Question 1: (7%)

Anyone planning to do any desktop publishing with a PC will want a larger screen, increasingly; however, World Wide Web users and game players are also discovering the rewards of a large monitor. Nowadays you can often see LCD (Liquid Crystal Diode) which is less bulky and smaller than the standard CRT (Cathode Ray Tube), the kind used in television sets. The LCD screens don’t emit any electromagnetic radiation, which could interfere with the heart medicines and other sophisticated electronic equipment in hospitals and thereby cause a crisis.

1. What are the differences between LCDs and CRTs? (Please answer the question with a complete sentence in English)

Questions 2-4: (9%, 3% for each)

Because hydrogen, in water, is one of the most abundant and widely distributed elements on the earth’s surface and because the burning of hydrogen merely produces water again, with no deleterious effects on the environment, we should not be surprised that many scientists consider this element potentially an ideal general fuel. Stated so simply, the concept can be misleading, because hydrogen is not a primary fuel; energy must be expended in order to decompose the water. A country can be independent of foreign oil and or coal imports only if it has available an alternate primary source of energy. However, even if a nation lacks such source, its hydrogen output can be very useful both as a means of energy transfer and as a means of making more efficient use of classical fuels.

2. According to the passage, hydrogen can be considered potentially an ideal general fuel because it

   A. can be used to make a country independent of foreign energy sources
   B. can be extracted easily from water by many different methods
   C. can be extracted from water without polluting the atmosphere
   D. is plentiful and its use will not harm the environment
E. is not a primary fuel and therefore it is a good alternate source of energy

3. It can be inferred that a country would not have to depend on foreign oil or coal if it could
   A. obtain a plentiful supply of water
   B. find a nonpolluting method of producing hydrogen
   C. develop more efficient ways of using classical fuels
   D. discover a way of making hydrogen burn efficiently
   E. use solar energy effectively to extract hydrogen from water

4. The author’s attitude toward the use of hydrogen as a solution to the energy crisis can best
described as
   A. simplistic
   B. noncommittal
   C. enthusiastic
   D. cautious
   E. cynical

Questions 5-11: (21%, 3% for each)

To understand the emulsifying process, we must first accept the scientific principle that oil and water do not naturally mix. Quiet literally, they find each other’s presence repulsive. A good illustration of this aversion is homemade oil-and-vinegar salad dressing.

When you shake or beat your salad dressing, you do more than disperse the oil throughout the vinegar. You also break down the oil into droplets minute enough to remain temporarily suspend in the vinegar (which from now on we will call water, because that tart condiment is, in effect, mainly water). The second you stop agitating the dressing, the oil droplets start to combine into units too large to be suspended in the water, and this slither their way upward, separating from the water in the process. The oil rises to the top and the water sinks because oil has a lower specific density than water.

If you want a stable emulsion, you need an emulsifying agent, which prevents the oil droplets from combining into larger units. Emulsifying agent occur naturally in many animal substances, including egg yolks and milk.

An emulsifying agent helps to keep the oil particles from combining in three basic ways. First, the agent coats the oil, serving as a physical barrier between the droplets. Second, it reduces the water’s surface tension, which, in turn, reduces the water’s ability to repulse oil. Third, the agent gives the surfaces of the oil droplets identical electrical charges, since like charges repel each other, the droplets repel each other.
5. What is the author’s main purpose in the passage?
   A. To show how emulsifiers are used to find oil.  
   B. To prove that oil and water do not mix.  
   C. To explain how emulsifiers work.  
   D. To discuss the nature of electrical charges.

6. The author uses the example of homemade salad dressing to
   A. indicate the importance of oil to salad.  
   B. show that oil and water do not mix.  
   C. emphasize the complex nature of cooking.  
   D. demonstrate the similarity between vinegar and water.

7. What does “they” in line 2 refer to?
   A. Oil and water  
   B. Oil droplets  
   C. Emulsifying agents  
   D. Animal substances

8. Which of the following is mentioned as containing an emulsifying agent?
   A. Oil  
   B. Vinegar  
   C. Water  
   D. Milk

9. Which of the following is the function of an emulsifying agent, as described in the last paragraph?
   A. It prevents oil droplets from combining.  
   B. It enables a substance to conduct more electricity.  
   C. It acts as a preservative.  
   D. It repel both oil and water.

