

## **THEORY QUESTIONS – CIE AND SEE**

### **Mathematics in IKS**

1. Discuss the development of mathematics in the Indian Knowledge System from the Vedic period to the Kerala School, highlighting key contributions and their global impact.
  2. Explain the major features, methods, and applications of arithmetic in ancient India. How did they influence the evolution of modern mathematics?
  3. Describe the fundamental concepts and contributions of Indian geometry. Illustrate its applications in architecture, astronomy, and town planning.
  4. Examine the development of trigonometry in ancient India, emphasizing key mathematicians, computational techniques, and their significance in astronomy.
  5. Elaborate on the major contributions of Indian algebra, focusing on the works of Āryabhaṭa, Brahmagupta, and Bhāskara II, and their impact on global mathematical traditions.
  6. Explain Piṅgala's Chanda Sāstra as an early text on binary mathematics and combinatorics. Discuss its principles, algorithms, and relevance to modern computing.
- 

### **Astronomy and Calendar Science**

7. Discuss the scientific basis, structure, and significance of the Indian calendar (Pañchāṅga). Explain its components and applications in various fields.
  8. Describe the main ideas presented in Āryabhaṭīya and analyze their significance in transforming ancient Indian astronomy into a mathematical science.
  9. Explain the concept of yugas and time cycles in Indian astronomy. How were solar and lunar years synchronized in the calendar system?
  10. Discuss the design, purpose, and importance of astronomical instruments (yantras) in ancient Indian astronomy. How did they contribute to observational accuracy and timekeeping?
- 

### **Engineering and Technology**

11. Discuss the development of metallurgy and metalworking technology in ancient India. Explain the processes, techniques, and scientific principles involved.

12. Write an essay on Wootz steel – its origin, properties, production process, global significance, and reasons for decline.
13. Examine the history, production techniques, and significance of iron and steel in ancient India with reference to key artifacts such as the Delhi Iron Pillar.
14. Describe the lost-wax casting technique in detail. Explain its steps, materials used, applications, and cultural importance.
15. Discuss the sources, techniques, chemical principles, and applications of dyeing and painting technology in ancient India.
16. Explain the art of perfume-making in ancient India, focusing on the scientific techniques, cultural significance, therapeutic uses, and global legacy of Indian perfumery.

## **QUIZ MATERIAL** (Reference purpose only- Use Notes as primary and ultimate source)

### **1-Mark Questions (35 Questions)**

1. **Q:** What does the art of perfume-making in ancient India represent?  
**A:** A harmonious blend of science, art, and culture.
2. **Q:** What were perfumes used for besides luxury in ancient India?  
**A:** Therapeutic and sacred purposes.
3. **Q:** Which key scientific skill was mastered in ancient perfumery?  
**A:** Extraction of aromatic compounds.
4. **Q:** What process ensured the longevity of perfumes in ancient India?  
**A:** Preservation techniques.
5. **Q:** What does the blending of perfumes involve?  
**A:** Combining different aromatic substances to create complex fragrances.
6. **Q:** What aspect of Indian perfumery influenced the world?  
**A:** Its scientific sophistication and unique fragrance-making techniques.
7. **Q:** In addition to art and culture, which field was central to ancient perfume-making?  
**A:** Science and chemistry.
8. **Q:** What is one reason perfumes were considered sacred in ancient India?  
**A:** They were used in rituals and spiritual practices.
9. **Q:** How does ancient Indian perfumery survive today?  
**A:** Through the modern natural perfume industry.
10. **Q:** What does mastery of extraction techniques show about ancient Indians?  
**A:** Advanced knowledge of plant materials and volatile compounds.
11. **Q:** Which natural materials were primarily used in ancient perfumery?  
**A:** Flowers, herbs, resins, and essential oils.
12. **Q:** What did perfumes symbolize in spiritual rituals?  
**A:** Purity and divine presence.
13. **Q:** What type of knowledge was necessary for effective blending?  
**A:** Chemical compatibility of fragrance components.
14. **Q:** What was a cultural use of perfumes in daily life?  
**A:** Personal adornment and body fragrance.
15. **Q:** Which ancient Indian tradition widely used perfumes?  
**A:** Ayurveda and ritual ceremonies.
16. **Q:** What is the term for combining multiple aromatic extracts into one fragrance?  
**A:** Blending.

