CLEP Chemistry Practice 2026

Free Practice Test — 30 Real Exam-Style Questions

with full answer key & explanations

Practice Questions

Try all 30 first, then check the answer key at the back.

1. Which of the following units is not a standard unit of volume in chemistry?

A. Milliliter (mL)
B. Cubic meter ($$m^3$$)
C. Centiliter (cL)
D. Quart (qt)

2. During an experiment, a student needs to separate a mixture of salt and sand. What common laboratory technique should the student use to achieve this separation?

A. Distillation
B. Evaporation
C. Centrifugation
D. Chromatography

3. In an experiment involving photosynthesis, scientists measure the absorption of specific wavelengths of light by chlorophyll. What is the approximate range of wavelengths of light that chlorophyll primarily absorbs?

A. 400-700nm
B. 10-40nm
C. 300-600µm
D. 45-90µm

4. A gold necklace often contains a mixture of gold and copper (copper is cheaper). You have a necklace that appears gold and weighs 6.5g. You want to determine whether it is pure gold. To make this calculation, which piece(s) of information do you need? i. Molar mass of gold ii. Volume of the necklace iii. Density of pure gold iv. Density of pure copper

A. ii., iii., and iv.
B. i. and iii.
C. i., ii, and iii.
D. i., ii., iii., and iv.

5. Where would you look on the periodic table to find all the elements with the same number of valence electrons?

A. A single column
B. A single row
C. A group of rows
D. A cluster of elements in the center of the table

6. What are the Group IA elements most commonly known as?

A. Halogens
B. Transition metals
C. Alkali metals
D. Noble gases

7. Which functional groups are found in all monosaccharides?

A. Ketone and carboxylic acid
B. Hydroxyl group and carboxylic acid
C. Amine and ether
D. Aldehyde or ketone and hydroxyl group

8. In descriptive chemistry, what does "chelation" mean?

A. Formation of hydrogen bonds within a single molecule
B. Formation of Van der Waals interactions between multiple molecules
C. Formation of a complex where a metal ion is bonded to a single molecule (ligand) through multiple bonds
D. Bonding of a metal ion with a single atom

9. Consider the halogens in the periodic table. Where would you expect to find the strongest oxidizing agent?

A. First element of the halogens
B. Last element of the halogens
C. Second element of the halogens
D. Middle element of the halogens

10. Consider fluorine and nitrogen, which are both in the same period of the periodic table. Which has greater electron affinity (EA)? Which has greater atomic radius (AR)?

A. Since they are in the same row, they have approximately the same EA and AR
B. Fluorine has greater EA and nitrogen has greater AR
C. Nitrogen has greater EA and AR
D. Fluorine has greater EA and AR

11. Which of the following distinctively characterizes a superoxide?

A. Oxygen has an oxidation state of -1/2
B. Oxygen forms a triple bond
C. Oxygen is bonded to multiple metals
D. Oxygen is in its elemental form

12. Why does adding antifreeze to a car's radiator benefit the vehicle's cooling system?

A. It will cause the coolant to evaporate more quickly
B. It will cause the radiator to reach its operating temperature more quickly
C. It will reduce the volatility of the coolant
D. No (aside from better component lubrication)

13. Under which condition is Boyle's Law not applicable?

A. When temperature is not constant
B. When volume is not constant
C. When pressure is constant
D. When different gas species are mixed

14. In the context of the Ideal Gas Law, what is a possible unit for the volume of a gas?

A. atmospheres (atm)
B. moles (mol)
C. kelvin (K)
D. liters (L)

15. A semi-permeable membrane encloses a gas mixture containing 5% helium and 95% nitrogen. This membrane is placed into an external gas mixture containing 2% helium and 98% nitrogen. What will happen now? Analyze the probabilities of gas transfer through the semi-permeable membrane based on the percentages provided.

A. Helium will flow from the membrane-enclosed space into the outer gas mixture
B. Nitrogen will flow from the membrane-enclosed space into the outer gas mixture
C. Helium and nitrogen will flow in both directions across the membrane
D. A combination of helium and nitrogen will flow in both directions across the membrane

16. Analyze the table below to determine which phases of matter are generally incompressible. Phase Compressibility Solid Incompressible Liquid Incompressible Gas Compressible Plasma Compressible

A. Solid, Liquid, and Gas
B. Solid and Liquid
C. Liquid and Gas
D. Solid and Plasma

17. All other conditions held equal, which of the following changes would increase the vapor pressure of a liquid?

A. Decreased volume
B. Increased volume
C. Increased temperature
D. Decreased temperature

18. You place a solid piece of paraffin wax into a heating apparatus and gradually increase the temperature while recording the temperature and time. The wax transitions from a solid to a liquid and then to a gas. The resulting graph shows both flat and upward-sloping lines. At which part of the graph does the 'heat of fusion' for paraffin wax occur?

