


STUDY PACK SAMPLE

Thank you for your trust and support as our very first customers.
— Wang & Guo



Beijing Crossline Edu Tech Co., Ltd.



I. CSCA Syllabus Analysis

Intro.

In this sample, you can see the syllabus breakdowns for three subjects — Mathematics, Physics, and Chemistry. Each breakdown will be sent to your email as part of the corresponding Study Pack in PowerPoint format. The Mathematics file includes 8 slides, Physics 9 slides, and Chemistry 14 slides.

All content is carefully prepared by our instructors based on an in-depth analysis of CSCA exam trends and question difficulty. We hope these materials will help you better understand the exam's structure and focus areas, and study in a more targeted and effective way.



CSCA 考纲拆解 - 数学篇

Mathematics Examination Syllabus Analysis

题目数量 Total Questions

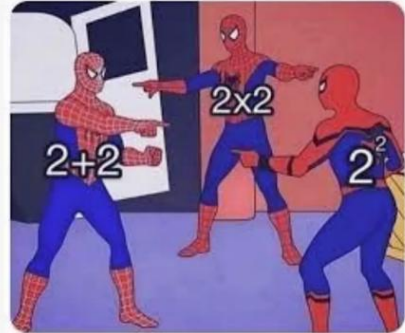
48 MCQs

考试时长 Duration

60 Minutes

总分 Total Score

100



Good luck guys~



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Exam Overview

Overview of Exam Structure and Requirements

Purpose: Assess students' mastery of core mathematical concepts and problem-solving abilities

Question Type: Multiple Choice (4 options)

Duration: 60 minutes

Language: Bilingual (Chinese/English)

Total Questions: 48 Questions

Total Points: 100 Points

Average Time per Question: 1.25 minutes (75 seconds)

Exam Features

The CSCA Mathematics Exam 2025 is designed to **comprehensively assess** students' mathematical abilities, covering four major modules with balanced distribution.

The exam emphasizes **practical application and logical reasoning**, requiring students to not only master basic concepts but also apply them flexibly to solve problems.

The difficulty distribution follows a **40%-30%-30% structure** (Easy-Medium-Complex), ensuring comprehensive evaluation of students at different levels.

All questions must be **original**, with clear labeling of module, difficulty, answer, and explanation.

Difficulty Distribution Analysis

Analysis of Difficulty Distribution Across Modules



Difficulty Structure by Module

Module	Easy	Medium	Complex
Set & Inequality	10 questions	10 questions	10 questions
Function & Sequence	10 questions	10 questions	10 questions
Geometry & Algebra	10 questions	10 questions	10 questions
Probability & Statistics	10 questions	10 questions	10 questions

Difficulty Design Philosophy

Easy Questions (40%) - Focus on basic concepts and their application of formula, ensuring students can demonstrate foundation knowledge.

Medium Questions (30%) - Require integrated reasoning and multi-step problem solving, testing students' ability to connect different concepts.

Complex Questions (30%) - Involve comprehensive analysis and advanced understanding of concepts, challenging high-achieving students.

This 40-30-30 structure ensures comprehensive assessment of students' mathematical skills and problem-solving abilities.

Each module includes some difficulty questions to ensure balanced assessment across all content areas.

Module 1: Sets and Inequalities

Module 1: Sets and Inequalities 8 Questions (17%)

Knowledge Points

Set Operations: Union, intersection, complement, and set equality.

Linear Inequalities: Solving one-variable linear inequalities on the number line.

Quadratic Inequalities: Solving quadratic inequalities by factoring.

Number Requirements

Easy (30%): Basic operations, set relationships, simple linear inequalities.

Medium (30%): Solving quadratic inequalities, set relationships, and linear inequalities.

Complex (30%): Solving quadratic inequalities, set relationships, and linear inequalities.



Module Features

Set and inequality modules account for 17%, serving as the **foundational** part of the exam.

This module emphasizes **logical reasoning** and **problem-solving** skills, testing students' ability to connect different concepts.

Key concepts include **set operations**, **linear inequalities**, and **quadratic inequalities**.

Module 1: Sets & Inequalities 8 Questions (17%)

Module 2: Functions and Sequences

Module 2: Functions and Sequences 10 Questions (21%)

Knowledge Points

Function Properties: Domain, range, monotonicity, odd/even.

Sequence Properties: Arithmetic, geometric, harmonic, and other sequences.

Number Lines: Interval and point-line relationship, greatest lower bound, least upper bound.

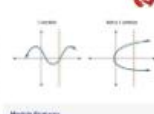
Number Lines: Interval and point-line relationship, greatest lower bound, least upper bound.

Number Requirements

Easy (30%): Basic function properties, simple sequence operations.

Medium (30%): Solving function problems, sequence problems, and number line problems.

Complex (30%): Solving function problems, sequence problems, and number line problems.



Module Features

Function and sequence modules account for 21%, serving as the **largest and most important** part of the exam.

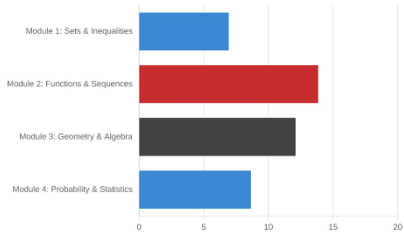
This module emphasizes **logical reasoning** and **problem-solving** skills, testing students' ability to connect different concepts.