17. **Q:** What role did preservation play in ancient perfume-making?  
**A:** It ensured perfumes remained effective and stable over time.
18. **Q:** Which regions were influenced by Indian perfumery through trade?  
**A:** Middle East and Europe.
19. **Q:** Why were Indian perfumes highly valued globally?  
**A:** For their quality, therapeutic value, and sacred significance.
20. **Q:** What does the continuation of natural perfumery traditions show?  
**A:** The lasting legacy of ancient Indian technology.
21. **Q:** What is the cultural importance of perfumes in ancient India?  
**A:** They were integral to rituals, festivals, and daily customs.
22. **Q:** What type of benefits did many ancient perfumes have?  
**A:** Medicinal and therapeutic benefits.
23. **Q:** What does the sophistication of ancient perfumery reveal about Indian science?  
**A:** A deep understanding of natural chemistry.
24. **Q:** What made Indian perfumes unique compared to others?  
**A:** Their combination of science, spirituality, and aesthetics.
25. **Q:** How were perfumes linked to social status in ancient India?  
**A:** They symbolized luxury and refinement among elites.
26. **Q:** What was one reason Indian perfumery spread globally?  
**A:** Trade of aromatic materials and knowledge.
27. **Q:** How did perfumes contribute to well-being?  
**A:** Through aromatherapy and healing properties.
28. **Q:** What does the sacred use of perfumes highlight about ancient Indian culture?  
**A:** Its integration of science and spirituality.
29. **Q:** What modern industry continues ancient Indian perfumery practices?  
**A:** Natural fragrance and essential oil industries.
30. **Q:** Which art form was closely connected with perfumery in ancient India?  
**A:** Ritual and ceremonial arts.
31. **Q:** What quality made ancient Indian perfumes desirable in foreign markets?  
**A:** Their complexity and natural origins.
32. **Q:** What type of knowledge was needed for perfume preservation?  
**A:** Knowledge of natural stabilizers and storage conditions.
33. **Q:** Which branch of knowledge often incorporated perfumery for healing?  
**A:** Ayurveda.
34. **Q:** What does the global adoption of Indian perfumery techniques indicate?  
**A:** India's historical leadership in aromatic sciences.

35. **Q:** What does the survival of ancient perfume-making practices reflect?

**A:** The timelessness and scientific depth of Indian traditions.

---

## 2-Mark Questions (15 Questions)

1. **Q:** Explain how perfume-making in ancient India combined science, art, and culture.

**A:** It used scientific methods like extraction and preservation, artistic blending of scents, and deep cultural symbolism in rituals and daily life, showing a holistic approach to technology.

2. **Q:** Discuss the therapeutic significance of perfumes in ancient India.

**A:** Perfumes were used in Ayurveda and aromatherapy to promote health, balance moods, and support healing, showing their medicinal importance beyond luxury.

3. **Q:** How did ancient Indian perfumery influence global fragrance traditions?

**A:** Through trade and cultural exchange, Indian techniques and materials shaped Middle Eastern and European perfumery, laying foundations for modern fragrance science.

4. **Q:** Describe the role of perfumes in sacred and ritual practices.

**A:** Perfumes symbolized purity, were offered to deities, used in temple rituals, and marked auspicious occasions, highlighting their sacred and spiritual role.

5. **Q:** What does mastery of extraction techniques reveal about ancient Indian science?

**A:** It reflects advanced knowledge of plant chemistry, volatile oils, and natural distillation processes.

6. **Q:** Explain the importance of blending in perfume-making.

**A:** Blending allowed the creation of complex, harmonious fragrances by combining various natural extracts, demonstrating skill in chemistry and aesthetics.

7. **Q:** How did preservation techniques contribute to the quality of perfumes?

**A:** They maintained fragrance stability, prevented spoilage, and ensured longevity, reflecting scientific understanding of storage and material interactions.

8. **Q:** Discuss the role of perfumery in ancient Indian social and cultural life.

**A:** Perfumes were used in daily grooming, hospitality, religious ceremonies, and royal courts, reflecting luxury, devotion, and refinement.

9. **Q:** In what ways were perfumes both luxurious and sacred in ancient India?

**A:** They were prized for personal adornment and status, while also used in temples and rituals, blending material luxury with spiritual significance.

10. **Q:** What impact did Indian perfumery have on modern natural perfume industries?

**A:** Ancient methods and materials form the basis of today's essential oil and natural fragrance industries, showing continuity of traditional knowledge.

11. **Q:** Why were Indian perfumes globally admired in ancient times?

**A:** For their natural origins, therapeutic properties, and intricate blends, which surpassed contemporary techniques elsewhere.

