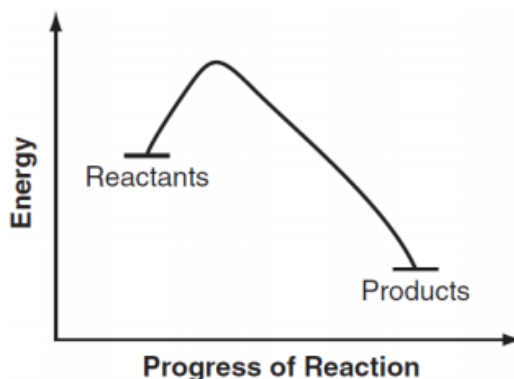


**Directions:** Read the questions carefully and choose the letter that corresponds to your answer.

1. All of the following are solutions except \_\_\_\_\_.
  - A. Brass
  - B. Coffee
  - C. Seawater
  - D. Milk
  
2. How many moles of  $\text{CO}_2$  does 88 grams of Carbon Dioxide contain?
  - A. 2
  - B. 3
  - C. 4
  - D. 5
  
3. Which chemical bonds are considered the strongest, requiring the most energy to break?
  - A. ionic bonds
  - B. van der Waals forces
  - C. hydrogen bonds
  - D. covalent bonds
  
4. Give the mass number for an atom that has 10 protons, 10 electrons, and 11 neutrons.
  - A. 31
  - B. 20
  - C. 10
  - D. 21

5. The graph below shows the change in energy that occurs during a chemical reaction. Which of the following is most likely to happen as the reaction nears completion?

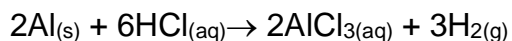


- A. The reaction releases energy to its surroundings.
- B. The energy level of the reactants remains constant.
- C. The reaction takes in energy from its surroundings.
- D. The energy level of the reactants increases gradually.

6. During \_\_\_\_\_, the chromosomes attach to the spindle and align at the metaphase plate of the spindle.

- A. prophase
- B. prometaphase
- C. metaphase
- D. anaphase

7. What mass, in g, of hydrogen gas is formed when 3.0 mol of aluminum react with excess hydrochloric acid according to the following equation?



- A. 3.0
- B. 4.5
- C. 6.0
- D. 9.0

8. Removing all lone pairs of electrons on the central atom of  $\text{ClF}_3$  would change the geometry from

- A. trigonal pyramidal to trigonal planar.
- B. from square shaped to trigonal pyramidal.
- C. from T-shaped to trigonal planar.
- D. from trigonal bipyramidal to trigonal planar.

9. What percent of a parent isotopes remains after 2 half-lives?

- A. 50%
- B. 25%
- C. 6.25%
- D. 2%

10. What the value does  $6.02 \times 10^{23}$  represent?

- A. The number of particles in a mole
- B. The number of particles per atom in a substance.
- C. The density of moles per square nanometer.
- D. The length of time for a material to decompose

11. Molality,  $m$ , is defined as number of moles of solute per kg of solvent. If 230 g of ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) is added to 500 g of water, what is the molality of the solution?

- A. 0.46 m
- B. 1 m
- C. 2.17 m

D. 10 m

12. What are the coefficients that will balance the formula equation below?



- A. 1, 3, 1, 3
- B. 3, 1, 3, 1
- C. 1, 1, 1, 3
- D. 1, 3, 3, 1

13. When ice changes from a solid to a liquid at its melting point

- A. its temperature increases.
- B. heat is given out.
- C. its particles gain energy.
- D. its particles become more ordered.

14. A container weighs 90 g when empty and 110 g when fully filled with water. The density of water is 1.0 g/mL. When the container is filled instead with liquid X, it weighs 140 g. What is the density of liquid X?

- A. 0.80 g/mL
- B. 1.4 g/mL
- C. 2.5 g/mL
- D. 3.0 g/mL

15. Your flashlight has three identical 1.5 volt batteries in it, arranged in a chain to give a total of 4.5 volts. Current passes first through battery (a), then through battery (b), then through battery (c), on its way to the bulb. When you operate the flashlight, the batteries provide power to the current and they gradually use up their chemical potential energy. Which battery will run out of chemical potential energy first?

- A. All three will run out at the same time.
- B. Battery (a) will run out first.
- C. Battery (b) will run out first.
- D. Battery (c) will run out first.

