

Chemistry CSCA — March 2026

Chemistry Wild Mock Version One

Instructions: Each question has four options, of which only one is correct. Read each question carefully before answering. Calculators are not permitted.

Atomic weights: H: 1 C: 12 N: 14 O: 16 Na: 23 Mg: 24 Al: 27 S: 32 Cl: 35.5 Ca: 40 Fe: 56
Cu: 64 Zn: 65 Ba: 137

Question 1

Which of the following pairs correctly classifies both phenomena as physical changes?

- (A) Dissolving sugar in water; rusting of iron
- (B) Sublimation of iodine crystals; evaporation of ethanol
- (C) Combustion of magnesium; melting of ice
- (D) Fermentation of glucose; condensation of steam

Question 2

A student needs to prepare exactly 250.0 mL of $0.200 \text{ mol} \cdot \text{L}^{-1}$ Na_2CO_3 solution. Which sequence of operations is correct?

- (A) Weigh 5.30 g Na_2CO_3 , dissolve in 250 mL of water, transfer to volumetric flask
- (B) Weigh 5.30 g Na_2CO_3 , dissolve in small amount of water, cool, transfer to 250 mL volumetric flask, add water to the mark
- (C) Weigh 4.24 g Na_2CO_3 , dissolve in 250 mL of distilled water
- (D) Weigh 5.30 g Na_2CO_3 , add directly to a 250 mL volumetric flask, fill to the mark

Question 3

At 25°C , 100 mL of $0.30 \text{ mol} \cdot \text{L}^{-1}$ HCl is mixed with 100 mL of $0.10 \text{ mol} \cdot \text{L}^{-1}$ $\text{Ba}(\text{OH})_2$. What is the pH of the resulting solution?

- (A) $\text{pH} = 1$
- (B) $\text{pH} = 7$
- (C) $\text{pH} > 7$
- (D) $\text{pH} = 13$

Question 4

16.0 g of a mixture of CuO and Fe_2O_3 is completely reduced by excess H_2 . The total mass of metals obtained is 12.8 g. What is the mole fraction of CuO in the original mixture?

- (A) 25%
- (B) 50%
- (C) 40%
- (D) 60%

Question 5

A sample contains 3.01×10^{23} molecules of CO_2 . Which of the following contains the same number of oxygen atoms as this sample?

- (A) 0.5 mol SO_2
- (B) 1 mol H_2O
- (C) 0.5 mol O_2
- (D) 1 mol SO_3

Question 6

Under standard conditions, a mixture of CO and CO₂ occupies 11.2 L. The mixture is passed through excess NaOH solution; the volume decreases to 5.6 L (at STP). What is the molar ratio of CO to CO₂ in the original mixture?

- (A) 1 : 1
- (B) 1 : 2
- (C) 2 : 1
- (D) 3 : 1

Question 7

A 500 mL solution contains 0.10 mol Na⁺, 0.20 mol Mg²⁺, and SO₄²⁻ ions only. What is the molar concentration of SO₄²⁻?

- (A) 0.50 mol·L⁻¹
- (B) 0.25 mol·L⁻¹
- (C) 1.00 mol·L⁻¹
- (D) 0.60 mol·L⁻¹

Question 8

Excess chlorine gas is passed into 100 mL of 1 mol·L⁻¹ FeBr₂ solution. Which statement about the resulting solution is correct?

- (A) The solution contains Fe²⁺, Fe³⁺, and Br⁻
- (B) The solution contains only Fe³⁺ and Br⁻
- (C) The solution contains Fe³⁺ and Cl⁻, and no Br⁻ remains
- (D) The molar ratio of Fe³⁺ to Cl⁻ is 1:3

Question 9

Which of the following statements about Na₂O₂ is incorrect?

- (A) Na₂O₂ reacts with water to produce O₂ and NaOH
- (B) Na₂O₂ can be used as an oxygen supply in emergency breathing apparatus
- (C) In Na₂O₂, the oxidation number of oxygen is -1
- (D) Na₂O₂ contains both ionic and covalent bonds

Question 10

Which of the following reactions represents a disproportionation reaction?

