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-Presents-

CHEMISTRY

REGENTS EXAM
REVIEW MANUAL

WITH 6 REGENTS EXAMS,
4 TOPICALLY ORGANIZED

SPECIAL EDITION
Each Question Linked is
to a Solution Video
QR Coded for One to One Initiative

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Chemistry

Table of Contents

Introduction to Chemistry

1. At STP, two 5.0-gram solid samples of different ionic compounds have the same density. These solid samples could be differentiated by their
   (1) mass
   (2) volume
   (3) temperature
   (4) solubility in water

06 17 10

2. The joule is a unit of
   (1) concentration
   (2) energy
   (3) pressure
   (4) volume

06 17 16

3. A student measures the mass and volume of a sample of copper at room temperature and 101.3 kPa. The mass is 48.9 grams and the volume is 5.00 cubic centimeters. The student calculates the density of the sample. What is the percent error of the student's calculated density?
   (1) 7.4%
   (2) 8.4%
   (3) 9.2%
   (4) 10.2%

06 17 33

4. Which sample of matter is a mixture?

08 17 13

(1) air
(2) ammonia
(3) manganese
(4) water

5. The temperature of a substance is a measure of the

08 17 18

(1) average kinetic energy of its particles
(2) average potential energy of its particles
(3) ionization energy of its particles
(4) activation energy of its particles

Base your answers to questions 6 through 8 on the information below and on your knowledge of chemistry.

In a laboratory investigation, a student compares the concentration and pH value of each of four different solutions of hydrochloric acid, HCl(aq), as shown in the table.

Data for HCl(aq) Solutions

Solution	Concentration of HCl(aq) (M)	pH Value
W	1.0	0
X	0.10	1
Y	0.010	2
Z	0.0010	3

The Chemistry Laboratory

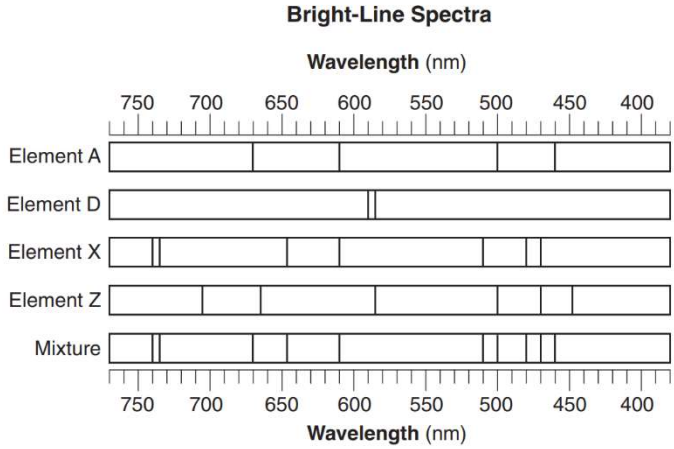
1. Paper chromatography can separate the components of a mixture of colored dyes because the components have differences in
   (1) decay mode
   (2) thermal conductivity
   (3) ionization energy
   (4) molecular polarity

08 17 14

2. In a laboratory investigation, a student separates colored compounds obtained from a mixture of crushed spinach leaves and water by using paper chromatography. The colored compounds separate because of differences in
   (1) molecular polarity
   (2) malleability
   (3) boiling point
   (4) electrical conductivity

06 18 15

Base your answers to questions 3 and 4 on your knowledge of chemistry and the bright-line spectra produced by four elements and the spectrum of a mixture of elements represented in the diagram below.



3. Which elements are present in this mixture?

06 18 31-32

(1) D and A
(2) D and Z
(3) X and A
(4) X and Z

4. Each line in the spectra represents the energy
(1) absorbed as an atom loses an electron
(2) absorbed as an atom gains an electron
(3) released as an electron moves from a lower energy state to a higher energy state
(4) released as an electron moves from a higher energy state to a lower energy state

5. Identify a laboratory process that can be used to separate a liquid mixture of methanol and water, based on the differences in their boiling points.

08 18 52

Atoms, Molecules, and Ions

1. Which statement describes the structure of an atom?
   (1) The nucleus contains positively charged electrons
   (2) The nucleus contains negatively charged protons
   (3) The nucleus has a positive charge and is surrounded by negatively charged electrons.
   (4) The nucleus has a negative charge and is surrounded by positively charged electrons.

06 17 01

2. Which term is defined as the region in an atom where an electron is most likely to be located?
   (1) nucleus
   (2) orbital
   (3) quanta
   (4) spectra

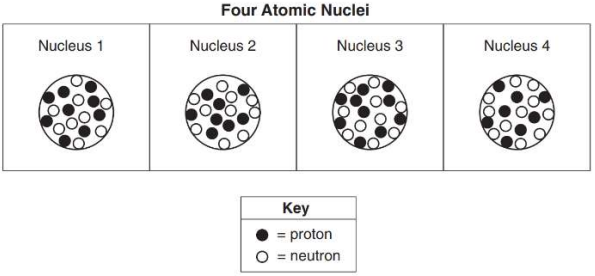
06 17 02

3. In which type of reaction can two compounds exchange ions to form two different compounds?
   (1) synthesis
   (2) decomposition
   (3) single replacement
   (4) double replacement

06 17 09

Base your answers to questions 7 through 10 on the information below and your knowledge of chemistry

The diagrams below represent four different atomic nuclei.