Key concepts include **function properties**, **sequence properties**, and **number line problems**.

Module 2: Functions & Sequences 10 Questions (21%)

Four Core Modules Distribution

Distribution of Four Core Modules - Question Count and Percentage



Module Distribution Features

Module 2: Functions & Sequences has the highest proportion at 33%, reflecting its importance in the mathematics curriculum.

Module 3: Geometry & Algebra accounts for 29%, emphasizing spatial thinking and algebraic reasoning.

Module 4: Probability & Statistics accounts for 21%, focusing on data analysis and statistical applications.

Module 1: Sets & Inequalities accounts for 17%, covering foundational concepts.

CSCA 考纲拆解

- 物理篇

Physics Examination Syllabus Analysis

题目数量 Total Questions

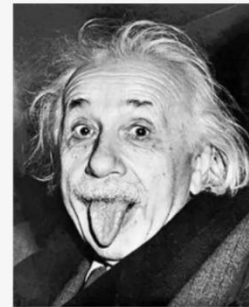
48 MCQs

考试时长 Duration

60 Minutes

总分 Total Score

100



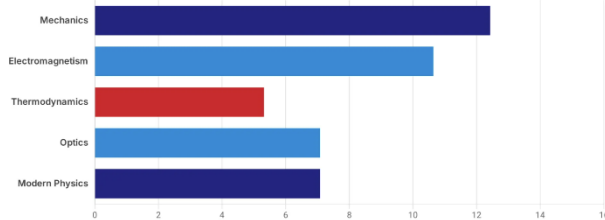
Good luck guys~



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Five Core Modules Distribution

Balanced Coverage Across Five Major Physics Modules



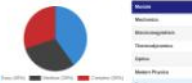
Module Features

Mechanics is the largest module at 29%, serving as the foundation for all physics concepts. **Electromagnetism** follows at 25%, emphasizing circuit analysis and electromagnetic phenomena. The remaining three modules—**Optics** (17%), **Modern Physics** (17%), and **Thermodynamics** (13%)—provide comprehensive coverage of advanced physics topics.

Difficulty Distribution Analysis

Comprehensive Analysis of Question Difficulty Levels

Overall Difficulty Distribution



Module	Easy	Medium	Difficult	Total
Mechanics	5	4	3	12
Electromagnetism	4	4	3	11
Thermodynamics	2	2	1	5
Optics	3	2	2	7
Modern Physics	3	2	2	7
Total	17	16	15	48

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Module 1: Mechanics

Module 1: Mechanics (12 Questions, 29%)

Knowledge Points

- Displacement, velocity, acceleration, position-time graphs
- Newton's laws of motion and applications
- Momentum and impulse
- Work, energy, power, conservation of energy
- Simple harmonic motion
- Spring forces, tension and normal forces
- Projectile motion and vector analysis

Question Requirements

- Class II questions
- High-level questions requiring logical reasoning
- Real-world application questions
- Comprehensive evaluation of students' ability

5

Module 2: Electromagnetism

Module 2: Electromagnetism (11 Questions, 23%)

Knowledge Points

- Electric field, electric field strength, electric potential
- Ohm's law, resistors, circuit analysis
- Magnetic field, magnetic force, Lorentz force
- Electromagnetic induction, Faraday's law
- AC circuits, power, energy

Question Requirements

- Class II questions
- High-level questions requiring logical reasoning
- Real-world application questions
- Comprehensive evaluation of students' ability

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Module 3: Thermodynamics

Module 3: Thermodynamics (5 Questions, 13%)

Knowledge Points

- Temperature, heat, internal energy, conservation of energy
- First law of thermodynamics
- Second law of thermodynamics
- Heat engines, Carnot cycle, efficiency
- Phase changes, latent heat

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Exam Overview

Overview of Exam Structure and Requirements

Purpose:	Assess students' mastery of fundamental physics knowledge and scientific thinking abilities
Question Type:	Multiple Choice (4 options)
Duration:	60 minutes
Language:	Bilingual (Chinese/English)
Total Questions:	48 Questions
Total Points:	100 Points
Average Time per Question:	1.25 minutes (75 seconds)

Exam Features

The CSCA Physics Exam 2025 is designed to **comprehensively assess** students' physics abilities, covering five major modules with balanced distribution.

The exam emphasizes **practical application** and **scientific reasoning**, requiring students to not only master fundamental concepts but also apply them to solve real-world physics problems.

The difficulty distribution follows a **40%-30%-30% structure** (Easy-Medium-Complex), ensuring comprehensive evaluation of students at different levels.

All questions must be **original**, with clear labeling of module, difficulty, answer, and explanation.