A. The second sloped segment
B. The intersection between the first sloped segment and the first flat segment
C. The first flat segment
D. The second flat segment

19. Consider this reaction: Cu + S -> CuS. How has the oxidation state of sulfur changed?

A. Unchanged
B. Decreased by 2
C. Increased by 2
D. Decreased by 1

20. In general, the highest lattice energy is associated with:

A. High ionic charges; the ionic radii are variable
B. Small ionic radii and high ionic charges
C. Small ionic radii and low ionic charges
D. Large ionic radii and high ionic charges

21. What is the atomic mass of Carbon-12?

A. 12.011 amu
B. 11.999 amu
C. 10.000 amu
D. 12.000 amu

22. Water is composed of hydrogen and oxygen (formula $$H_2O$$). What type(s) of bonds do you expect to find in the water molecule?

A. Neither ionic nor covalent
B. Impossible to say without knowing the electronegativities of hydrogen and oxygen
C. Covalent only
D. Ionic only

23. Consider the ionic radius of a chlorine atom (Cl) compared to its cation (Cl■) and its anion (Cl■). How do they compare?

A. Cl > Cl■; Cl > Cl■
B. Cl = Cl■; Cl < Cl■
C. Cl > Cl■; Cl = Cl■
D. Cl > Cl■; Cl < Cl■

24. Which element will likely form stronger covalent bonds: C (electron configuration $$1s^2 2s^2 2p^2$$) or Si (electron configuration $$1s^2 2s^2 2p^6 3s^2 3p^2$$)?

A. C, because it has a fuller valence shell and is, therefore, more stable
B. Si, because it forms the 4+ ion more easily
C. Si, because it can have more electrons involved in bonding
D. Si, because it can more easily form multiple bonds

25. Which of the following diagrams properly illustrates the Rutherford atomic model?

A. Electrons all circling the nucleus in a single orbit
B. Electrons in random motion around a dense nucleus
C. Electrons in fixed orbits circling the nucleus
D. Electrons occupying clouds of space around the nucleus

26. Which of the following properties can be determined by studying the kinetics of a reaction that cannot be inferred from its balanced chemical equation? i. Activation energy ii. Reaction intermediates iii. Reaction rate iv. Product yield

A. i., iii., and iv.
B. iv. only
C. i., ii., and iii.
D. i. only

27. Consider the reaction step involving $$2X + Y \rightarrow $$ products. What is the molecularity of this reaction step?

A. Unimolecular
B. Bimolecular
C. Can't say without knowing the rate law
D. Can't say without knowing all steps involved in the overall reaction

28. Consider a reaction system with various components: solids, solvents, dissolved ions, and gases. When writing the equilibrium constant expression for this system, which of the following should be included? Component Solids Solvents Dissolved ions (concentration) Gases

A. Solids, Dissolved ions (concentration), and Gases
B. Dissolved ions (concentration) and Gases
C. Dissolved ions (concentration) only
D. Solvents and Dissolved ions (concentration)

29. What does a very small equilibrium constant, $$K$$, indicate about a chemical reaction?

A. The reaction runs very quickly and reaches equilibrium fast
B. The reaction produces a significant amount of products
C. The reaction essentially goes to completion
D. The reaction essentially does not occur at all

30. Identify the spectator ion(s) in the following reaction: $$Na_2SO_4$$ $$(aq) + BaCl_2$$ $$(aq) \rightarrow BaSO_4$$ $$(s) + 2 NaCl$$ $$(aq)$$

A. $$Na^+, Cl^-$$
B. $$Na^+, SO_4^{2-}$$
C. $$Cl^-, SO_4^{2-}$$
D. $$Ba^{2+}$$ only

Answer Key & Explanations

1. D — Quart (qt)
Answer: Quart (qt) Volume in chemistry is typically measured in liters, milliliters, cubic meters, etc. A quart is not a standard unit of volume in the International System of Units (SI) used in chemistry.

2. A — Distillation
The correct answer is Filtration. Filtration is a common laboratory technique used to separate solid particles from liquids or gases. The sand in the mixture is captured by the filter paper, while the salt passes through as a solution.

