

Chemistry, 2013 EC, natural science, entrance exam

Grade 12 · Chemistry · 2013 E.C.

Time allowed: 120 minutes**Questions:** 30**Total marks:** 30

Name _____ Grade _____ ID No. _____ Date _____

1. Significant figures are figures with (1)
A. measured values with the highest precision.
B. measured values with the highest accuracy.
C. measured values with the highest uncertainty.
D. exactly known digits with the last digit uncertain.
2. The branch of chemistry that is involved in separation, identifying and determining the relative amounts of components in a sample of material is known as (1)
A. Biochemistry. B. Physical chemistry.
C. Analytical chemistry. D. Inorganic chemistry.
3. For the determination of the density of a new ceramic, a student measured the mass of a piece on an analytical and obtained 3.8056 gram and its volume 2.5 mL by displacement of water in a graduated cylinder. The correct reported density of the ceramic should be (1)
A. 1.5222 g/mL B. 1.5 g/mL
C. 1.5224 g/mL D. 3.5 g/mL
4. The scientific method is (1)
A. a collection of scientific guesses and hypotheses by seeking patterns in the observation.
B. a method of arriving at an organized body of knowledge based on reproducible experiments and observation.
C. the sum total of unique guidelines for the practice of science in the world.
D. the result of fortunate, accidental discovery in the development of science.
5. One of the following is NOT a cause of uncertainty in measurement? (1)
A. The type of material measured
B. The person doing the experiment
C. The measuring device
D. The environment where the measurement is made
6. Which of the following is true about isotopes? Isotopes of an element have (1)
A. the same number of electrons and neutrons.
B. different number of neutrons and the same number protons.
C. different physical and chemical properties.
D. the same atomic mass but different atomic numbers.

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7. Which statement correctly describes Heisenberg's uncertainty principle? (1)
- A. If we measure the momentum of a particle precisely then its position will be correspondingly precise.
 - B. A particle with a mass moving at a given speed can be described by the wave characteristics of material particles.
 - C. A small particle like the electron can behave both as a particle and a wave.
 - D. Both the location and the momentum of a subatomic particle like the electron cannot be precisely known.
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8. Which of the following statement is correct about energy changes when an electron changes its energy level? (1)
- A. When an electron jumps from a lower energy level to a higher level, the photon emitted is equal to the difference between the two energy levels.
 - B. When an electron falls from a higher energy level to a lower energy level, the energy is equal to the difference between the two energy levels is observed.
 - C. When an electron jumps from a lower energy to a higher energy level, the energy is equal to the difference between the two energy levels is absorbed.
 - D. When an electron falls from a higher energy level to a lower energy level, the energy is higher than the difference between the two energy levels is emitted.
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9. The sanitizer in wide use for protection against Covid-19 is labeled 83% alcohol. How can one scientifically check the concentration? This can be done by (1)
- A. forming a hypothesis.
 - B. collection of data.
 - C. experimentation.
 - D. making observation.
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10. The correct electronic configuration for chromium (Cr, Z=24) is (1)
- A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4d^2$
 - B. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$
 - C. $1s^2 2s^2 3s^2 3p^6 4s^1 d^6$
 - D. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$
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11. According to Hund's rule equal energy (degenerate) orbitals are filled with (1)
- A. two electrons of opposite spins placed in the first orbitals.
 - B. maximum number of unpaired electrons with parallel spins.
 - C. two electrons of parallel spins placed in the first orbital.
 - D. maximum number of unpaired electrons with opposite spins.
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12. In the modern periodic table (1)
- A. non-metals are placed on the right hand side of the periodic table.
 - B. elements with similar properties are placed in the same period.
 - C. metals are placed on the right hand side of the periodic table.
 - D. transition and inner transition elements are placed in the middle of the periodic table.
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13. Covalent compounds are liquids or gases at room temperature and have low melting and boiling points. Which of the following statements explains these properties of covalent compounds? (1)
- A. The intermolecular forces of attraction in covalent compounds are strong.
 - B. The unit of particles in covalent compounds are ions.
 - C. There are no forces of attraction between the molecules in covalent compounds.
 - D. Covalent compounds exist as separate molecules.

14. Both carbonyl sulphide, COS(SCO), $S = C = O$ and carbon dioxide (CO_2) $O = C = O$ are linear molecules. COS is polar whereas CO_2 is non-polar. this is because (1)
- A. CO_2 has a net dipole moment of zero.
 - B. the $C = O$ bonds in both COS and CO_2 are polar.
 - C. regions of high negative charge is distributed equally around the central atom in COS.
 - D. Sulphur is more electronegative than oxygen.
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15. Which of the following statements is true about the formation of CH_4 according to valence bond theory? (1)
- A. The 2s and two 2p orbitals in carbon hybridize to form three sp^2
 - B. The 2s and three 2p orbitals in carbon hybridize to form four sp^3
 - C. The 2s and one 2p orbitals in carbon hybridize to form two SP orbitals.
 - D. Carbon can form two hybrid orbitals as it has got only two half-filled orbitals.
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16. Phosphorus ($Z = 15$) has the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^3$, what kind of hybridization does phosphorus undergo in the formation of phosphorus pentachloride (PCl_5) (1)
- A. sp^3
 - B. $sp^3 d$
 - C. sp^2
 - D. sp
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17. One of the following reactions illustrates the formation of coordinate covalent bond? (1)
- A. $NaOH + HCl \rightarrow NaCl + H_2O$
 - B. $Be + 2F_2 \rightarrow BeF_2$
 - C. $NH_3 + HCl \rightarrow NH_4^+ + Cl^-$
 - D. $CaCO_3 + HCl \rightarrow CaCl_2 + H_2O + CO_2$
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18. Hydrogen bonding occurs in compounds that contain $H - N$, $H - O$ and $H - F$ bonds. These bonds are stronger than the ordinary dipole-dipole interaction because (1)
- A. the partially positive H of one molecule is attracted to the partially negative lone pairs on the N, O or F another molecule.
 - B. the $H - N$, and $H - F$ bonds are less polar than ordinary covalent bonds.
 - C. the small sizes of N, O and F makes these atoms so electropositive that their covalently bonded H is highly negative.
 - D. the $H - N$, $H - O$ and $H - F$ bonds are non-polar and thus do not interact with neighboring molecules.
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19. Which of the following is an example of exception to the octet rule? (1)
- A. NH_3
 - B. CCl_4
 - C. H_2O
 - D. PCl_5
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20. When the boiling point of hydrides of group VIA elements, H_2O , H_2S , H_2Se and H_2Te are arranged in the order of increasing boiling point. The trend is $H_2Te < H_2Se < H_2S < H_2O$, water having the highest boiling point, this is due to (1)
- A. the small size of O compared to the other group VIA elements.
 - B. the basic different structures of each hydride.
 - C. increasing boiling points with increasing molecular mass.
 - D. hydrogen bonding present in H_2O molecules.