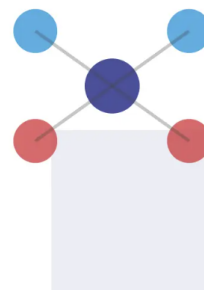
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CSCA Chemistry Exam 2025

Knowledge Distribution & Key Concepts Analysis

48 Multiple Choice Questions | 60 Minutes | 100 Points



Exam Overview

Comprehensive 60-Minute Assessment

Exam Duration

60 minutes

Total Questions

48 questions (all multiple choice)

Total Score

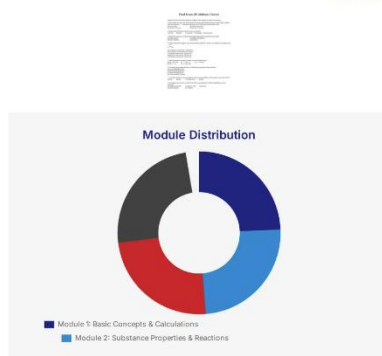
100 points maximum

Average Time per Question

1.25 minutes (75 seconds)

Module Structure

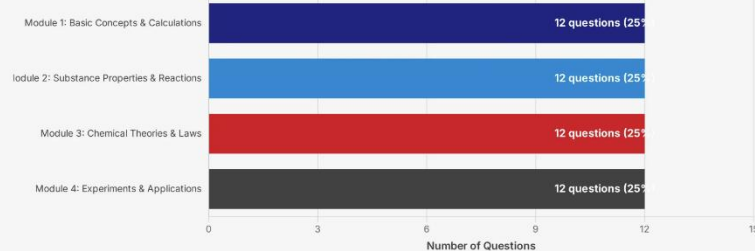
Four main modules with **equal weight distribution** (25% each), ensuring comprehensive evaluation across all fundamental chemistry domains.



Four Main Modules Distribution

The examination employs a **balanced distribution strategy**, allocating exactly **12 questions** to each of the four core modules. This equal weighting ensures comprehensive coverage across all fundamental areas of chemistry.

Balanced Question Allocation Across Core Chemistry Domains



Module 1: Basic Concepts & Calculations (12 questions)



Module 2 & 3 Knowledge Distribution



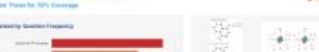
Module 4: Experiments & Applications



Difficulty Distribution Analysis



Top 10 High-Frequency Topics





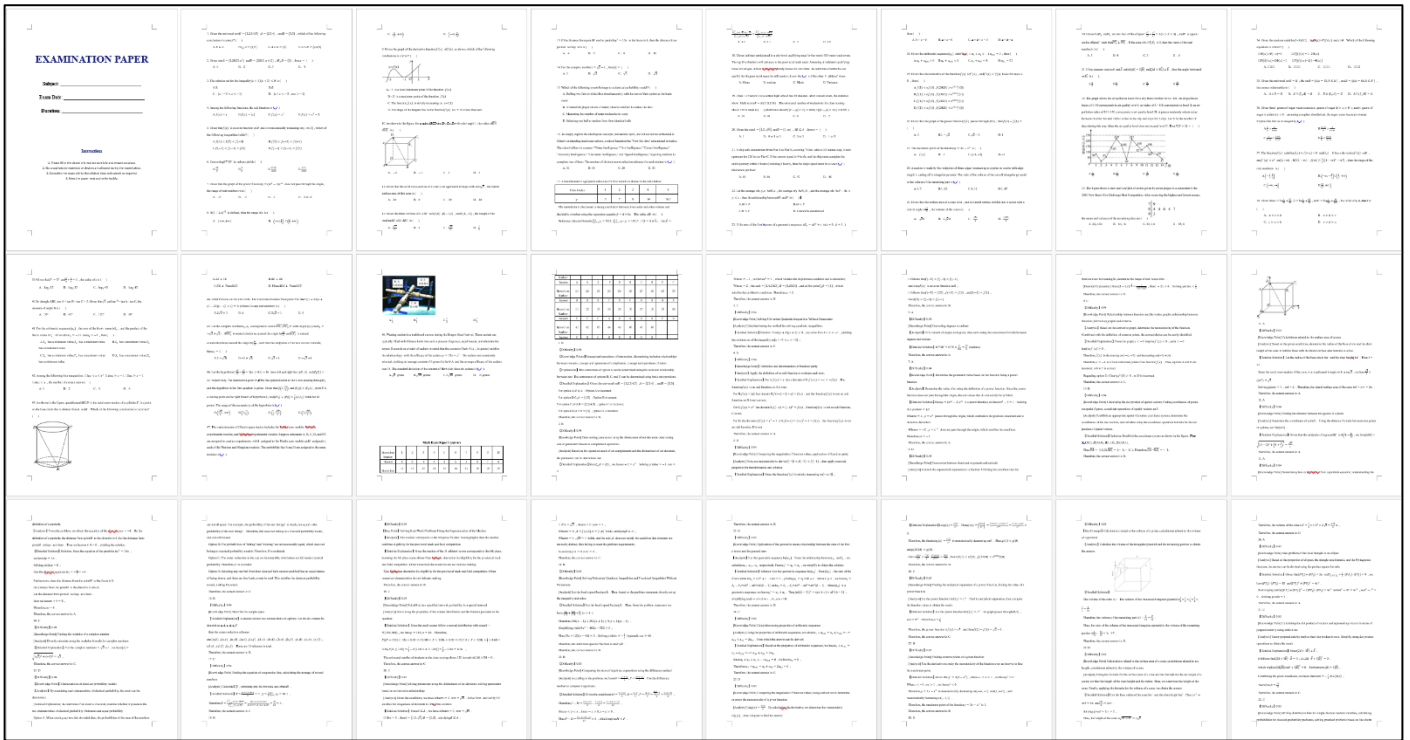
II. Mock Test Papers

Intro.

In this sample, you will see a small selection of our mock exam questions for three subjects — Mathematics, Physics, and Chemistry. All questions are designed by our experienced instructors in strict accordance with the official CSCA syllabus. The papers draw inspiration from exam questions previously used by various Chinese universities for international students, as well as from real problems in the Chinese National College Entrance Examination (Gaokao).