06 17 54-57

7. Identify the element that has atomic nuclei represented by nucleus 1.

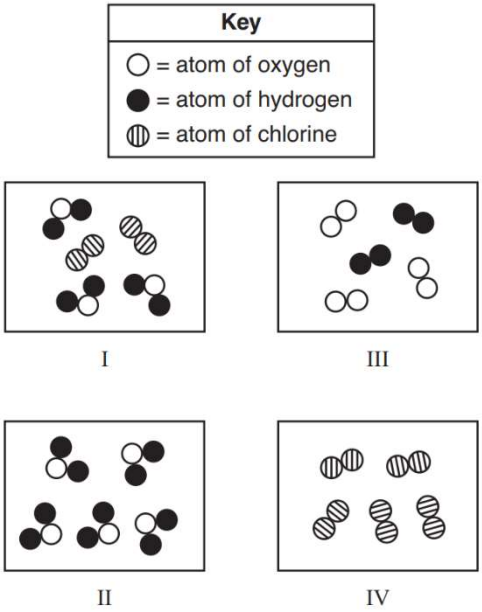
8. Determine the mass number of the nuclide represented by nucleus 2.

9. Explain why nucleus 2 and nucleus 4 represent the nuclei of two different isotopes of the same element.

10. Identify the nucleus above that is found in an atom that has a stable valence electron configuration.

15. Which two particle diagrams each represent a sample of one substance?

08 17 36



(1) I and II
(2) I and III
(3) II and III
(4) II and IV

16. Which statement describes the charge and location of an electron in an atom?

06 18 01

(1) An electron has a positive charge and is located outside the nucleus.
(2) An electron has a positive charge and is located in the nucleus.
(3) An electron has a negative charge and is located outside the nucleus.
(4) An electron has a negative charge and is located in the nucleus.

17. If two atoms are isotopes of the same element, the atoms must have

06 18 03

(1) the same number of protons and the same number of neutrons
(2) the same number of protons and a different number of neutrons
(3) a different number of protons and the same number of neutrons
(4) a different number of protons and a different number of neutrons

18. Which ion has the largest radius?

06 18 09

(1) Br^-
(2) Cl^-
(3) F^-
(4) I^-

19. Which particle has the *least* mass?

06 18 28

(1) alpha particle
(2) beta particle
(3) neutron
(4) proton

20. The table below shows the number of protons, neutrons, and electrons in four ions.

06 18 33

Four Ions

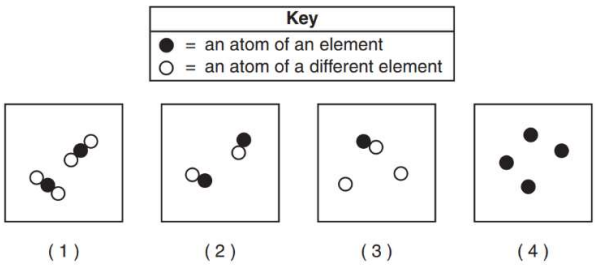
Ion	Number of Protons	Number of Neutrons	Number of Electrons
A	8	10	10
E	9	10	10
G	11	12	10
J	12	12	10

Which ion has a charge of 2– ?

(1) A
(2) E
(3) G
(4) J

21. Which particle diagram represents a mixture?

06 18 40



The Electric Structure of Atoms

1. Which electron transition in an excited atom results in a release of energy?
   (1) first shell to the third shell
   (2) second shell to the fourth shell
   (3) third shell to the fourth shell
   (4) fourth shell to the second shell

06 17 05

2. Which electron configuration represents the electrons of an atom of neon in an excited state?
   (1) 2-7
   (2) 2-8
   (3) 2-7-1
   (4) 2-8-1

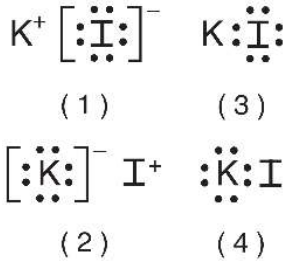
06 17 31

3. Which electron configuration represents the electrons in an atom of calcium in an excited state?
   (1) 2–8–8
   (2) 2–8–8–2
   (3) 2–7–8–1
   (4) 2–7–8–3

08 17 31

4. Which Lewis electron-dot diagram represents the bonding in potassium iodide?

08 17 48



(1) (3)

(2) (4)

5. Which statement explains why a xenon atom is electrically neutral?
   (1) The atom has fewer neutrons than electrons.
   (2) The atom has more protons than electrons.
   (3) The atom has the same number of neutrons and electrons.
   (4) The atom has the same number of protons and electrons.

