

Chemistry Admission Test – Sample

Khalifa University – Department of Chemistry | Chemistry Entrance Placement Test | 40 items | 90 minutes

Question
<p>1. Which of the following is the SI base unit for the amount of a substance?</p> <p>A) Gram B) Litre C) Mole D) Kelvin</p> <p>Correct Answer C</p>
<p>2. How many significant figures are present in the measurement 0.003080 m?</p> <p>A) 3 B) 4 C) 5 D) 6</p> <p>Correct Answer B</p>
<p>3. A metal block has a mass of 94.5 g and a volume of 12.0 cm³. What is its density?</p> <p>A) 7.88 g/cm³ B) 0.127 g/cm³ C) 8.10 g/cm³ D) 6.50 g/cm³</p> <p>Correct Answer A</p>
<p>4. A normal human body temperature is 37.0 °C. What is this temperature on the Kelvin scale?</p> <p>A) 236 K B) 310 K C) 298 K D) 273 K</p> <p>Correct Answer B</p>
<p>5. Which of the following is classified as a pure compound rather than a mixture?</p> <p>A) Air B) Brass C) Carbon dioxide D) Sea water</p> <p>Correct Answer C</p>
<p>6. When the equation $__ \text{C}_3\text{H}_8 + __ \text{O}_2 \rightarrow __ \text{CO}_2 + __ \text{H}_2\text{O}$ is correctly balanced using the smallest whole-number coefficients, the coefficient of O₂ is:</p> <p>A) 3</p>

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- B) 5
- C) 7
- D) 10

Correct Answer B

7. Which statement best describes the particles in the gaseous state of matter?

- A) Particles are tightly packed in a fixed, ordered arrangement
- B) Particles are close together but able to move past one another
- C) Particles are far apart and move freely and rapidly
- D) Particles vibrate only about fixed positions

Correct Answer C

8. An ion contains 16 protons, 16 neutrons, and 18 electrons. What is the correct symbol for this ion?

- A) ${}^{32}_{16}\text{S}^{2-}$
- B) ${}^{32}_{16}\text{S}^{2+}$
- C) ${}^{34}_{16}\text{S}^{2-}$
- D) ${}^{32}_{18}\text{Ar}$

Correct Answer A

9. What is the ground-state electron configuration of a chlorine atom ($Z = 17$)?

- A) $1s^2 2s^2 2p^6 3s^2 3p^5$
- B) $1s^2 2s^2 2p^6 3s^2 3p^6$
- C) $1s^2 2s^2 2p^6 3s^2 3p^3$
- D) $1s^2 2s^2 2p^6 3s^1 3p^6$

Correct Answer A

10. What is the frequency of light that has a wavelength of 400 nm? ($c = 3.0 \times 10^8$ m/s)

- A) $7.5 \times 10^{14} \text{ s}^{-1}$
- B) $1.3 \times 10^{15} \text{ s}^{-1}$
- C) $4.0 \times 10^{14} \text{ s}^{-1}$
- D) $1.2 \times 10^{17} \text{ s}^{-1}$

Correct Answer A

11. Which experiment provided evidence for a small, dense, positively charged nucleus within the atom?

- A) Millikan's oil-drop experiment
- B) Rutherford's gold-foil experiment
- C) Thomson's cathode-ray experiment
- D) Dalton's law of multiple proportions

Correct Answer B

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12. As you move from left to right across a period in the periodic table, the atomic radius generally:

- A) Increases
- B) Decreases
- C) Remains constant
- D) Increases then decreases

Correct Answer B

13. Atoms X, Y, and Z are in the same period. Their first ionization energies are X = 496, Y = 738, Z = 578 kJ/mol. Which lists them in order of increasing atomic number (left to right across the period)?

- A) X, Y, Z
- B) X, Z, Y
- C) Z, Y, X
- D) Y, Z, X

Correct Answer B

14. Which of the following elements has the highest first ionization energy?

- A) Na
- B) Cl
- C) Al
- D) Mg

Correct Answer B

15. Which of the following is a characteristic property of metalloids?

- A) They are excellent conductors of electricity like metals
- B) They have properties intermediate between metals and non-metals
- C) They are always gases at room temperature
- D) They never form compounds

Correct Answer B

16. Which type of bond is formed by the complete transfer of valence electrons from one atom to another?

- A) Covalent bond
- B) Metallic bond
- C) Ionic bond
- D) Hydrogen bond

Correct Answer C

17. What is the correct chemical formula of the ionic compound formed between the aluminium ion (Al^{3+}) and the sulfate ion (SO_4^{2-})?