Please note that the mock exams are intentionally set at a slightly higher difficulty level than the actual CSCA exam. This is to help you strengthen your understanding and build solid exam skills. If you can handle these questions with confidence, you're very likely to achieve excellent results in the CSCA exam.





- Mathematic Mock Test Paper Sample
- You will receive **five sets** of such practice tests in one Study Pack. Each test comes with the **answer key and detailed explanations**, including the main knowledge points being tested and the difficulty level of each question.

MATHEMATICS

1. Given the universal set $U = \{1, 2, 3, 4, 5, 6, 7\}$, $A = \{1, 2, 3, 4\}$, and $B = \{3, 4, 5\}$, which of the following conclusions is correct? ()
 A. $B \subseteq A$ B. $C_U A = \{1, 5\}$ C. $A \cup B = \{3\}$ D. $A \cap B = \{2, 4, 5\}$
2. Given sets $A = \{1, 2, 23, a^2\}$ and $B = \{2023, a + 2\}$, if $C_U B = \{1\}$, then $a =$ ()
 A. 1 B. 2 C. 3 D. 4
3. The solution set for the inequality $(x + 1)(x + 3) < 0$ is ()
 A. R B. \emptyset
 C. $\{x | -3 < x < -1\}$ D. $\{x | x < -3 \text{ or } x > -1\}$
4. Among the following functions, the odd function is ()
 A. $f(x) = x$ B. $f(x) = |x|$ C. $f(x) = x^2$ D. $f(x) = x^2 - 1$
5. Given that $f(x)$ is an even function on R and is monotonically increasing on $(-\infty, 0]$, which of the following inequalities holds? ()
 A. $f(1) < f(5) < f(-3)$ B. $f(5) < f(-3) < f(-1)$
 C. $f(-3) < f(-1) < f(5)$ D. $f(-1) < f(-3) < f(5)$
6. Converting $67^\circ 30'$ to radians yields ()
 A. $\frac{23}{8}$

• The questions increase in difficulty step by step — from simple foundational problems to challenging analytical ones, each paper provides full coverage across all levels.

【Difficulty】 0.94

【Knowledge Points】 Concept and operations of intersection, determining inclusion relationships between two sets, concept and operations of complement, concept and operations of union

【Explanation】 The correctness of option A can be determined using the inclusion relationship between sets. The correctness of options B, C, and D can be determined using basic set operations.

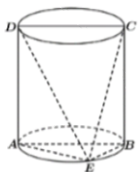
【Detailed Explanation】 Given the universal set $U = \{1, 2, 3, 4, 5\}$, $A = \{2, 3, 4\}$, and $B = \{3, 5\}$.

For option A: $B \not\subseteq A$. Option A is incorrect.

For option B: $C_U A = \{1, 5\}$. Option B is correct.

For option C: $A \cup B = \{2, 3, 4, 5\}$, option C is incorrect;

43. As shown in the figure, quadrilateral $ABCD$ is the axial cross-section of a cylinder. E is a point on the base circle that is distinct from A and B . Which of the following conclusions is incorrect? ()



- A. $AE \perp CE$ B. $BE \perp DE$
 C. $DE \perp$ Plane BCE D. Plane $ADE \perp$ Plane BCE

44. Point P moves on the unit circle. The maximum distance from point P to the line $l: (1 + 3\lambda)x + (1 - 2\lambda)y - (7 + \lambda) = 0$ (where λ is any real number) is ()
 A. $2\sqrt{3} + 1$ B. 6 C. $3\sqrt{2} + 1$ D. 5

45. Let the complex numbers z_1, z_2 correspond to vectors $\vec{OZ_1}, \vec{OZ_2}$ with origin $(0, 0)$ and $z_1 = -\sqrt{2} + \sqrt{2}i$. $\vec{OZ_1}$ is rotated clockwise around the origin by $\frac{3\pi}{4}$ and $\vec{OZ_2}$ is rotated counterclockwise around the origin by $\frac{\pi}{4}$, such that the endpoints of the two vectors coincide, then $z_2 =$ ()
 A. $1 - \sqrt{3}i$ B. $1 + \sqrt{3}i$ C. $\sqrt{3} - i$ D. $\sqrt{3} + i$

【Difficulty】 0.65

【Knowledge Point】 Understanding the definition of a hyperbola; finding the eccentricity or range of eccentricity of a hyperbola

【Analysis】 Substitute $x = c$ into the hyperbola equation to find the y-coordinate of point A. From $|F_2Q| > |F_2A|$, combine b, c with the eccentricity formula to obtain the range. Then, based on the definition of a hyperbola, discuss the case where F_2, P, Q are collinear: $|PF_2| + |PQ|$ achieves its minimum value $|F_2Q|$. Combine this with the range obtained from the eccentricity formula. Finally, from $e > 1$, take the intersection to find the result.

【Detailed Solution】 Solution: Let $x = c$. Substituting into the hyperbola equation yields $y = \pm b \cdot \sqrt{\frac{c^2}{a^2} - 1} = \pm \frac{b^2}{a}$.

From $|F_2Q| > |F_2A|$, we obtain $\frac{b^2}{a} > \frac{a^2}{a}$, which is equivalent to $3a^2 > 2b^2 = 2(c^2 - a^2)$, yielding $e = \frac{c}{a} > \frac{3}{2}$.