06 18 02

6. Which electrons in a calcium atom in the ground state have the greatest effect on the chemical properties of calcium?
   (1) the two electrons in the first shell
   (2) the two electrons in the fourth shell
   (3) the eight electrons in the second shell
   (4) the eight electrons in the third shell

06 18 04

Formulas, Equations, and Chemical Reactions

1. What is conserved during all chemical reactions?
   (1) charge
   (2) density
   (3) vapor pressure
   (4) melting point

06 17 08

2. What occurs when a catalyst is added to a chemical reaction?
   (1) an alternate reaction pathway with a lower activation energy
   (2) an alternate reaction pathway with a higher activation energy
   (3) the same reaction pathway with a lower activation energy
   (4) the same reaction pathway with a higher activation energy

06 17 24

3. What is the name of the compound with the formula $CH_3CH_2CH_2NH_2$?
   (1) 1-propanol
   (2) 1-propanamine
   (3) propanal
   (4) propanamide

06 17 25

4. Which compound is an isomer of $C_2H_5OC_2H_5$? 06 17 26

(1) CH_3COOH
(2) $C_2H_5COOCH_3$
(3) $C_3H_7COCH_3$
(4) C_4H_9OH

5. What is the chemical formula for sodium sulfate? 06 17 34

(1) Na_2SO_4
(2) Na_2SO_3
(3) $NaSO_4$
(4) $NaSO_3$

Base your answers to questions 6 through 8 on the information below and on your knowledge of chemistry.

Ammonia, $NH_3(g)$, can be used as a substitute for fossil fuels in some internal combustion engines. The reaction between ammonia and oxygen in an engine is represented by the unbalanced equation below.

$$NH_3(g) + O_2(g) \rightarrow N_2(g) + H_2O(g) + \text{energy}$$

6. Balance the equation *in your answer booklet* for the reaction of ammonia and oxygen, using the smallest whole-number coefficients. 06 17 69-71

7. Show a numerical setup for calculating the mass, in grams, of a 4.2-mole sample of O_2. Use 32 g/mol as the gram-formula mass of O_2.

8. Determine the new pressure of a 6.40-L sample of oxygen gas at 300. K and 100. kPa after the gas is compressed to 2.40 L at 900. K.

Base your answers to questions 9 through 13 on the information below and on your knowledge of chemistry.

Fruit growers in Florida protect oranges when the temperature is near freezing by spraying water on them. It is the freezing of the water that protects the oranges from frost damage. When $H_2O(\ell)$ at 0°C changes to $H_2O(s)$ at 0°C, heat energy is released. This energy helps to prevent the temperature inside the orange from dropping below freezing, which could damage the fruit. After harvesting, oranges can be exposed to ethene gas, C_2H_4, to improve their color.

9. Write the empirical formula for ethene.

06 17 72-76

10. Explain, in terms of bonding, why the hydrocarbon ethene is classified as unsaturated.

11. Determine the gram-formula mass of ethene.

12. Explain, in terms of particle arrangement, why the entropy of the water *decreases* when the water freezes.

13. Determine the quantity of heat released when 2.00 grams of $H_2O(\ell)$ freezes at 0°C.

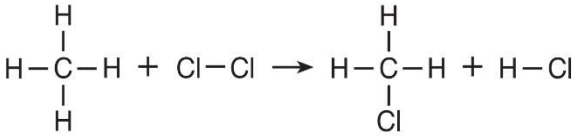
14. What is the chemical formula of titanium(II) oxide?

08 17 34

(1) TiO
(2) Ti_2O
(3) TiO_2
(4) Ti_2O_3

15. Given the equation representing a reaction:

08 17 43



Which type of reaction is represented by this equation?

(1) addition
(2) esterification
(3) polymerization
(4) substitution

Base your answers to questions 16 through 19 on the information below and on your knowledge of chemistry.

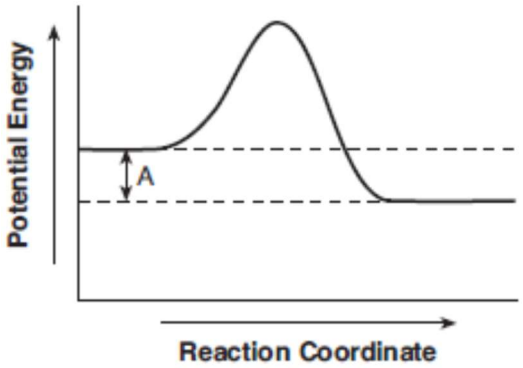
Millions of tons of ammonia are produced each year for use as fertilizer to increase food production. Most of the hydrogen needed to produce ammonia comes from methane gas reacting with steam. This reaction, which occurs in a container under controlled conditions, is shown below in unbalanced equation 1.

Equation 1: $CH_4(g) + H_2O(g) + \text{energy} \rightarrow CO(g) + H_2(g)$

The reaction that produces ammonia is represented by balanced equation 2, shown below. A catalyst can be used to increase the rate of the reaction.

Equation 2: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g) + \text{energy}$

A potential energy diagram for equation 2 is shown below.



16. Balance equation 1 *in your answer booklet*, using the smallest whole-number coefficients.

08 17 69-72

17. Explain, in terms of collision theory, why an increase in temperature increases the rate of reaction between methane gas and steam.