- (A) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2\uparrow$
- (B) $\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaClO} + \text{H}_2\text{O}$
- (C) $2\text{H}_2\text{S} + \text{SO}_2 \rightarrow 3\text{S} + 2\text{H}_2\text{O}$
- (D) $\text{MnO}_2 + 4\text{HCl}(\text{conc}) \rightarrow \text{MnCl}_2 + \text{Cl}_2\uparrow + 2\text{H}_2\text{O}$

Question 11

Which of the following organic compounds has the molecular formula C₄H₈O₂ and is an ester that can be hydrolyzed to give only one type of product?

- (A) CH₃COOC₂H₅
- (B) HCOOCH₂CH₂CH₃
- (C) CH₃CH₂COOCH₃
- (D) HCOOC(CH₃)₃ — methyl propanoate isomer

Question 12

Concentrated H₂SO₄ reacts with excess copper at elevated temperature. Which of the following statements is correct?

- (A) The reaction stops when all H₂SO₄ is consumed
- (B) Both SO₂ and H₂ are produced
- (C) The reaction stops before all the copper is consumed
- (D) Cu acts as a reducing agent, and S in H₂SO₄ is reduced from +6 to -2

Question 13

A gas X decolorizes bromine water and turns acidified KMnO_4 purple solution colorless. X also reacts with NaHCO_3 to produce CO_2 . Which compound could X be?

- (A) $\text{CH}_2=\text{CHCOOH}$ (acrylic acid)
- (B) CH_3CHO (acetaldehyde)
- (C) HCHO (formaldehyde)
- (D) $\text{C}_6\text{H}_5\text{OH}$ (phenol)

Question 14

Which of the following ionic equations is correct for the reaction of excess NaOH solution added to AlCl_3 solution?

- (A) $\text{Al}^{3+} + 3\text{OH}^- \rightarrow \text{Al}(\text{OH})_3\downarrow$
- (B) $\text{Al}^{3+} + 4\text{OH}^- \rightarrow \text{AlO}_2^- + 2\text{H}_2\text{O}$
- (C) $\text{Al}^{3+} + 3\text{OH}^- \rightarrow \text{Al}(\text{OH})_3\downarrow$, then $\text{Al}(\text{OH})_3 + \text{OH}^- \rightarrow \text{AlO}_2^- + 2\text{H}_2\text{O}$
- (D) $\text{Al}(\text{OH})_3 + \text{OH}^- \rightarrow \text{Al}^{3+} + 4\text{OH}^-$

Question 15

When a small piece of sodium is added to a CuSO_4 solution, which of the following correctly describes all observed phenomena?

- (A) A red-brown precipitate forms and gas bubbles are released
- (B) A blue precipitate forms, gas bubbles are released, and no red copper deposits appear
- (C) Red copper deposits on the bottom and hydrogen gas is released
- (D) The solution turns colorless and a red copper mirror forms

Question 16

An element X is in Period 3. Its chloride has the formula XCl_3 . The oxide of X reacts with both HCl and NaOH . Which element is X?

- (A) Phosphorus (P)
- (B) Aluminum (Al)
- (C) Silicon (Si)
- (D) Sulfur (S)

Question 17

Which of the following correctly lists elements in order of increasing first ionization energy?

- (A) $\text{Na} < \text{Mg} < \text{Al} < \text{Si}$
- (B) $\text{Na} < \text{Al} < \text{Mg} < \text{Si}$
- (C) $\text{Si} < \text{Al} < \text{Mg} < \text{Na}$
- (D) $\text{Mg} < \text{Na} < \text{Si} < \text{Al}$

Question 18

For the reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$, $\Delta H = -92 \text{ kJ} \cdot \text{mol}^{-1}$. At equilibrium, which of the following changes will simultaneously increase both the equilibrium constant K and the yield of NH_3 ?

- (A) Increase pressure
- (B) Decrease temperature
- (C) Add a catalyst
- (D) Remove NH_3 from the system

Question 19

At 25°C , $K_a(\text{CH}_3\text{COOH}) = 1.8 \times 10^{-5}$. Which of the following statements about a $0.1 \text{ mol} \cdot \text{L}^{-1}$ CH_3COOH solution is correct?

- (A) $\text{pH} = 1$
- (B) $c(\text{H}^+) = c(\text{CH}_3\text{COO}^-)$
- (C) $c(\text{H}^+) > c(\text{CH}_3\text{COO}^-) > c(\text{OH}^-)$
- (D) Adding NaCl increases the degree of ionization of CH_3COOH

Question 20

Which of the following statements about chemical bonds in a water molecule is correct?