Since $|PF_1| + |PQ| > \frac{3}{2}|F_1F_2|$ holds for all values, we only need to find the minimum value of $|PF_1| + |PQ|$.

By the definition of a hyperbola, we have $|PF_1| = 2a + |PF_2|$ and $|F_2Q| = 2c$, which implies $|PF_1| + |PQ| = |PF_2| + |PQ| + 2a$.

When F_2, P, Q are collinear, $|PF_2| + |PQ|$ attains its minimum value $|F_2Q| = \frac{b^2}{a}$, yielding $e < 2a + \frac{b^2}{a}$.

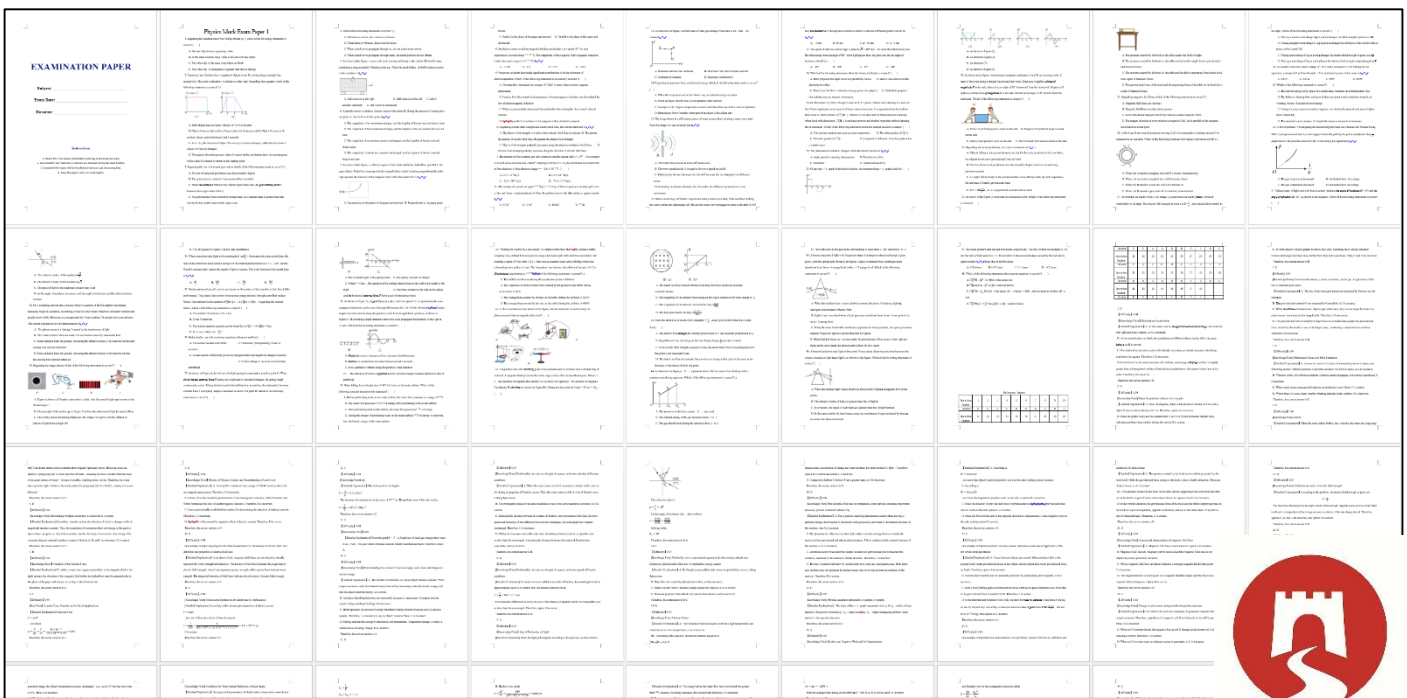
That is, $e = \frac{c}{a} < \frac{5}{2}$. From $e > 1$, combining $\frac{3}{2} < e < \frac{5}{2}$ yields the range of e as $(\frac{3}{2}, \frac{5}{2})$.

• All questions come with detailed step-by-step solutions, so if you get stuck, you can easily review the full explanation.



PHYSICS

- Physics Mock Test Paper Sample
- You will receive **five sets** of such practice tests in one Study Pack. Each test comes with the **answer key and detailed explanations**, including the main knowledge points being tested and the difficulty level of each question.



- Classical mechanics, thermodynamics, electromagnetism, and optics models are all precisely aligned with the key exam topics.

- Don't look at the answers before you start!

