

FIITJEE INTERNAL TEST SIMULATION TEST

for

NTSE STAGE – I

(All Class X Batches)

Scholastic Aptitude Test (SAT)

QP CODE:

Time: 120 Minutes

Maximum Marks: 100

Please read the instructions carefully.

INSTRUCTIONS

- A: The question paper consists of **100** multiple choice questions divided into five sections.
Section – I contains **40** questions of **SST**.
Section – II contains **20** questions of **Mathematics**.
Section – III contains **13** questions of **Physics**.
Section – IV contains **13** questions of **Chemistry**.
Section – V contains **14** questions of **Biology**.
- For each question you will be **awarded 1 mark** if you darken the bubble corresponding to the correct answer and zero mark if no bubbles is darkened or your response is incorrect.
- Attempt **All** questions.
- Use of Calculator is **NOT PERMITTED**.
- All symbols have their usual meanings, if not mentioned in the question.
- The Question Paper contains blank spaces for your rough work.
No additional sheets will be provided for rough work.
- This booklet also contains **OMR** answer sheet.

Enrollment No. : Batch : _____

Name : _____

Candidate's Signature _____ Invigilator's Signature: _____

Section – I
Social Science
(1 – 40)

1. Choose the correct response from the given options.
Many within the Congress were initially opposed to the idea of non – cooperation because
(A) They did not think that British rule in India would collapse if Indians refused to cooperate
(B) They were not yet sure of Gandhiji’s ability to successfully lead a nationwide movement
(C) They were reluctant to boycott the council election scheduled for November 1920
(D) They did not agree with Gandhiji’s proposal to carry the movement forward in stages.
1. C
2. In late 19th and early 20th centuries, nationalism captured the imagination of the Indian people through a variety of cultural processes. Which of the following was not a part of those processes?
(A) Rewriting history to show India’s continuous progress from the ancient to the modern times
(B) Creation of different images of Bharat Mata
(C) Recording, collection and publication of folk tales and folk songs
(D) Designing flags as inspiring symbols of nationalism
2. A
3. Which of the following statements about the Non-cooperation Movement are correct?
I. The Justice Party participated in the elections in Madras.
II. The nationalist lawyers did not join back the courts.
III. The taluqdars were targeted.
IV. The import of foreign cloth declined and the export of Indian textiles increased manifold.
A. I and III
B. I and IV
C. I, II and III
D. II, III and IV
3. A
4. **Assertion(A):** Mahatma Gandhi called off the Civil Disobedience Movement and entered into a pact with Irwin in 1931.
Reason(R): Industrial workers in Sholapur attacked structure that symbolized British rule
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is not the correct explanation of A
(C) A is true and R is false
(D) A is false and R is true
4. B
5. **Assertion (A):** In the mid – 1840s hundreds of thousands died of starvation in Ireland
Reason (R): The disease destroyed the wheat
(A) Both (A) and (R) are correct and (R) explains (A)
(B) Both (A) and (R) are correct but (R) does not explain (A)
(C) Only (A) is correct
(D) Only (R) is correct
5. C
6. What according to Henry Ford was the ‘best cost cutting decision’?
(A) to cut the wages of the workers
(B) not to give overtime
(C) not to give off day in the week
(D) to inspire the workers to work harder by giving them double of their daily wage
6. D

7. Which of the following statements regarding the Silk Routes are correct?
 I. They also meant cultural links.
 II. They spread over land and by sea.
 III. They connected Asia with Europe and Africa.
 IV. Besides textiles, gold and silver got exported from Asia to Europe through these routes.
 (A) I, II and III (B) I, II and IV
 (C) II, III and IV (D) I, II, III and IV
7. **A**
8. **Assertion (A)** : In the 17th and 18 Century merchants from the towns in Europe started financing peasants and artisans in the country side for production for them.
Reason (R) : In the urban centres powerful crafts and trade guilds with monopoly rights restricted the entry of new people into the trade.
 (A) Both A and R are true and R is the correct explanation of A
 (B) Both A and R are true but R is not the correct explanation of A
 (C) A is true and R is false
 (D) A is false and R is true
8. **A**
9. "During the First World War years, industrial production in India boomed." Which of the following is an appropriate reason for the same?
 (A) Manchester's imports into India declined as British mills were busy with war production.
 (B) Indian industries were called upon to supply war needs
 (C) Indian producers were asked by Germany to produce for them.
 (D) Indian producers got orders from the United States.
- (A) only A and B (B) only B and C
 (C) only C and D (D) All of the above
9. **A**
10. **Assertion (A)**: During eighteenth century France witnessed the emergence of a middle class.
Reason (R): The emergence of the middle class happened on account of royal patronage.
 (A) A is true, R is false
 (B) A is false, R is true
 (C) Both A and R are true but R is not the correct explanation of A.
 (D) Both A and R are true and R is the correct explanation of A
10. **A**
11. Who said:-
 "Shameless are those woman, who wish to become man, have not duties been fairly distributed"
 (A) George Danton (B) Chaumelte
 (C) Robespierre (D) Belly
11. **B**
12. The Paris Commune of 1871 is also popularly remembered for two important legacies. What are these legacies?
 (A) Liberty and equality
 (B) Red flag and Marsoilaise
 (C) Red Phrygian cap and the Broken chain
 (D) The Winged woman and the Law tablet
12. **B**

