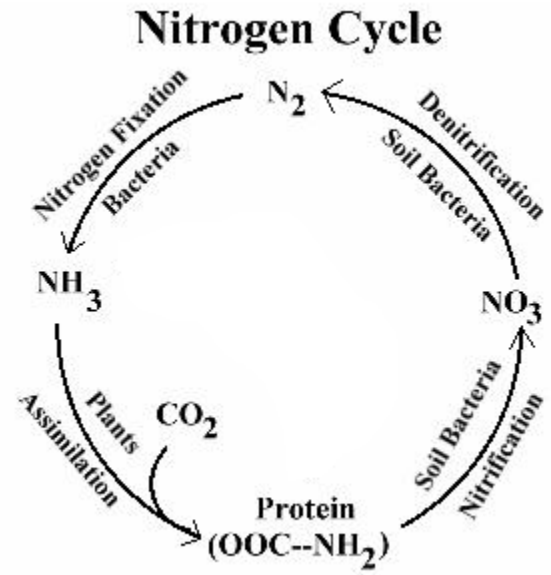
       25kg phosphorous

    __B__ potassium

    __A__nitrogen

    __C__phosphorus

11.



12. Peanuts, legumes (also small grains: rye, oats, barley, wheat)

13. a. $N_2 + 3H_2 \rightarrow 2NH_3$; b. Haber process

14. Potash. K_2CO_3; also accept KOH or K_2O

15. Diphosphorus pentoxide, P_2O_5

PART 3: PESTICIDES

16. Any 2: lead, copper, arsenic, mercury, fluoride; persistent in the environment and toxic to all forms of life

17. Any 1: Nicotine, rotenone, sabadilla, ryanodine, pyrethrum

18. B (organophosphate) , A (organochlorine), C (carbamate)

19. Bioaccumulation: the process of accumulating higher and higher doses of a pesticide up a fodd chain. Plants or insects take in DDT, or it runs off into the water. The plankton get DDT from the water, fish eat the plankton, eagles eat the fish. The DDT is stored in fat cells and accumulated from species to species until it is magnified into a much higher concentration so the eagles get a high dose of it and that high dose weakens the shells of their eggs.

20. Any 3

    Development of resistance by pests. Resurgence and secondary pest outbreaks. Adverse environmental effects (ex: run off into water, kill fish). Adverse human health effects. Harm desirable insects.

21. B

22. D

23. E

24. B

BONUS: dichlorodiphenyltricholoethane, Rachel Carson

MATERIAL LIST:

Jars of soil mixed with water

Soil testing kits

Vials with lids for mixing soil with water and testing tablets

PART 4: SOIL TESTING

1. pH – P –

   N – K –

2. if pH is low – apples, blueberries, potatoes, tomatoes

   if pH is neutral/high – cherries, cabbage, broccoli

3. give credit if it makes sense….adding superphosphate if low in P, add wood ashes or fertilizer rich in K if low in K, add ammonia/nitrogen rich fertilizer if low in N, etc.

   if an element is surplus they should water a lot and add fertilizer that only has the other elements or plant crops/plants that use a lot of the surplus nutrient

4. a. Approx. 0.00014 M, use line, slope = 35.7, y-intercept = 0; 7.8 ppm (basically mg/L)

   b. Beer's Law

   c. Ca, Mg, Zn, b/c they are colorless in solution