10. Emulsifying agents work in all of the following ways EXCEPT by
    A. acting as a physical barrier between droplets  
    B. lowering the surface tension of water  
    C. increasing the specific density of water  
    D. making the oil droplets repel each other

11. If you make a salad dressing, add an emulsifying agent, shake the dressing, and then let it stand for several minutes, where would you expect to find the oil?
    A. At the bottom of the dressing  
    B. At the top of the dressing  
    C. In the middle of the dressing  
    D. Throughout the dressing

Questions 12-16: (15%, 3% for each)

Magnesium is another mineral we now obtain by collecting huge volume of ocean water and treating it with chemicals, although originally it was derived only from brines or from the treatment of such magnesium-containing rocks as dolomite, of which whole mountain ranges are composed. In a cubic mile of seawater there are about four million tons of magnesium. Since the direct extraction method was developed about 1941, production has increased enormously. It was magnesium from the sea that made possible the wartime growth of the aviation industry, for every airplane made in the United States contains about half a ton of magnesium metal. And it has innumerable uses in other industries where a lightweight metal is desired, besides its long-standing utility as an insulating material, and its use in printing inks, medicines, and toothpastes.
12. What is the main topic of this passage?
   A. use of seawater   B. Treatment of seawater   C. Chemical properties of magnesium
   D. Derivation and uses of magnesium

13. According to the passage, magnesium was first obtained from
   A. rocks found on land   B. great amounts of ocean water   C. the sea floor
   D. major industrial sites

14. According to the passage, which of the following was a direct consequence of the new method of obtaining magnesium?
   A. The development of insulation materials   B. Increased airplane production   C. Improved medical facilities
   D. The development of cheap inks for printing

15. According to the passage, why is magnesium important to industry?
   A. It is strong.   B. It conducts heat well.   C. It weighs little.   D. It is inexpensive to produce.

16. It can be inferred from the passage that during the past fifty years to demand for magnesium has
   A. declined greatly   B. remained stable   C. increased slightly   D. risen dramatically

Questions 17-19: (9%, 3% for each)

The influenza virus is a single molecule composed of millions of individual atoms. While bacteria can be considered as a type of plant, secreting poisonous substances into the body of the organism they attack, viruses, like the influenza virus, are living organisms themselves. We may consider them as regular chemical molecules since they have strictly defined atoms structure; but on the other hand, we must also consider them as being alive since they are able to multiply in unlimited quantities.

17. According to this passage, bacteria are

18. The writer says that viruses are alive because they
   A. have a complex atomic structure,   B. move.   C. multiply.   D. need warmth and light.

19. The atomic structure of viruses   A. is variable.   B. is strictly defined.   C. cannot be analyzed chemically.   D. is more complex than that of bacteria.
Questions 20-26: (21%, 3% for each)

For years, the chemistry community has recognized the importance and utility of olefin metathesis. Now, the Royal Swedish Academy of Sciences has chosen to recognize it, too: Last week, the academy awarded the 2005 Nobel Prize in Chemistry to three chemists who developed the reaction—Yves Chauvin of the French Petroleum Institute, Rueil-Malmaison, France; Robert H. Grubbs of California Institute of Technology; and Richard R. Schrock of Massachusetts Institute of Technology. They will share equally the $1.3 million prize.

The Swedish academy’s choice “confirms what is generally agreed upon in the synthetic chemistry community—that olefin metathesis is a very useful catalytic reaction that has a broad scope,” comments Harvard University chemistry professor and Nobel Laureate Elias J. Corey.

In olefin metathesis, two carbon-carbon double bonds react to form two new carbon-carbon double bonds. In the process, substituents attached to the carbon atoms involved are exchanged. This exchange can result in various outcomes, including straight swapping of substituents, closure of large rings, formation of dienes, and polymerization. The reaction, which is catalytic, takes place under mild conditions and is so general that it is widely applicable.

The reaction was first observed in the 1950s, but it wasn’t until 1971 that a convincing mechanism was proposed. Chauvin and student Jean-Louis Hérisson suggested that the reaction is initiated by a metal carbene, which reacts with an olefin to form a new olefin and a new metal carbene, which propagates the reaction. Other chemists shed further light on the mechanism, which put the reaction on the path of practicality. For example, work in 1975 by Columbia University chemistry professor Thomas J. Katz and graduate student James McGinnis led them to synthesize discrete metal-carbene complexes, which they used to initiate the reaction.