- A) AlSO_4

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- B) $\text{Al}_2(\text{SO}_4)_3$
- C) $\text{Al}_3(\text{SO}_4)_2$
- D) $\text{Al}(\text{SO}_4)_3$

Correct Answer B

18. Which of the following molecules contains a non-polar covalent bond?

- A) HCl
- B) Cl_2
- C) H_2O
- D) NH_3

Correct Answer B

19. Based on electronegativity differences, which of the following bonds is the most polar?

- A) C–H
- B) N–H
- C) O–H
- D) F–H

Correct Answer D

20. Which property is most characteristic of substances with giant ionic crystal structures?

- A) Low melting points
- B) Conduct electricity when molten or in solution
- C) Soft and easily compressed
- D) Soluble only in non-polar solvents

Correct Answer B

21. Chlorine has two isotopes: ^{35}Cl (75.0%) and ^{37}Cl (25.0%). What is its average atomic mass?

- A) 35.0 amu
- B) 35.5 amu
- C) 36.0 amu
- D) 37.0 amu

Correct Answer B

22. What is the percent by mass of nitrogen in ammonium nitrate, NH_4NO_3 ? (N = 14, H = 1, O = 16; molar mass = 80 g/mol)

- A) 17.5 %
- B) 35.0 %
- C) 52.5 %
- D) 70.0 %

Correct Answer B

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23. For the reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$, a mixture contains 2.0 mol N_2 and 3.0 mol H_2 . Which is the limiting reagent?

- A) N_2
- B) H_2
- C) Both are completely consumed
- D) Neither; they are in exact ratio

Correct Answer B

24. Consider the reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$. How many moles of hydrogen are required to produce 312 moles of ammonia?

- A) 312 mol H_2
- B) 468 mol H_2
- C) 208 mol H_2
- D) 936 mol H_2

Correct Answer B

25. According to the Brønsted–Lowry theory, an acid is a species that:

- A) Accepts a proton (H^+)
- B) Donates a proton (H^+)
- C) Accepts a pair of electrons
- D) Donates a hydroxide ion

Correct Answer B

26. In a titration, 25.0 mL of HCl is exactly neutralized by 30.0 mL of 0.100 M NaOH. What is the concentration of the HCl solution?

- A) 0.083 M
- B) 0.100 M
- C) 0.120 M
- D) 0.150 M

Correct Answer C

27. What volume of 0.452 M NaOH is required to neutralize 85.0 mL of 0.176 M H_2SO_4 ?

- A) 436.6 mL
- B) 218.3 mL
- C) 66.2 mL
- D) 38.4 mL

Correct Answer C

28. What is the pH of a 0.0010 M solution of the strong acid HNO_3 ?

- A) 2
- B) 3
- C) 4

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D) 11

Correct Answer B

29. What volume of water must be added to 50.0 mL of 6.0 M HCl to dilute it to 2.0 M? (Assume volumes are additive.)

- A) 50 mL
- B) 100 mL
- C) 150 mL
- D) 200 mL

Correct Answer B

30. When the redox equation $__ \text{MnO}_4^- + __ \text{Fe}^{2+} + __ \text{H}^+ \rightarrow __ \text{Mn}^{2+} + __ \text{Fe}^{3+} + __ \text{H}_2\text{O}$ is balanced in acidic solution, the coefficient of Fe^{2+} is:

- A) 2
- B) 3
- C) 5
- D) 8

Correct Answer C

31. In a reaction, the theoretical yield of product is 25.0 g but only 20.0 g is actually obtained. What is the percent yield?

- A) 62.5 %
- B) 75.0 %
- C) 80.0 %
- D) 125 %

Correct Answer C

32. A gas occupies 250 mL at 1.0 atm. If the volume is reduced to 25 mL at constant temperature, the new pressure is:

- A) 0.10 atm
- B) 10. atm
- C) 25 atm
- D) 250 atm

Correct Answer B

33. According to the ideal gas equation $PV = nRT$, at constant temperature and number of moles, pressure and volume are:

- A) Directly proportional
- B) Inversely proportional
- C) Equal
- D) Independent of each other

Correct Answer B

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34. A gas at 300 K and 2.0 atm is heated to 600 K at constant volume. What is the new pressure?

- A) 1.0 atm
- B) 2.0 atm
- C) 4.0 atm
- D) 8.0 atm

Correct Answer C

35. A student needs to deliver a precise, variable volume of 17.60 mL of acid during a titration. Which apparatus is most appropriate?

- A) A beaker
- B) A burette
- C) A measuring cylinder
- D) A conical flask

Correct Answer B

36. Which instrument is most appropriate for accurately measuring the mass of a small solid sample in the laboratory?

- A) A graduated cylinder
- B) An electronic analytical balance
- C) A thermometer
- D) A stopwatch

Correct Answer B

37. Which separation technique is most suitable for obtaining pure water from a salt (NaCl) solution?

- A) Filtration
- B) Simple distillation
- C) Decantation
- D) Sieving

Correct Answer B

38. Which technique would best separate two miscible liquids that have different boiling points?

- A) Filtration
- B) Evaporation
- C) Fractional distillation
- D) Magnetic separation

Correct Answer C

39. What type of chemical hazard is indicated by a hazard symbol showing an exclamation mark?

- A) Carcinogenic

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- B) Radioactive
- C) Irritant
- D) Explosive

Correct Answer C

40. Which of the following is the correct laboratory safety practice?

- A) Pipetting corrosive liquids by mouth
- B) Wearing safety goggles when handling chemicals
- C) Tasting chemicals to identify them
- D) Storing flammable solvents near an open flame

Correct Answer B