- (A) Water contains both σ and π bonds
- (B) The O–H bond is nonpolar because oxygen and hydrogen are both nonmetals
- (C) The bond angle in H_2O is approximately 104.5° due to two lone pairs on oxygen
- (D) H_2O has a linear geometry because oxygen has two bonding pairs

Question 21

For the equilibrium $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$, which of the following changes would shift the equilibrium to the right AND increase the total pressure of the system?

- (A) Decreasing volume at constant temperature
- (B) Adding Cl_2 at constant volume
- (C) Increasing temperature at constant volume
- (D) Removing PCl_3 at constant temperature and volume

Question 22

A weak acid HA has $\text{pK}_a = 4.74$ at 25°C . A buffer solution is prepared with equal concentrations of HA and NaA. Which of the following is true?

- (A) $\text{pH} = 4.74$ and $c(\text{HA}) > c(\text{A}^-)$
- (B) $\text{pH} = 4.74$ and $c(\text{HA}) = c(\text{A}^-)$
- (C) $\text{pH} = 7.00$ because the solution is neutral
- (D) Adding a small amount of HCl will drastically change the pH

Question 23

The electron configuration of the ground-state ion Cu^{2+} is:

- (A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$
- (B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$
- (C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$
- (D) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1 4s^2$

Question 24

Which of the following types of intermolecular forces are present between two HF molecules?

- (A) London dispersion forces only
- (B) Dipole-dipole forces and London dispersion forces only
- (C) Hydrogen bonding, dipole-dipole, and London dispersion forces
- (D) Ionic interactions and hydrogen bonds

Question 25

To separate a mixture of NaCl and I_2 , which of the following procedures is most appropriate?

- (A) Filtration
- (B) Dissolve in water, then extract with CCl_4 , separate layers, evaporate CCl_4 layer
- (C) Heat the mixture to decompose I_2
- (D) Add AgNO_3 solution to precipitate Cl^-

Question 26

In the industrial synthesis of sulfuric acid (contact process), the conversion of SO_2 to SO_3 uses V_2O_5 catalyst at around $450\text{--}500^\circ\text{C}$. Which statement correctly explains why extremely high temperatures are NOT used?

- (A) Higher temperatures would decompose the catalyst
- (B) The reaction is exothermic; higher temperatures shift equilibrium left, reducing SO_3 yield
- (C) Higher temperatures increase reaction rate but SO_2 becomes explosive
- (D) The reaction is endothermic and higher temperature would be wasteful

Question 27

A gas sample is a mixture of H_2 and HCl . To determine the volume percent of each, the gas is first passed through anhydrous CaCl_2 , then through NaOH solution, and the volume change is measured. Which statement is correct?

- (A) CaCl_2 absorbs HCl ; NaOH absorbs H_2
- (B) CaCl_2 absorbs H_2O only; NaOH absorbs HCl ; the remaining gas is H_2
- (C) The order must be reversed: NaOH first, then CaCl_2
- (D) CaCl_2 can absorb both HCl and H_2O simultaneously from the mixture

Question 28

In a laboratory electrolysis cell with inert electrodes, aqueous CuSO_4 is electrolyzed. After passing 2 mol of electrons, which of the following correctly describes what is deposited at the cathode and what is released at the anode?

- (A) 1 mol Cu at cathode; 1 mol O_2 at anode
- (B) 1 mol Cu at cathode; 0.5 mol O_2 at anode
- (C) 2 mol Cu at cathode; 1 mol O_2 at anode
- (D) H_2 at cathode; Cl_2 at anode

Question 29

An unknown white solid could be Na_2CO_3 , NaHCO_3 , or a mixture of both. A student dissolves a sample in water, then adds excess BaCl_2 solution; a white precipitate forms. The student then filters and adds dilute HCl to the filtrate; no bubbles are observed. The original solid is:

- (A) Na_2CO_3 only
- (B) NaHCO_3 only
- (C) A mixture of Na_2CO_3 and NaHCO_3
- (D) Cannot be determined from these experiments

Question 30

Which of the following laboratory operations is correct?

- (A) When diluting concentrated H_2SO_4 , add water slowly into acid while stirring
- (B) Sodium is cut and the fresh surface immediately turns gray-white, so it must be stored under kerosene
- (C) To test for CO_2 , pass the gas directly into limewater without any prior treatment
- (D) A burette reading should always be taken from the top of the meniscus for accuracy

Question 31

Zinc powder is added to a mixture of $\text{Fe}(\text{NO}_3)_2$ and AgNO_3 solutions. After the reaction is complete and excess Zn remains, which metals are present in the solid residue?