3. A — 400-700nm
Answer: 400-700nm Chlorophyll primarily absorbs light in the blue (around 430nm) and red (around 680nm) regions of the electromagnetic spectrum. The approximate range of wavelengths of light that chlorophyll absorbs is therefore between 400 and 700nm.

4. A — ii., iii., and iv.
Answer: ii. and iii. With the necklace's volume, you can calculate its density (mass/volume). Compare this to the density of pure gold; if it is not identical, then you know the necklace is impure. (You would need the density of pure copper if you wanted to determine whether copper was the impurity, but that is not what the question asked.)

5. A — A single column
Answer: A single column In the periodic table, columns are called groups or families. Elements within the same group have the same number of valence electrons, which contributes to similar chemical properties. Each row is called a period and contains elements with increasing atomic numbers, but varying valence electron counts.

6. C — Alkali metals
Answer: Alkali metals Group IA contains elements like lithium, sodium, potassium, and cesium, which are highly reactive and readily form hydroxides with water. These elements are called alkali metals because they form alkaline solutions.

7. D — Aldehyde or ketone and hydroxyl group
Answer: Aldehyde or ketone and hydroxyl group All monosaccharides contain either an aldehyde or ketone group, along with multiple hydroxyl (OH) groups. This molecular structure is what classifies them as simple sugars and allows them to undergo chemical reactions essential to metabolism.

8. C — Formation of a complex where a metal ion is bonded to a single molecule (ligand) through multiple bonds
Answer: Formation of a complex where a metal ion is bonded to a single molecule (ligand) through multiple bonds Chelation involves a single ligand forming multiple bonds with a metal ion, effectively creating a ring structure. This can stabilize the metal ion and is often seen in biological systems, where metal ions are involved in enzyme active sites or transport mechanisms.

9. A — First element of the halogens
The correct answer is: First element of the halogens. The trends among the halogens mirror the trends for electronegativity and oxidizing strength in the periodic table. The oxidizing strength increases towards the top of the column.

10. B — Fluorine has greater EA and nitrogen has greater AR
Fluorine has greater electron affinity (EA) and nitrogen has greater atomic radius (AR). EA generally increases across a period due to the greater nuclear charge attracting electrons more strongly, while AR decreases across a period due to the additional protons pulling electrons closer to the nucleus.

11. A — Oxygen has an oxidation state of -1/2
Answer: Oxygen has an oxidation state of -1/2 In superoxides, such as KO_2 and NaO_2, oxygen exhibits an oxidation state of -1/2, which is different from its usual -2 state. This unique oxidation state allows superoxides to participate in oxidation-reduction reactions differently from peroxides and other oxygen compounds.

12. A — It will cause the coolant to evaporate more quickly
Adding antifreeze to a car's radiator lowers the freezing point and raises the boiling point of the coolant. This is a colligative property, wherein adding a solute (antifreeze) to a solvent (water) affects its physical properties like freezing and boiling points. This makes the coolant more effective at preventing the engine from overheating or freezing in different weather conditions.

13. A — When temperature is not constant
Answer: When temperature is not constant Boyle's Law states that there is an inverse proportional relationship between Volume and Pressure $$\left(V_1 P_1 = V_2 P_2 \right)$$, provided that Temperature and the amount of gas (n) are held constant. It does not matter what type of gas is involved, and it does not matter if there multiple different gas species.

14. D — liters (L)
Answer: liters (L) According to the Ideal Gas Law ($$PV = nRT$$), volume is typically measured in liters (L) when using standard units. The ideal gas constant R is consistent with units of pressure in atmospheres (atm), volume in liters (L), amount of substance in moles (mol), and temperature in kelvin (K).

15. A — Helium will flow from the membrane-enclosed space into the outer gas mixture
Answer: Helium will flow from the outer gas mixture into the membrane-enclosed space. This problem is about the behavior of gases and partial pressures: helium can traverse the membrane, but nitrogen cannot. There is a partial pressure gradient to balance the concentration of helium on either side of the membrane, so helium flows into the area of higher concentration to balance the pressures. Notably, gas transfer via a semi-permeable membrane does not care about the types of gases on either side of the membrane. The membrane may reach an equilibrium with completely different types of gases inside and outside of the membrane.

16. B — Solid and Liquid
Answer: Solid and Liquid. Solids and liquids are generally incompressible compared to gases and plasmas, which are compressible phases of matter.

