1. The disintegration rate for a sample containing $^{60}_{27}C$ as the only radioactive nuclide is found to be 6740 dis/h. The half-life of $^{60}_{27}C$ is 5.2 years. Estimate the number of atoms of $^{60}_{27}C$ in the sample. (10%)

2. Calculate the vapor pressure at 25°C of a solution containing 165 g of the nonvolatile solute, glucose, $C_6H_{12}O_6$, in 685 g H_2O. The vapor pressure of water at 25°C is 23.8 mmHg. (10%)

3. Use Hess's law to determine ΔH for the reaction

$$CO_{(g)} + \frac{1}{2}O_{2(g)} \rightarrow CO_{2((g)}$$

given that

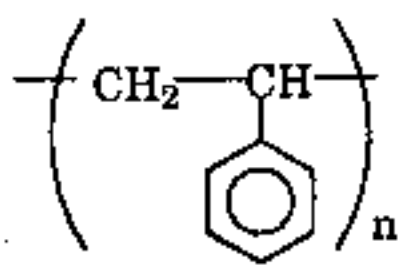
$$C \text{ (graphite)} + \frac{1}{2}O_{2(g)} \rightarrow CO_{(g)} \quad \Delta H = -110.54 \text{ kJ/mol}$$

$$C \text{ (graphite)} + O_{2(g)} \rightarrow CO_{2(g)} \quad \Delta H = -393.51 \text{ kJ/mol}$$

(10%)

4. Draw Structural formula for the following compounds
   (a) 1,3-dichlorobenzene (2%)
   (b) naphthalene (2%)
   (c) 2-butanol (2%)
   (d) 2,2,4-trimethylpentane (2%)

5. Propose a monomer from which the polymer



is made. (5%)

6. What is the molar solubility of PbI_2 in 0.1 M $KI_{(aq)}$? $K_{sp} = 7.1\times10^{-9}$ for PbI_2. (7%)

7–31 選擇題，每題二分

7. How many liters of 1.5 M calcium chloride solution can be produced from 250 g of calcium chloride?
A. 1.0 L B. 1.5 L C. 2.0 L D. 2.5 L E. none of the above

8. In order to explain the valence observed for many of the elements in terms of electron configurations, it is often useful to look at electronic states slightly different from the ground state. In comparing the ground state of boron with the state more useful to describe bonding, the number of unpaired electrons goes from
A. 1 to 2 B. 1 to 3 C. 3 to 4 D. 3 to 5 E. none of the above

9. Draw the Lewis structure for sulfur trioxide, SO_3, that has a formal charge of 0 on the sulfur. How many pairs of unshared electrons are present?
A. 1 B. 3 C. 2 D. 6 E. none of the above

10. Consider the unbalanced equation, $C_4H_{10} + O_2 \rightarrow$ products. If you have an excess of oxygen, which of the following is a likely product?
A. CO B. H_2 C. C D. CO_3 E. none of the above

11. A chemical reaction will always be spontaneous when
A. ΔH is negative and ΔS is negative
B. ΔH is positive and ΔS is positive
C. ΔG is positive D. ΔH is negative and ΔS is positive
E. none of the above

12. Given:
$N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$ $\Delta H° = 3.6$ kJ
$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ $\Delta H° = -6.7$ kJ
What is the standard enthalpy of formation for nitric oxide, NO?
A. 10.3 kJ B. 10.3 kJ C. 5.2 kJ D. -20.6 kJ
E. none of the above

13. In the industrial process for producing copper, air is blown through molten chalcocite, an ore containing CuS. Write a balanced chemical equation for the oxidation of CuS by oxygen. How many moles of Cu can be produced by reacting 10 moles of oxygen?(Assume SO2 is a reaction product.)
A. 5 B. 10 C. 15 D. 20 E. none of the above

14. Which of the following is a product of the reaction of FeS with excess sulfuric acid?
A. FeO B. H_2S C. H_2 D. O_2 E. none of the above

15. Which of the following molecular types is associated with molecules that have no dipole moment?
A. AX_2E B. AX_4E C. AX_3E D. AXE_3
E. none of the above

16. The molar enthalpy of fusion for ethanol is 5.01 kJ mol^{-1}, and its melting point is -114.6 °C. What is the entropy change for the ethanol when one mole melts?
A. 31.6 J K^{-1} B. 36.8 J K^{-1} C. 26.8 J K^{-1} D. 15.6 J K^{-1}
E. none of the above

17. Q for a gas phase reaction is 8.2, and Kp is 3.5×10^{-3}. What is the ΔG at 25 °C as the reaction proceeds to equilibrium?
A. 8.7 kJ B. 10 kJ C. 19 kJ D. 22 kJ
E. none of the above

18. Consider the reaction, $2A \rightarrow B + C$, where the reactants and products are in aqueous solution. Assume the concentrations to be [A] = 1.5 M, [B] = 2.0 M and [C]= 1.3 M. If K_{eq} for the reaction is 10, which of the following is true?
A. The reaction is at equilibrium.