16. If you balance the equation below, what is the least sum of the coefficients?



- A. 26
- B. 15
- C. 9
- D. 7

17. The radioactive half-life of a certain isotope is 2 days. What part of this isotope will remain after 8 days?

- A.  $\frac{1}{2}$
- B.  $\frac{1}{4}$
- C.  $\frac{1}{8}$
- D.  $\frac{1}{16}$

18. Mixtures can be classified as homogenous or heterogenous and can be separated by simple means. Solutions and suspensions

- A. are both compounds.
- B. are both examples of a homogenous mixture.
- C. are both examples of a heterogenous mixture.
- D. can be separated into components by physical means.

19. The main reason why one can possibly walk barefoot on a red-hot wooden coals without burning the feet is

- A. the low thermal conductivity of coal.
- B. the high temperature of coal.
- C. the low temperature of coal.
- D. the stepping techniques.

20. Which of the following characterizes water?

- A. Water releases only heat quickly.
- B. Water releases and gains heat quickly.
- C. Water releases and gains heat slowly.
- D. Water gains only heat slowly.

21. When a lit match is touched to the wick of a candle, the candle begins to burn. When the match is removed, the candle continues to burn. In this reaction, the match \_\_\_\_\_.

- A. behaves as a catalyst.
- B. supplies activation energy.
- C. is part of the rate determining step.
- D. lowers the activation energy barrier

22. 1 atm is equal to \_\_\_\_\_ Torr.



- C. Sodium
- D. Fluorine

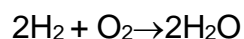
26. What is the most common isotope of Carbon?

- A. Carbon-12
- B. Carbon 16
- C. Carbon-14
- D. Carbon-13

27. What is the molar concentration of NaCl solution that contains 30 grams of salt per 200 mL of solution?

- A. 0.15 M
- B. 0.30 M
- C. 1.3 M
- D. 2.6 M

28. What is the limiting reagent for the following chemical reaction if 24 grams of hydrogen and 48 grams of oxygen react to form water?



- A. Hydrogen
- B. Oxygen
- C. Water
- D. This reaction has no limiting reagent.

29. Which among the following is correctly paired?

- A. cheddar cheese : heterogeneous
- B. liquid soap : homogeneous
- C. sugar : element



D. orange juice : compound

30. An analysis of a compound used in the production of aluminum is 32.79% sodium, 13.02 % aluminum and 54.19% fluorine. The empirical formula of the compound is

- A.  $\text{Na}_3\text{AlF}_6$
- B.  $\text{Na}_5\text{AlF}_8$
- C.  $\text{NaAlF}$
- D.  $\text{Na}_3\text{AlF}_3$

31. The height of the column of mercury in a mercury barometer is dependent on the following EXCEPT on the

- A. diameter of the tube.
- B. atmospheric pressure.
- C. density of mercury and weather condition.
- D. altitude at which the measurement is made.

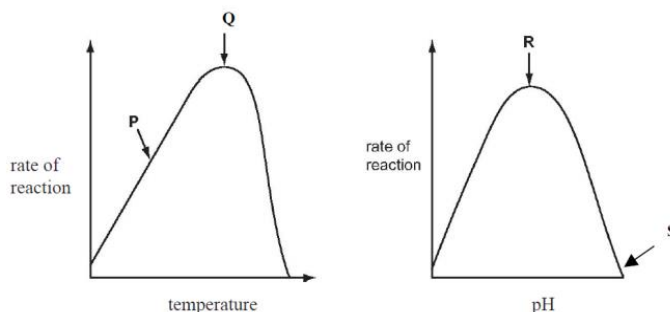
32. What process can be used on a liquid to separate its components without losing either component in the process?

- A. Distillation
- B. Evaporation
- C. Sieving
- D. Paper Chromatography

33. What component of hard water makes it "hard"?

- A. sodium and nitrogen
- B. oxygen and hydrogen
- C. large amounts of calcium and magnesium ions
- D. large amounts of sodium and carbon dioxide