21. Given the following catalyzed reactions

(1)

- I. $2\text{CO}_2(\text{s}) \rightarrow 2\text{SO}_3(\text{g})$; $\text{V}_2\text{O}_5(\text{s})$ as a catalyst
II. $\text{OCl}^-(\text{aq}) + \text{I}^-(\text{aq}) \rightarrow \text{OI}^-(\text{aq}) + \text{Cl}^-(\text{aq})$; $\text{OH}^-(\text{aq})$ as inhibitor
III. $\text{CO}(\text{s}) + \text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g})$;
IV. $\text{CO}(\text{s}) + \text{H}_2(\text{g}) \rightarrow \text{HCHO}(\text{g})$; $\text{Cu}(\text{s})$ as a catalyst

Which reactions are examples for homogeneous catalysis?

- A. I and II
B. II
C. II and III
D. IV

22. Which statement is true about catalyst?

(1)

- A. A catalyst slows down or speeds up a reaction, itself being consumed.
B. A positive catalyst decreases the rate of a reaction by increasing the activation energy.
C. A negative catalyst increases the rate of a reaction by decreasing the value of activation energy.
D. The role of a catalyst is to increase or decrease the rate of a reaction by lowering or increasing the activation energy.

23. According to the transition state theory

(1)

- A. the collision between two reacting species results in the formation of an activated complex, which has less energy than both reactants and products.
B. in the activated complex, the original bonds are weakened and the new bonds are partially formed.
C. the activation energy is the energy that must be absorbed or released by reactants to reach the activated complex.
D. the standard reaction enthalpy ($\Delta H^\circ(\text{O})$) depends on the magnitude of the activation energy (E_{a}).

24. Which of the following is true about the rate constant?

(1)

- A. It expresses the relationship between the rate of a chemical reaction and the volume of reacting species.
B. The volume of a rate constant tells us how fast or slow a reaction is.
C. The value of a rate constant is independent of reaction conditions.
D. A small rate constant indicates a faster reaction and a larger rate constant indicates a slower reaction.

25. The mathematical expression $K = (-E_{\text{a}} / (2.303R)) 1/T + \log A$ derived from the Arrhenius equation is of important as it Shows

(1)

- A. reactions with lower activation energies have higher values of k and are therefore faster.
B. for a given value of activation energy the rate constant increases as the temperature increases.
C. reactions with lower activation energies, the value of the rate constant decreases as the temperature increases.
D. for a given value of activation energy, the value of the rate constant decreases as the temperature increases.

26. From the magnitude of the equilibrium constant, K_{eq} one can deduce that

(1)

- A. small K_{eq} values indicate the reaction yields very high amounts of products near equilibrium.
B. large K_{eq} value indicates that the reaction reaches equilibrium with little reactants remaining.
C. intermediate K_{eq} value indicates that the reaction does proceed in the forward direction.
D. K_{eq} will be larger when we have higher amounts of reactants over products.

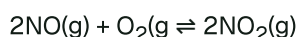
27. The statement "If a system at equilibrium is subjected to a stress, the system will readjust itself to reduce the effects of the stress is known as (1)

- A. Faradays law
B. Boyle's law
C. Avogadro's principle
D. Le-Chatelier's principle
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28. The law of mass action states that (1)

- A. the rate of a reaction is directly proportional to the product of the concentration of reactants raised to the power of their respective coefficients in the balanced equation.
B. the K_{eq} expression is the ratio of the concentrations reactants to the products raised to their coefficients.
C. a chemical equilibrium is attained only when the reaction is started with reactants.
D. for a reaction at equilibrium, the reaction quotient, Q is always less than the equilibrium constant, $(K_{eq})^{(-)}$
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29. For the reaction between gaseous NO and O_2 to form $NO_2(g)$, what will be the equilibrium constant expression. (1)



- A. $K_c = [NO_2]^2 / [NO]^2 [O_2]$
B. $K_p = [P NO_2]^2 / [NO]^2 [O_2]$
C. $K_p = [P NO_2] / (P NO)^2 (P O_2)$
D. $K_p = [P NO]^2 (P O_2) / (P NO_2)$
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30. In the production of NH_3 by the Haber process according to the equation $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $\Delta H = -92KJmol^{-1}$ What are the favorable conditions for the production of high yield of NH_3 ? (1)

- A. Low pressure and low temperature
B. High pressure and low temperature
C. High pressure and high temperature
D. Low pressure and high temperature

— END OF EXAMINATION —