B. The reaction will proceed to the right.
C. The reaction will proceed to the left.
D. The concentration of A will increase.
E. none of the above

19. How many Faradays of electrons are required to plate out 5.00 g of gold from an aqueous solution of Au^{3+}?
A. 1.70 Faradays B. 7.6×10^{-2} Faradays C. 2.5×10^{-2} Faradays
D. 2.65 Faradays E. none of the above

20. How many grams of Ag^+ can be deposited as silver metal by 2.50×10^4 C of charge?
A. 28.0 g B. 18.0 g C. 56.0 g D. 0.250 g
E. none of the above

21. Which of the following has a chiral carbon?
A. $CH_3CH_2CH_3$ B. $CH_3CHClCH_3$ C. $CH_2NH_2CO_2H$
D. CH_2CHCH_3 E. none of the above

22. What is the appropriate classification of the molecule, $CH_3CH_2CH_2C(=O)CH_2CH_2CH_3$?
A. aldehyde B. carboxylic acid C. ester
D. alcohol E. none of the above

23. Consider the reaction, $2KClO_3(s) + MnO_2(s) \rightarrow 2KCl(s) + MnO_2(s) + 3O_2(g)$. Which of the following is a catalyst for this reaction?
A. Sn B. MnO_2 C. KCl D. $KClO_3$
E. none of the above

24. The equilibrium constant for the vapor phase reaction, $PCl_3 + Cl_2 \longleftrightarrow PCl_5$, is 49. If the value for the rate constant for the forward reaction is 0.015 L mol^{-1} s^{-1}, what is the rate constant for the reverse reaction?

A. 33 mol L^{-1} B. 3300 s^{-1} C. 3.1 x 10^{-4} s^{-1}
D. 320 s^{-1} E. none of the above

25. The greenhouse effect relates to humannkind's concern with global warming. Which of the following gases is currently most important in terms of the increase in the earth's temperature?
A. H_2O B. CO_2 C. CCl_2F_2 D. CH_3CH_3
E. none of the above

26. Clean or unpolluted rain water has a slightly acidic pH. Which of the following is the cause of this acidity?
A. Water naturally dissociates to make itself acidic.
B. Acetic acid from normal biological processes is present in the water.
C. Carbon dioxide from the atmosphere dissolves in the rain water and is converted into carbonic acid.
D. Some $S0_2$ is present in clean air. This is enough to make it acidic.
E. none of the above

27. The major function of starch in the diet is
A. protein synthesis B. a source of energy
C. an aid to enzyme action D. cell wall function
E. none of the above

28. Which of the following is true for the oxidation of glucose in a living system?
A. Carbon monoxide is a reaction product.
B. The reaction is exothermic.
C. The reaction is always at equilibrium.
D. No useful work can be produced from the reaction.
E. none of the above

29. The main gases which are produced in outgassing are carbon dioxide, water and nitrogen. The atmosphere is composed of 80% nitrogen.

Which of the following statements is false?

A. Nitrogen makes up 80% of the gas produced by outgassing.
B. The water that was produced condensed to form the oceans and ice caps.
C. The carbon dioxide dissolved in the water.
D. The carbon dioxide is currently part of the carbonate minerals on the earth's crust.
E. none of the above

30. The mass defect for a helium-4 nucleus is 0.0304 u. What is the binding energy for a helium-4 nucleus? (1 u = 1.66×10^{-24} g)

A. 1.36×10^{-12} J B. 2.41×10^{-12} J C. 4.54×10^{-12} J
D. 6.82×10^{-12} J E. none of the above

31. Which of the following is false?

A. The compounds necessary to initiate life can form in the atmosphere.
B. The compounds necessary to initiate life exist in interstellar dust.
C. The compounds necessary to initiate life are present in the gases emitted from volcanoes.
D. Simple proteins result when amino acid solutions are evaporated.
E. none of the above