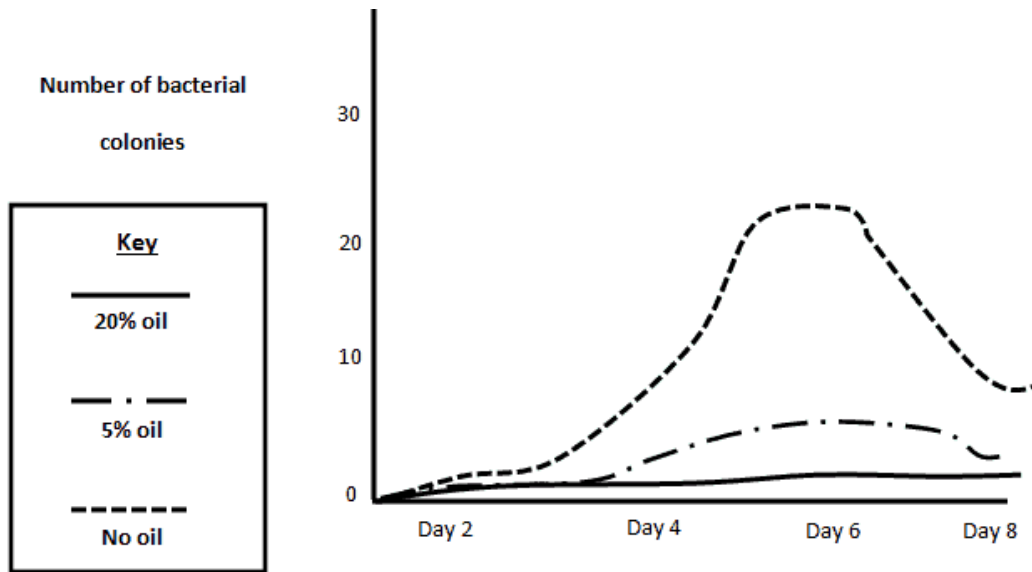
34. The graphs below show the effects of temperature and pH on enzyme activity. Which statement explains the enzyme activity at the point shown?



- A. At P, hydrogen bonds are formed between enzyme and substrate.
- B. At Q, the kinetic energy of enzyme and substrate is highest.
- C. At R, peptide bonds in the enzyme begin to break.
- D. At S, the substrate is completely denatured.

**Read the passage below to answer question numbers 35 to 40.**

A group of scientists were studying the growth of bacteria. It is their hope that they will be able to induce the bacteria to grow and metabolize oil as a food source. They have taken three samples of *Escherichia coli* and are growing them on nutrient agar plates. The scientists used three conditions to test the *E. coli* bacteria. The first group was grown at 37°C on plain nutrient agar plates. The second group was grown at 37°C on plain nutrient agar plates with a 5% oil solution. The third group was grown at 37°C on plain nutrient agar plates with a 20% oil solution. The results of the experiment are listed in the graph below.



35. What is the independent variable in the experiment above?

- A. The type of bacteria used
- B. The nutrient agar.
- C. The nutrient agar with oil.
- D. The number of days the bacteria grew.

36. What is the dependent variable in the experiment above?

- A. The number of days the bacteria grew.
- B. The nutrient agar.
- C. The nutrient agar with the oil.
- D. The amount of growth of the bacteria

37. Which bacterial culture had the greatest rate of growth throughout the 8 day period?

- A. Only the culture grown on nutrient agar had significant growth.
- B. The nutrient agar plate and the 5% oil plate had growth.

- C. The nutrient agar plate and the 20% oil plate had growth.
- D. The 5% oil and 20% oil plates had growth.

38. What is the best explanation for why the *E.coli* grew on the 5% oil plate but not the 20% oil plate?

- A. The bacteria are used to an environment with 5% oil and not 20% oil.
- B. The bacteria were able to mutate to tolerate a slightly oily environment of 5% oil, providing it had other nutrients available and the 20% had far too much oil.
- C. The 5% plate had conditions that are similar to the natural environment they are accustomed to.
- D. The 5% plate allowed more oxygen to interface with the bacteria because less oil was present.

39. Why did the nutrient agar bacteria plateau and then drop in numbers as they approached Day 8?

- A. The bacteria died because they had reached their mature age.
- B. The bacteria ran out of nutrients and had reached the carrying capacity of the plate.
- C. The bacteria always die after Day 6 in culture.
- D. There is no definitive reason why the bacteria died off after Day 6.

40. An excellent way to demonstrate that the scientists have induced *E.coli* to survive and metabolize oil would be to:

- A. Repeat the experiment several times with 5% oil on a nutrient agar plate.
- B. Induce the bacteria on the 5% oil plate to grow on nutrient agar.
- C. Take the bacteria from the 5% oil plate and test them on a new 20% oil plate.
- D. new bacteria with the same experiment to see if that is the only bacteria that can accomplish this.