- (A) Zn and Ag only
- (B) Zn , Fe , and Ag
- (C) Zn , Ag , and some $\text{Fe}(\text{NO}_3)_2$ remains in solution
- (D) Fe and Ag only, Zn is fully consumed

Question 32

In the reaction $3\text{Cl}_2 + 6\text{KOH} (\text{hot, concentrated}) \rightarrow \text{KClO}_3 + 5\text{KCl} + 3\text{H}_2\text{O}$, the ratio of chlorine atoms oxidized to chlorine atoms reduced is:

- (A) 1 : 5
- (B) 5 : 1
- (C) 1 : 1
- (D) 1 : 3

Question 33

A 1.00 g sample of a pure hydrocarbon is burned in excess O_2 . The products are passed through anhydrous CaCl_2 (absorbs H_2O) and then through NaOH solution (absorbs CO_2). The CaCl_2 tube gains 1.80 g and the NaOH tube gains 2.64 g. What is the empirical formula of the hydrocarbon?

- (A) CH_4 (methane)
- (B) CH_2 (ethylene)

- (C) C_2H_2 (acetylene)
- (D) C_3H_4

Question 34

Exactly 10.0 mL of an H_2SO_4 solution of unknown concentration is titrated with $0.100 \text{ mol}\cdot\text{L}^{-1}$ NaOH. The endpoint requires 24.60 mL of NaOH. What is the concentration of H_2SO_4 ?

- (A) $0.246 \text{ mol}\cdot\text{L}^{-1}$
- (B) $0.123 \text{ mol}\cdot\text{L}^{-1}$
- (C) $0.0492 \text{ mol}\cdot\text{L}^{-1}$
- (D) $0.492 \text{ mol}\cdot\text{L}^{-1}$

Question 35

In the laboratory, which of the following methods is appropriate to remove SO_2 impurity from a sample of CO_2 gas?

- (A) Pass through concentrated H_2SO_4
- (B) Pass through saturated NaHCO_3 solution
- (C) Pass through NaOH solution
- (D) Pass through concentrated NaCl solution

Question 36

A sample of 10.6 g of Na_2CO_3 solid is heated with excess dilute HCl. The volume of CO_2 gas produced at STP is:

- (A) 2.24 L
- (B) 4.48 L
- (C) 1.12 L
- (D) 22.4 L

Question 37

Which of the following aqueous solutions has the highest electrical conductivity?

- (A) $0.1 \text{ mol}\cdot\text{L}^{-1}$ CH_3COOH
- (B) $0.1 \text{ mol}\cdot\text{L}^{-1}$ NaCl
- (C) $0.1 \text{ mol}\cdot\text{L}^{-1}$ H_2SO_4
- (D) $0.05 \text{ mol}\cdot\text{L}^{-1}$ BaCl_2

Question 38

Which of the following ions cannot coexist in large amounts in an acidic aqueous solution?

- (A) Fe^{2+} , SO_4^{2-} , Na^+ , Cl^-
- (B) Cu^{2+} , NO_3^- , Cl^- , K^+
- (C) Al^{3+} , NO_3^- , Na^+ , SO_4^{2-}
- (D) Fe^{2+} , NO_3^- , H^+ , K^+

Question 39

For the reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ at equilibrium in a sealed container, the equilibrium is disturbed. After reaching a new equilibrium, the concentration of O_2 is higher than before. Which change caused this?

- (A) Increasing the temperature
- (B) Decreasing the volume of the container
- (C) Adding more SO_2
- (D) Adding more O_2

Question 40

A mixture of NaCl and Na_2SO_4 is dissolved in water. Which reagent combination correctly identifies and confirms both anions?

- (A) Add AgNO_3 : white precipitate confirms Cl^- ; then add BaCl_2 : white precipitate confirms SO_4^{2-}

- (B) Add excess $\text{Ba}(\text{NO}_3)_2$ to precipitate SO_4^{2-} , filter, then add AgNO_3 and dilute HNO_3 to filtrate to test for Cl^-
- (C) Add dilute HCl : no reaction with Cl^- ; then add BaCl_2 : white precipitate confirms SO_4^{2-}
- (D) Add dilute H_2SO_4 : confirms SO_4^{2-} ; then add AgNO_3 to confirm Cl^-

Question 41

0.2 mol of Na_2O_2 reacts completely with CO_2 to produce O_2 and Na_2CO_3 . How many moles of electrons are transferred in this reaction?