noticeable, so D is incorrect.
Therefore, the correct answer is 16. D

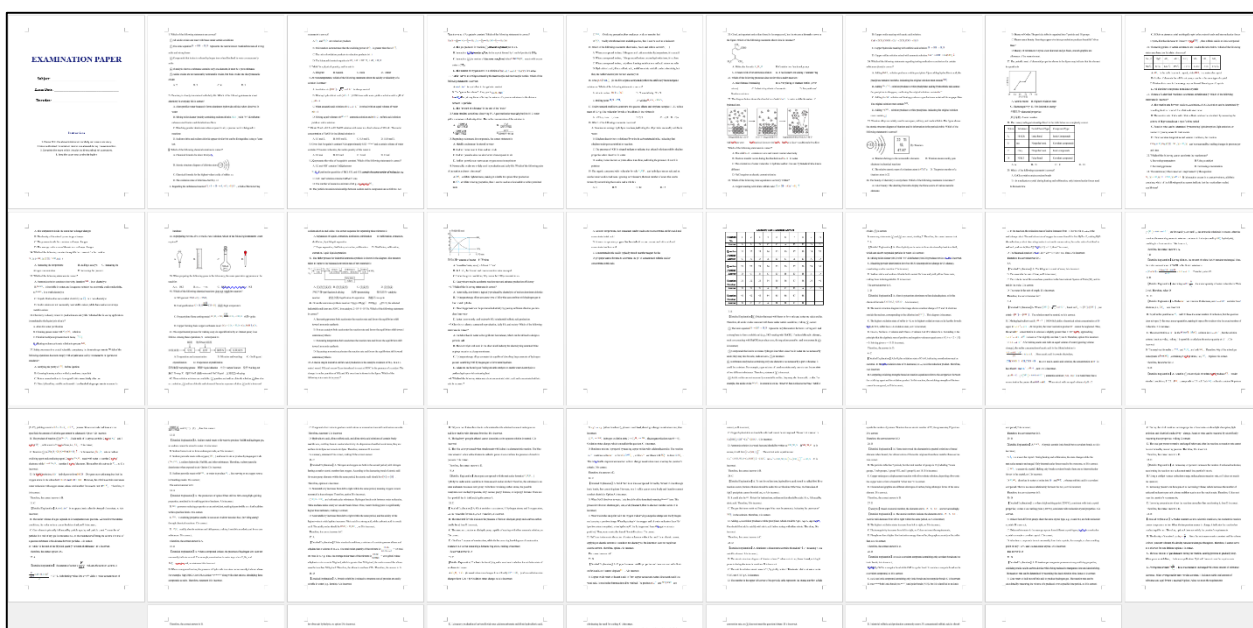
【Difficulty】 0.94
[Knowledge Point] Relationship between wave speed, wavelength, and frequency

[Detailed Explanation] The wavelength λ is approximately equal to $\lambda = \frac{v}{f} = 0.01\text{m} = 1\text{cm}$. For noticeable diffraction, the wavelength must be smaller than the wavelength of the wave. Therefore, the correct answer is 17. A

【Difficulty】 0.94
【Knowledge Point】 Lenz's Law
[Detailed Explanation] L



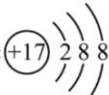
CHEMISTRY



- Chemistry Mock Test Paper Sample
- You will receive **five sets** of such practice tests in one Study Pack. Each test comes with the **answer key** and **detailed explanations**, including the main knowledge points being tested and the difficulty level of each question.

3. Which of the following chemical notations is correct?

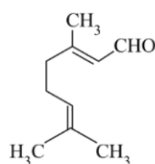
A. Chemical formula for alum: $KAl(SO_4)_6$

B. Atomic structure diagram of chlorine atom: 

C. Chemical formula for the highest-valent oxide of sulfur: SO_2

D. The oxidation state of chlorine in $NaClO_2$: +3

20. Citral, an important antioxidant found in lemongrass oil, has the structural formula shown in the figure. Which of the following statements about citral is incorrect?



A. Molecular formula: $C_{10}H_{16}O$

B. Contains two functional groups

C. It reacts with silver ammonia solution

D. It has isomers containing a benzene ring

- Try our questions and see your score!
- Preparing for the CSCA isn't just about the exam — it helps you learn what Chinese students study and get ready for university life in China.

3. D

【Detailed Explanation】 A. Alum is potassium aluminum sulfate dodecahydrate, with the chemical formula $KAl(SO_4)_2 \cdot 12H_2O$. A is incorrect;

B. The atomic structure diagram in the image shows a nuclear charge of 17 and 18 electrons outside the nucleus, corresponding to the chlorine ion (Cl^-). This diagram is incorrect.

C. The highest oxidation state of sulfur is +6, so its highest-oxidation-state oxide has the formula SO_3 . In SO_2 , sulfur has a +4 oxidation state, so C is incorrect;

D. In $NaClO_2$, Na has a +1 valence and O has a -2 valence. Let Cl's valence be x. According to the principle that the algebraic sum of positive and negative valences equals zero: $(+1) + x - 2 \times (-2) = 0$. Solving gives $x = +3$. D is correct;

Therefore, the answer is: D.

20. D

【Detailed Explanation】

A. Citral contains 10 carbon atoms, 16 hydrogen atoms, and 1 oxygen atom, with the molecular formula $C_{10}H_{16}O$. Therefore, A is correct.

B. The structural formula indicates the presence of both an aldehyde group and a carbon-carbon double bond, thus B is correct;

C. The structure contains an aldehyde group capable of reacting with silver ammonia solution, so C is correct;

D. Citral has 3 degrees of unsaturation, while the benzene ring has 4 degrees of unsaturation.

Therefore, no isomer containing a benzene ring exists, making D incorrect;

The correct answer is D.





III. E-Books & Study Resources

Intro.

In this sample, you will find brief introductions to the textbooks and digital materials we offer. All of these resources — covering a wide range of subjects including Chinese language, Mathematics, Physics, Chemistry, Medicine, Economics, and general introductions to China — have been carefully selected by our team to help you better prepare for your studies and life in China.