12. **Q:** How did perfumery reflect India's scientific sophistication?  
**A:** It integrated botanical knowledge, chemical processes, and material science long before modern chemistry emerged.
13. **Q:** Explain how perfumery illustrates the integration of science and spirituality.  
**A:** Scientific extraction and blending produced scents that carried deep ritual meaning, showing how knowledge served both material and spiritual purposes.
14. **Q:** What does the continuity of ancient perfumery practices indicate about Indian knowledge systems?  
**A:** It highlights their adaptability, depth, and enduring relevance in both traditional and modern contexts.
15. **Q:** Summarize the legacy of ancient Indian perfumery.  
**A:** It influenced global fragrance traditions, laid the foundations for natural perfumery, and continues to inspire modern industries with its scientific, cultural, and aesthetic depth.

### **Mathematics in IKS**

#### **Arithmetic – 1 Mark**

1. Sanskrit term for “science of computation” – **Gaṇita**
2. A key feature of Indian arithmetic – **Algorithmic and sūtra-based methods**
3. System that transformed global mathematics – **Decimal place-value system with zero (śūnya)**
4. Who formalized operations with zero and negative numbers – **Brahmagupta**
5. Major application of arithmetic in ancient India – **Astronomy and commerce**

#### **Arithmetic – 2 Marks**

1. State two reasons arithmetic was central in IKS – **Astronomy calculations; commerce and accounting**
2. Mention two operations Brahmagupta formalized beyond positive numbers – **Zero and negative numbers (debt and fortune rules)**

---

### **Geometry – 1 Mark**

1. Sanskrit name for geometry – **Rekha-gaṇita**
2. Vedic source with right-angle and diagonal rules – **Śulba Sūtras**
3. Author of the earliest Pythagorean theorem statement – **Baudhāyana**
4. Measurement tool used in geometry and astronomy – **Śaṅku (gnomon)**

#### **Geometry – 2 Marks**

1. State two uses of geometric transformations in IKS – **Equal-area figure conversion; altar and temple layout**
  2. Name two approximations known to Indian geometers –  $\sqrt{2}$  from Śulba Sūtras;  $\pi$  refined up to 11 decimals by Mādhava
- 

#### **Trigonometry – 1 Mark**

1. Sanskrit term for trigonometry – **Jyotpatti**
2. Key shift made by Indian mathematicians – **Chord to half-chord (sine)**
3. Mathematician who prepared the first sine tables – **Āryabhaṭa**

#### **Trigonometry – 2 Marks**

1. Name two computational methods used in IKS trigonometry – **Recursive differences; finite-difference corrections**
  2. Mention two applications of trigonometry – **Eclipse prediction; height and distance calculation using shadow geometry**
- 

#### **Algebra – 1 Mark**

1. Literal meaning of Bījagaṇita – **Science of seeds (unknowns)**
2. Method used by Āryabhaṭa for solving  $ax + c = by$  – **Kuṭṭaka (pulverizer) method**
3. Algorithm used by Bhāskara II for Pell-type equations – **Chakravāla method**

#### **Algebra – 2 Marks**

1. Two features that distinguish Indian algebra – **Algorithmic nature; use of zero and negative numbers with defined rules**
  2. Two types of equations solved by Indian mathematicians – **Quadratic equations; indeterminate equations**
- 

#### **Piṅgala's Chanda Śāstra – 1 Mark**

1. Field and mathematical concept introduced – **Prosody with early binary mathematics and combinatorics**
2. Binary representation: Guru = 1, Laghu = 0
3. Total patterns for n syllables –  $2^n$

#### **Piṅgala – 2 Marks**

1. Name two algorithms described by Piṅgala – **Prastāra (enumeration); Naṣṭa and Uddiṣṭa (encoding and decoding)**

2. Mention two wider mathematical influences of Piṅgala's work – **Binomial coefficients and Pascal-like triangle; binary encoding logic**
- 

## **Astronomy**

### **Elements of the Indian Calendar – 1 Mark**

1. Basis of Sāvāna year – **Time between two sunrises (366 days)**
2. Length of Saurā (solar) year – **365.2564 days**
3. Purpose of adhika māsa – **Synchronize lunar and solar years**

### **Calendar – 2 Marks**

1. Difference between Saurā and Cāndra years – **Solar year based on Sun's revolution (~365.25 days); Lunar year based on Moon's revolution (~354.36 days)**
  2. Define tithi – **Time for the Sun-Moon angular distance to increase by 12°; 30 tithis per lunar month**
- 

### **Āryabhaṭīya and Siddhāntic Tradition – 1 Mark**

1. Āryabhaṭa's explanation of day and night – **Earth's rotation on its axis**
2. Total number of sections in Āryabhaṭīya – **4 (Gītikā, Gaṇita, Kālakriyā, Gola)**
3. Cause of eclipses according to Āryabhaṭa – **Shadows of Earth and Moon**