- (A) 0.1 mol
- (B) 0.2 mol
- (C) 0.4 mol
- (D) No electron transfer occurs; this is not a redox reaction

Question 42

Which of the following salts undergoes hydrolysis to give a basic solution, and which ions are responsible?

- (A) NH_4Cl ; NH_4^+ hydrolyzes to give NH_3 and H^+ , making the solution acidic
- (B) Na_2CO_3 ; CO_3^{2-} hydrolyzes to give HCO_3^- and OH^- , making the solution basic
- (C) NaCl ; neither Na^+ nor Cl^- hydrolyzes, so the solution is acidic
- (D) FeCl_3 ; Fe^{3+} hydrolyzes to give $\text{Fe}(\text{OH})_3$ and Cl^- , making the solution basic

Question 43

Which of the following correctly describes saponification (hydrolysis of an ester under basic conditions)?

- (A) It is a reversible reaction that reaches equilibrium
- (B) It is irreversible because the carboxylate salt formed does not react with alcohol
- (C) It requires concentrated H_2SO_4 as a catalyst
- (D) It produces an alcohol and a carboxylic acid as final products

Question 44

Scientists identify element Z: it is in Period 3, its highest oxide is acidic, and its simple ion has a noble gas configuration. When Z reacts with Na, the product contains a Z^{2-} ion. Which element is Z?

- (A) Phosphorus (P)
- (B) Sulfur (S)
- (C) Chlorine (Cl)
- (D) Silicon (Si)

Question 45

A strip of iron is placed in 100 mL of $0.5 \text{ mol} \cdot \text{L}^{-1}$ CuSO_4 solution. After the reaction, the mass of the iron strip increases by 0.40 g. How many moles of Cu were deposited?

- (A) 0.01 mol
- (B) 0.02 mol
- (C) 0.05 mol
- (D) 0.04 mol

Question 46

For the thermochemical equation $\text{C}(\text{graphite}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$, $\Delta H = -393.5 \text{ kJ} \cdot \text{mol}^{-1}$ and $\text{H}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$, $\Delta H = -285.8 \text{ kJ} \cdot \text{mol}^{-1}$. Using Hess's law, calculate ΔH for: $\text{C}(\text{graphite}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g})$ given that $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$, $\Delta H = -890.3 \text{ kJ} \cdot \text{mol}^{-1}$.

- (A) $\Delta H = -74.8 \text{ kJ} \cdot \text{mol}^{-1}$
- (B) $\Delta H = +74.8 \text{ kJ} \cdot \text{mol}^{-1}$
- (C) $\Delta H = -965.1 \text{ kJ} \cdot \text{mol}^{-1}$
- (D) $\Delta H = -464.5 \text{ kJ} \cdot \text{mol}^{-1}$

Question 47

A mixture of Na_2CO_3 and NaHCO_3 with total mass 21.0 g is gently heated until constant mass. The mass loss is 3.1 g. What was the original mole ratio of Na_2CO_3 to NaHCO_3 ?

- (A) 1 : 2
- (B) 2 : 1
- (C) 1 : 1
- (D) 3 : 1

Question 48

Consider the cell reaction: $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$. In a galvanic cell based on this reaction, which of the following statements is correct?

- (A) Zinc is the cathode and is oxidized
- (B) Electrons flow from Cu electrode to Zn electrode through the external circuit
- (C) In the salt bridge, cations migrate toward the Zn half-cell
- (D) The Cu electrode gains mass as the reaction proceeds

End of Examination — 48 Questions — 60 Minutes — 100 Points

Wild Mock 1 сложнее января на **~25%**. Если январь — это база (термины, простая органика), то март — жесткая аналитика уровня реального **CSC**. В марте многоходовые задачи на смеси, закон Гесса и **pH** вместо счета в одно действие. Теория глубже: механизмы ОВР и гидролиз. Если в январе у тебя **90%**, в марте готовься серьезнее. Это отличный чек-ап перед экзаменом, чтобы не расслабляться на простых пробниках.