With improvements in metal-carbene initiators, the reaction became more widely used. Schrock and Grubbs led efforts to develop the catalysts that now allow olefin metathesis to flourish. Schrock’s catalysts are based on molybdenum (or tungsten); Grubbs’s are based on ruthenium and are widely credited with having put olefin metathesis in the hands of synthetic chemists because the catalysts are easy to use. “Chemists now routinely use the catalysts to prepare pharmaceutical candidates and new materials in an efficient and environmentally friendly way,” says Jeremy M. Berg, director of the National Institute of General Medical Sciences, which has supported the research of the American winners.
20. Who did not win the Nobel Prize at 2005?
   A. Yves Chauvin   B. Robert H. Grubbs   C. Richard R. Schrock   D. Elias J. Corey

21. The above article was probably published in

22. Who did propose a convincing mechanism to olefin metathesis reaction?
   A. Yves Chauvin   B. Thomas J. Katz   C. Jeremy M. Berg   D. Richard R. Schrock

23. Which of the following is not an example of olefin metathesis reaction?

   \[
   \text{A. } R_1^1 R_1^2 + R_1^2 R_1^2 \longrightarrow R_1^1 R_1^1 + R_1^2 R_1^2
   \]

   \[
   \text{B. } R_1^1 R_1^1 + H_2 \longrightarrow (CR_1^1 R_1^1 H)_2
   \]

   \[
   \text{C. } \text{Pb(NO}_3\text{)}_2(\text{aq}) + 2 \text{KI(}\text{aq}) \longrightarrow \text{PbI}_2(\text{s}) + 2 \text{KNO}_3(\text{aq})
   \]

   \[
   \text{D. } \text{Pb(NO}_3\text{)}_2(\text{aq}) + 2 \text{HCl(}\text{aq}) \longrightarrow \text{CH}_3\text{CHCl}_2
   \]

24. Which of the following is not the transition metal used in the catalysts developed by
   Grubbs and Schrock
   A. Ru   B. Pt   C. W   D. Mo

25. The olefin metathesis reaction is often used to make
   A. less expensive production of pesticides
   B. more efficient production of polymers
   C. cleaner production of pharmaceutical intermediates
   D. all of the above

26. Which of the following could initiate an olefin metathesis reaction?
   A. titanium tetrachloride
   B. metal carbene
   C. nickel metal
   D. rhodium metal
Questions 27-28: (6%, 3% for each)

Plastics are materials which are softened by heat and set into lasting form when shaped in a mold. Some are natural; some are semisynthetic, the result of chemical reaction on a natural substance; some are synthetic, built up from the constituents of oil or coal. All are based on the chemistry of carbon, with its capacity for forming chains. The molecules that compose them (monomers) link together in the setting or curing process to form chains (polymers), which give plastics their flexible strength. Some plastics retain their ability to be softened and reshaped; like wax, they are thermoplastic. Others set permanently in the shapes they are given by heat and pressure; like eggs, they are thermosetting.

27. Which of the following is necessary to create any type of plastic?
   A. Carbon  B. Eggs  C. Oil  D. coal

28. Plastics that harden into permanent shapes are called
   A. chained  B. thermoplastic  C. monomer  D. thermosetting

Questions 29-32: (12%, 3% for each)

The atmosphere is composed mainly of oxygen and nitrogen, but it also contains minute quantities (about 0.3 percent) of carbon dioxide, which plays an important role in stabilizing temperatures both near the Earth’s surface and in the upper atmosphere. Various other substances are present as well—most notably, water vapor.

Water is, meteorologically, the most important constituent of the atmosphere of the Earth. It is present up to altitudes of about 40,000 to 45,000 feet, in amounts ranging from about zero over some mountains and deserts, to four percent over oceans and seas. If all of it were condensed in liquid form, it would cover the entire surface of the Earth with one inch of rainfall.

Water exists in the atmosphere in three forms: as an invisible, gaseous vapor, as liquid droplets, and as solid ice crystals. In the two latter states, it comprises visible precipitation—rain, hail, sleet, snow.
29. What is the main topic of the passage?
   A. Weather patterns of the Earth   B. Water in our atmosphere   C. The structure of water molecules   D. The three forms of water
30. Which of the following is NOT mentioned in the passage as being present in the Earth’s atmosphere?  
   A. Oxygen   B. Carbon dioxide   C. Nitrous oxide   D. Nitrogen
31. According to the passage, what is the highest percentage of water found anywhere in the Earth’s atmosphere?   
   A. 45%   B. 40%   C. More than 4% but less than 5%   D. 4%
32. It can be inferred from the passage that the water content of the atmosphere is greater over 
   A. bodies of water   B. icy areas   C. dry land   D. mountain ranges