### **Āryabhaṭīya – 2 Marks**

1. Two planetary corrections introduced – **Manda-saṃskāra and Śīghra-saṃskāra**
  2. Mention two legacies of Āryabhaṭīya – **Introduction of sine function; foundation for later Siddhāntas**
- 

### **Pañchāṅga – 1 Mark**

1. Five limbs of Pañchāṅga – **Tithi, Vāra, Nakṣatra, Yoga, Karaṇa**
2. Value of a Karaṇa – **Half of a tithi (6° separation)**
3. Basis of Vāra naming – **Planetary association with weekdays**

### **Pañchāṅga – 2 Marks**

1. Two uses of Pañchāṅga – **Fixing dates for festivals; selecting auspicious times (muhūrtas)**
2. Name two types of calendars used in India – **Solar (Sauramāna); Lunar (Chāndramāna)**



---

### **Yantras and Jyotiṣa – 1 Mark**

1. Simple instrument for shadow-based measurements – **Śaṅku (gnomon)**
2. Instrument representing the celestial sphere – **Gola Yantra**
3. Water clock used for time measurement – **Ghati Yantra**

### **Yantras and Jyotiṣa – 2 Marks**

1. Two roles of Jyotiṣa in ancient India – **Calendar construction and timekeeping; agricultural and ritual timing**
  2. Two reasons Jantar Mantar observatories were important – **Precise angular measurements; prediction of eclipses and solstices**
- 

## **Engineering & Technology**

### **Metals and Metalworking – 1 Mark**

1. Early technique to crack ore-bearing rock – **Fire-setting**
2. Metal first produced by downward distillation – **Zinc (at Zawar)**
3. Approximate maximum temperature of ancient furnaces – **1400 °C**

### **Metals and Metalworking – 2 Marks**

1. Name two copper alloys and one use each – **Bronze – tools and idols; Brass – utensils and lamps**
  2. Mention two key steps in mining and ore extraction – **Roasting; smelting with charcoal and flux**
- 

### **Wootz Steel – 1 Mark**

1. Type of steel produced by crucible process – **Wootz steel (high-carbon steel)**
2. Carbon percentage range of Wootz steel – **1–1.5%**
3. Famous use of Wootz steel abroad – **Damascus swords**

### **Wootz Steel – 2 Marks**

1. Two factors that led to its decline – **Colonial taxation and policies; European industrial steel**
  2. Two points of modern relevance – **Precursor to modern high-carbon steels; inspired materials science research**
-

### **Iron and Steel in India – 1 Mark**

1. Example of corrosion-resistant iron structure – **Delhi Iron Pillar**
2. Earliest evidence of iron use in India – **1200 BCE**
3. Text mentioning surgical steel instruments – **Suśruta Saṃhitā**

### **Iron and Steel – 2 Marks**

1. Two reasons for the rust resistance of Delhi Iron Pillar – **Low phosphorus content; passive iron-hydrogen-phosphate layer**
  2. Two application domains for iron and steel – **Architecture; agriculture**
- 

### **Lost-Wax Casting – 1 Mark**

1. Indian name for lost-wax casting – **Madhucchiṣṭa Vidhāna**
2. Composition of Pañcaloha alloy – **Gold, silver, copper, tin, zinc**
3. Famous example of lost-wax bronze art – **Chola bronzes (e.g., Nataraja)**

### **Lost-Wax Casting – 2 Marks**

1. Mention two steps in the lost-wax casting process – **Dewaxing heated mould; pouring molten alloy and breaking mould**
  2. State two characteristics of lost-wax casting – **Unique one-time casts; highly detailed complex forms**
- 

### **Dyes and Painting Technology – 1 Mark**

1. Plant source of blue dye – **Indigo (*Indigofera tinctoria*)**
2. Example of a mordant – **Alum**
3. Mineral source of green pigment – **Malachite**

### **Dyes and Painting – 2 Marks**

1. Name two dyeing techniques – **Mordant dyeing; resist dyeing (e.g., Bandhani, Ikat)**
  2. Mention two scientific principles used in ancient dyeing – **Redox reactions in indigo dyeing; metal–dye complex formation**
- 

### **The Art of Making Perfumes – 1 Mark**

1. Three key aspects of ancient Indian perfumery – **Extraction, blending, preservation**
2. Two non-luxury uses of perfumes – **Therapeutic and sacred purposes**

3. Continuation of ancient perfumery today – **Modern natural perfume industry**

**The Art of Making Perfumes – 2 Marks**

1. Mention two ways ancient Indian perfumery shows scientific depth – **Mastery of extraction techniques; understanding of preservation and stability**
2. State two ways Indian perfumery influenced global traditions – **Techniques transmitted through trade; shaped Middle Eastern and European fragrance practices**