The full set of e-books and teaching materials will be delivered to you as a complete package. Although our library is still growing, we are continuously expanding and updating our collection to provide you with more high-quality learning materials in the future. We hope these resources will serve as a valuable companion throughout your journey in China.

Please note that all e-books and materials provided are complimentary resources included in the Study Pack and are not intended for any commercial use.

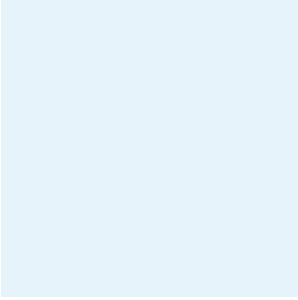


Chinese Title	English Title	Author(s)	Description
科技汉语读写教程	Chinese for Science and Technology: Reading & Writing	Compilation Team of BLCU	Improves reading and writing skills for science and engineering students through academic and technical texts.
科技汉语听说教程	Chinese for Science and Technology: Listening & Speaking	Compilation Team of BLCU	Builds scientific communication skills through lab discussions and academic presentations.
大文科专业汉语 听说教程	Professional Chinese for Humanities and Social Sciences: Listening & Speaking	Compilation Team of BLCU	Develops listening and speaking skills for humanities and social science students.
大文科专业汉语 综合教程（上）	Professional Chinese for Humanities and Social Sciences: Integrated Course (Vol. 1)	Compilation Team of BLCU	Integrates listening, speaking, reading, and writing for humanities majors.
大文科专业汉语 综合教程（下）	Professional Chinese for Humanities and Social Sciences: Integrated Course (Vol. 2)	Compilation Team of BLCU	Continues integrated language training with advanced academic topics.
发展汉语 初级综合 1	Developing Chinese: Elementary Comprehensive (Book 1)	Beijing Language and Culture University Press	A beginner-level textbook focusing on basic grammar and everyday communication.
发展汉语 初级综合 2	Developing Chinese: Elementary Comprehensive (Book 2)	Beijing Language and Culture University Press	Expands vocabulary and grammar for practical daily communication.
发展汉语 高级综合 1	Developing Chinese: Advanced Comprehensive (Book 1)	Beijing Language and Culture University Press	Enhances advanced reading, writing, and discussion abilities.
How Chinese Learn Mathematics: Perspectives from Insiders	How Chinese Learn Mathematics: Perspectives from Insiders	Fan Lianghuo (Ed.)	Explores Chinese students' learning methods and cultural influences in math education.
数学 精讲精练	Mathematics: Intensive Lecture and Practice	Zhao Meiwei, Shao Linlin, Wang Guang	Focuses on key concepts and problem-solving through detailed explanations and exercises.
物理 精讲精练	Physics: Intensive Lecture and Practice	Zhang Di, Jia Yan	Summarizes key physics knowledge and provides targeted exercises for exam preparation.
化学 精讲精练	Chemistry: Intensive Lecture and Practice	Qiao Mengyu, Zhang Shi	Covers essential chemical principles with structured lectures and practices.
物理（第2版）	Physics (2nd Edition)	Zhang Di	Comprehensive university-level physics covering mechanics, electromagnetism, and optics.
Teaching Physics through Ancient Chinese Science and Technology	Teaching Physics through Ancient Chinese Science and Technology	Zhang Di	Links modern physics with examples from ancient Chinese inventions.



中医汉语综合教程	Chinese for Traditional Chinese Medicine: Integrated Course	Compilation Team of BLCU	Introduces core TCM vocabulary and expressions for medical study.
中医基础字词一点通	Chinese for Traditional Chinese Medicine: Basic Characters and Terms	Compilation Team of BLCU	Teaches essential TCM terms and characters for beginners.
西医汉语读写教程	Chinese for Western Medicine: Reading & Writing	Compilation Team of BLCU	Trains reading and writing for medical reports and academic papers.
西医汉语听说教程	Chinese for Western Medicine: Listening & Speaking	Compilation Team of BLCU	Builds listening and speaking skills for clinical and academic settings.
经贸汉语阅读教程	Business Chinese Reading (2nd Edition)	Compilation Team of BLCU	Strengthens reading comprehension in business, trade, and economics.
中国概况（第2版）	China Overview (2nd Edition)	Compilation Team of BLCU	Provides an overview of China's geography, culture, economy, and society.
...			





IV. Formula Sheet & Knowledge Base

Intro.

In this sample, you will also find the **Knowledge Base & Formula Sheet** for the three subjects — Mathematics, Physics, and Chemistry. Each sheet includes all the essential formulas and key concepts you'll need for the CSCA exam.

As Chinese exams often involve extensive formula application, mastering these formulas is absolutely crucial. Our instructors have compiled and organized them clearly to help you quickly review, memorize, and apply them with confidence during the test.