13. Given below are statements regarding the course of development of Socialism in Europe. Arrange them in chronological sequence.
- I. Socialists took over the government in Russia through the October Revolution.
 II. Socialists and trade unionists formed a labour party in Britain and Socialist party in France
 III. The Russian Social Democratic Worker's Party was founded by Socialists who respected Marx' s ideas.
 IV. Socialists could not succeed in forming a government in Europe and governments continued to be run by conservatives, liberals and radicals.
 V. Second International was formed to coordinate the efforts of socialists throughout Europe.
- (A) V, III, II, IV, I (B) I, II, III, IV, V
 (C) V, II, III, I, IV (D) IV, V, III, I, II

13. **A**

14. Hitler's ideology related to the geopolitical concept of Lebensraum, or living space implied
- (A) there was no equality between people but only a racial hierarchy
 (B) only those species survived on earth that could adapt themselves to changing climatic conditions
 (C) new territories had to be acquired for settlement to increase the area of the mother country
 (D) an exclusive racial community of pure Germans to be created by physically eliminating all those who were seen as undesirable.

14. **C**

15. When did Hitler pull Germany out of the League of Nations?
- (A) 1933 (B) 1934
 (C) 1935 (D) 1936

15. **A**

16. Which of the following methods is used in western and central Himalayas for the soil conservation?
- (A) Terrace farming (B) Strip cropping
 (C) Shelter belts (D) None of the above

16. **A**

17. When the top layer of the soil is removed over a large area by the running water, it is called
- (A) Wind erosion (B) Sheet erosion
 (C) Water erosion (D) Gully erosion

17. **B**

18. Match the following river patterns with the places where the generally develop.

	Column-I		Column-II
i	Dendritic	a	where hard and soft rocks exist parallel to each other.
ii	Trellis	b	when streams flow to different directions from a central peak or dome like structure
iii	Rectangular	c	where the river channel follows the slope of the terrain.
iv	Radial	d	on a strongly joined rocky terrain

- (A) i – a, ii – b, iii – c, iv - d (B) i – b, ii – c, iii – d, iv – a
 (C) i – c, ii – a, iii – d, iv - b (D) i – c, ii – a, iii – b, iv – d

18. **C**

19. **Assertion(A):** The availability of water resources varies over space and time in India.
Reason(R): Water availability is governed by variations in seasonal and annual precipitation although water scarcity is aggravated by over-exploitation and unequal access to water among different social groups.
 (A) Both A and R are true and R is the correct explanation of A
 (B) Both A and R are true but R is not the correct explanation of A
 (C) A is true and R is false
 (D) A is false and R is true

19. **A**

20. Which of the following crops are covered under the National Food Security Mission?
 (1) Rice (2) Wheat
 (3) Pulses (4) Mustard

Select the code

- (A) 1 and 2 only (B) 2 and 3 only
 (C) 1, 2 and 3 (D) 1, 2 and 4

20. **C**

21. Which of the following is the major oilseed produced in India?
 (A) Groundnut (B) Soyabean
 (C) Castor seeds (D) Coconut

21. **A**

22. On what basis is the industrial sector classified into public and private sectors?
 (A) Employment conditions
 (B) The nature of economic activity
 (C) Ownership of enterprises
 (D) Number of workers employed in the enterprise

22. **C**

23. Which one of the following factors plays the most important role in the location of an industry in a particular region?
 (A) Raw material (B) Market
 (C) Least Production cost (D) All the above

23. **D**

24. Match List – I (National highways of India) with List – II (Description) and select the codes given below:

List – I (National highways of India)		List – II (Description)	
A.	National Highway Number – 1	I.	Covers most of Rajasthan
B.	National Highway Number – 15	II.	Known as Sher Shah Suri Marg
C.	National Highway Number – 7	III.	Connects Delhi and Mumbai
D.	National Highway Number – 8	IV.	Is the longest national highway