17. C — Increased temperature
Answer: Increased temperature Vapor pressure is the pressure exerted by a vapor in equilibrium with its liquid phase. At higher temperatures, molecules have more kinetic energy, which allows more molecules to escape

from the liquid to the vapor phase, thus increasing the vapor pressure.

18. C — The first flat segment
Answer: The first flat segment. When paraffin wax absorbs heat to transition from solid to liquid, its temperature does not change during the phase change. This is represented by the first flat segment on the graph. The second flat segment represents the heat of vaporization as the wax changes from liquid to gas.

19. B — Decreased by 2
Answer: Decreased by 2 On the left side of the equation, both elements are in their neutral, unbonded states and therefore have oxidation states of 0. Therefore, the right side of the equation must also have a net oxidation state of 0. We know that copper sulfide is really composed of the copper ion (Cu$$^{2+}$$) and sulfide ion (S$$^{2-}$$), so sulfur's oxidation state is -2 and has therefore decreased by 2 overall.

20. B — Small ionic radii and high ionic charges
Answer: Small ionic radii and high ionic charges Lattice energy is the energy released when ions form a solid lattice. Higher lattice energies are associated with stronger electrostatic forces between ions. These forces are strongest when the ions have high charges and are close together, resulting in smaller ionic radii.

21. D — 12.000 amu
Answer: 12.000 amu The atomic mass of Carbon-12 is defined as exactly 12.000 atomic mass units (amu). This standard is used as a reference in atomic mass measurements, making it important for understanding the scale and calculation of atomic masses in chemistry.

22. C — Covalent only
Answer: Covalent only Even without having a table of electronegativities, you can accurately predict that since both hydrogen and oxygen are non-metals, they likely form covalent bonds. Remember that ionic bonds generally occur between metals and non-metals, where the difference in electronegativity is such that the non-metal steals electrons from the metal instead of sharing the electrons between atoms.

23. D — Cl > Cl■; Cl < Cl■
If a chlorine atom loses an electron to become a cation ($$Cl^+$$), its radius shrinks because it has lost its outer-most electron. Conversely, if it gains an electron to become an anion ($$Cl^-$$), its radius increases due to the added electron and the associated repulsive effects.

24. A — C, because it has a fuller valence shell and is, therefore, more stable
Answer: C, because it has a smaller atomic radius and can form stronger bond overlaps. Covalent bonding strength is influenced by the ability of atoms to effectively overlap their bonding orbitals. Carbon's smaller atomic radius allows for a more effective orbital overlap, resulting in stronger bonds compared to silicon.

25. B — Electrons in random motion around a dense nucleus
Answer: Electrons in random motion around a dense nucleus In the Rutherford model, the atom consists of a small, dense nucleus surrounded by electrons that move in a random fashion. Rutherford's experiment with alpha particles showed that atoms are mostly empty space with a tiny, dense, positively charged nucleus.

26. C — i., ii., and iii.
Answer: i., ii., and iii. The balanced chemical equation provides information about stoichiometry and the overall products and reactants. However, it does not indicate the activation energy, reaction intermediates, or rate of the reaction. Kinetics studies reveal the activation energy needed to start the reaction, identify intermediate species formed during the reaction, and measure the speed (reaction rate). The yield of

products, however, is typically determined by the extent of the reaction and thermodynamics, not kinetics.

27. A — Unimolecular
A reaction step involving three molecules (2X and Y) coming together is termed termolecular. The molecularity of a reaction step is the number of molecules that must collide simultaneously for the reaction to occur. In this case, since the step involves three molecules, it is termed termolecular.

28. B — Dissolved ions (concentration) and Gases
By definition, pure solids and pure solvents are excluded from equilibrium constant expressions. Only the concentrations of dissolved ions and the partial pressures of gases are included.

29. D — The reaction essentially does not occur at all
Answer: The reaction essentially does not occur at all The equilibrium constant $$K$$ is a ratio of the concentration of products to reactants. A very small $$K$$ value indicates that there are many more reactants than products at equilibrium, suggesting that the reaction hardly proceeds forward.

30. A — $$Na^+, Cl^-$$
The correct answer is $$Na^+, Cl^-$$. A spectator ion is present in solution but does not participate in the reaction. It is helpful to look for ions that remain aqueous throughout the reaction. In this case, $$Na^+, Cl^-$$ remain dissolved in solution, while $$Ba^{2+}$$ and $$SO_4^{2-}$$ react to form a precipitate.

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