Math Knowledge Base

◆ PART 1: FUNDAMENTAL CONCEPTS, DEFINITIONS & ESSENTIAL I

1.1 Sets, Logic & Basic Counting

- Definitions
 - Set, element: $a \in A, a \notin A$.
 - Subset, proper subset: $A \subseteq B, A \subset B$.
 - Union, intersection, complement
 - Empty set
- Operations
 - $p = mv$; impulse $J = \Delta p$
 - Conservation of momentum

1.2 Functions: Definition

Definition: $f: D \rightarrow R$

One-to-one, onto

Even/odd: $f(-x) = \pm f(x)$

Composition: $(f \circ g)(x) = f(g(x))$

Common elements

Power: x^n ($n \in \mathbb{Z}$)

Exponential: a^x

Logarithm: $\log_a x$

Trigonometric

Limits and continuity

limit as $x \rightarrow a$

Squeeze theorem

Monotonicity and boundedness

Sequences & Series

Sequences: $\{a_n\}$

Arithmetic sequence

Geometric sequence

converges $\leftrightarrow |r| < 1$

Common series

Derivatives (basic)

Definition: $f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$

Basic rules:

Power rule: $d/dx x^n = nx^{n-1}$

Constant multiple rule: $d/dx (c \cdot f(x)) = c \cdot f'(x)$

Product rule: $d/dx (f(x) \cdot g(x)) = f'(x) \cdot g(x) + f(x) \cdot g'(x)$

Quotient rule: $(u/v)' = (u'v - uv')/v^2$

Chain rule: $d/dx f(g(x)) = f'(g(x)) \cdot g'(x)$

Physics Knowledge

◆ PART 1: FUNDAMENTAL CONCEPTS, DEFINITIONS & ESSENTIAL I

1.1 Physical Constants & Units (SI)

- Speed of light: $c = 2.997\,924\,58 \times 10^8 \text{ m/s}$
- Gravitational constant: $G = 6.674\,30 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$
- Planck's constant: $h = 6.626\,070\,15 \times 10^{-34} \text{ J}\cdot\text{s}$
- Reduced Planck's constant: $\hbar = h/(2\pi)$
- Elementary charge: $e = 1.602\,176\,634 \times 10^{-19} \text{ C}$
- Mass of electron: $m_e = 9.109\,383\,7015 \times 10^{-31} \text{ kg}$
- Permittivity of free space: $\epsilon_0 = 8.854\,187 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
- Permeability of free space: $\mu_0 = 4\pi \times 10^{-7} \text{ N A}^{-2}$
- Standard g (nominal): $g = 9.80665 \text{ m}\cdot\text{s}^{-2}$

1.2 Mechanics — Kinematics & Dynamics

- Kinematic equations (constant acceleration)
 - $v = u + at$
 - $s = ut + \frac{1}{2}at^2$
 - $v^2 = u^2 + 2as$
- Projectile motion: horizontal & vertical components (for flat ground).
- Newton's laws:
 - 1st: inertia; 2nd: $F_{\text{net}} = ma$; 3rd: action-reaction
- Work and energy:
 - Work: $W = \int \mathbf{F} \cdot d\mathbf{s}$; for constant \mathbf{F} parallel to $d\mathbf{s}$: $W = F \cdot s$
 - Kinetic energy: $K = \frac{1}{2}mv^2$
 - Potential energy (gravity near Earth): $U = mgh$
 - Work-energy theorem: $W_{\text{net}} = \Delta K$
 - Conservation of mechanical energy (if no non-conservative forces): $K + U = \text{constant}$
- Momentum and impulse:
 - Momentum: $\mathbf{p} = m\mathbf{v}$
 - Impulse: $\mathbf{J} = \Delta \mathbf{p}$

$$T(\text{K}) = t(^{\circ}\text{C}) + 273.15$$

Gas Density Ratio:

$$\rho = M_1/M_2 = \rho_1/\rho_2 \quad (\text{at same } T \text{ and } P)$$

◆ PART 2: SUBSTANCE PROPERTIES & CLASSIFICATION

1.1 Classification of Substances (物质分类)

Key Categories:

Chemistry Knowledge

◆ PART 1: FUNDAMENTAL CONCEPTS & CLASSIFICATION

1.1 Amount of Substance (物质的量)

Definitions:

Symbol	Definition
n	Amount of substance (mol)
N_A	Avogadro's constant
M	Molar mass
V_m	Molar volume

$$c = n/V \quad (\text{mol/L})$$

$$[\text{OH}^-] = 10^{-\text{pOH}} \text{ mol/L}$$

$$K_w = 1.0 \times 10^{-14} \quad (\text{at } 25^{\circ}\text{C})$$

at 25°C

pH:

Substance	Formula
acid	$\text{pH} = -\lg(c_{\text{acid}})$
base	$\text{pOH} = -\lg(c_{\text{base}})$, then $\text{pH} = 14 - \text{pOH}$

Formulas:

$$c_{\text{acid}} = (c_{\text{acid}} - c_{\text{base}} - V_{\text{base}})/(V_{\text{total}})$$

$$c_{\text{base}} = (c_{\text{base}} - c_{\text{acid}} - V_{\text{acid}})/(V_{\text{total}})$$

(理想气体定律)

$$PV = nRT$$

where P is pressure, V is volume, n is amount of substance, R is the gas constant, and T is temperature.

$$c = n/V$$

$$M = m/n$$

$$V_m = V/n$$

$$c = n/V = (m/M)/V = \rho/M$$

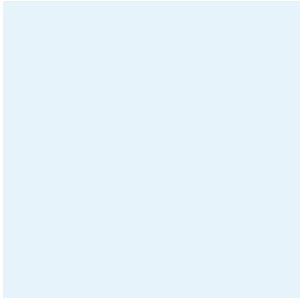
$$c = \rho/M$$

$$c = \rho/M$$

$$c = \rho/M$$

$$c = \rho/M$$





**Good luck
and see
you in
China!**

Please feel free to contact us if you have any questions, and stay tuned on Discord for our latest updates.

- Wang & Guo



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