(A) A-IV, B-III, C-I, D-II

(B) A-I, B-II, C-IV, D-III

(C) A-II, B-I, C-IV, D-III

(D) A-I, B-III, C-II, D-IV

24. **C**

25. Which four major ports of India lie on the Golden Quadrilateral?
 (A) Chennai, Tuticorin, Mangalore, Marmagao
 (B) Kolkata, Chennai, Mangalore, Mumbai
 (C) Marmagao, Mumbai, Kandla, Mangalore
 (D) Kolkata, Mumbai, Vishakhapatnam, Chennai

25. **D**

26. Find the standard meridian of the country when it is 10:00 am there, while in India it is 8:30 am of the same day.
 (A) 105°E (B) 112°.30' E (C) 105° W (D) 112°.30' W
 26. **A**
27. What was the local time in Tokyo situated at 139°45' East longitude, when the President of India was hosting the Indian National Flag in the presence of Japanese Prime Minister at 10 a.m. in New Delhi? The viewer in Japan 'were watching live telecast of this event.
 (A) 6.11 a.m. (B) 1.49 a.m.
 (C) 2.49 a.m. (D) 1.49 p.m.
 27. **D**
28. Match List – I (Rivers) with List – II (Origin) and select the correct answer using the codes given below:
- | List – I (Rivers) | | List – II (Origin) | |
|-------------------|----------|--------------------|------------------|
| A. | Godavari | I. | Cardanmom Hills |
| B | Krishna | II. | Amarkantak Hills |
| C | Narmada | III. | Nasik Hills |
| D | Vaigai | IV | Mahabaleshwar |
- (A) A – IV, B – III, C – I, D – II (B) A – III, B – IV, C – II, D – I
 (C) A – I, B – II, C – IV, D – III (D) A – II, B – I, C – III, D – IV
 28. **B**
29. Which one of the following is the correct order of rivers from north to south?
 (A) Ravi, Chenab, Jhelum, Indus (B) Indus, Jhelum, Chenab, Ravi
 (C) Jhelum, Indus, Ravi, Chenab (D) Chenab, Ravi, Indust, Jhelum
 29. **B**
30. Keeping in mind the location of the following sanctuaries/national parks of India, arrange them from south to north:
 I. Periyar, II. Dachigam, III. Sarsika IV. Kanha
 (A) I, IV, II, III (B) III, I, IV, II
 (C) IV, I, III, II (D) I, IV, III, II
 30. **D**
31. Which of the following Acts would not apply to a company like TISCO?
 (A) Minimum Wages Act
 (B) National Rural Employment Guarantee Act
 (C) Factories Act
 (D) Payment of Gratuity Act
 31. **B**
32. Infant mortality rate refer to the number of children that die:
 (A) before the age of one year as a proportion to 1000 live births in that particular year
 (B) before the age of five years as a proportion to 1000 live births in that particular year
 (C) before ht age of one year as a proportion of 100 live births in that particular year
 (D) out of 1000 live births in that particular year
 32. **A**
33. Historically, the first currency called 'Rupee' was introduced in India by ____
 (A) Gayasuddin Tughlaq (B) Sikandar Lodhi
 (C) Sher Shah Suri (D) Akbar
 33. **C**
34. Construction and Manufacturing come in the _____ sector.
 (A) Secondary (B) Tertiary
 (C) Primary (D) All of above

34. **A**

35. Match List – I (Revolution) with List – II (Area) and select the correct answer using the codes given below:

List – I (Revolution)		List – II (Area)	
A.	Blue	I.	Dairy development
B.	Green	II.	Fisheries development
C.	White	III.	Food production
D.	Yellow	IV.	Silk production

(A) A-II, B-III, C-IV, D-I

(B) A-III, B-IV, C-II, D-I

(C) A-IV, B-II, C-I, D-III

(D) A-II, B-III, C-I, D-IV

35. **D**

36. Knowledge is also known as

(A) human capital

(B) working capital

(C) fixed capital

(D) none of these

36. **A**

37. Which of the following articles provide “The Right to Education”?

(A) 22 C

(B) 21 A

(C) 20

(D) 21 B

37. **B**

38. Assertion (A): In Belgium state government is not subordinate to central government and enjoys more power than earlier.

Reason (R): Many powers of central government were transferred to state government

(A) Both A and R are correct and R explains A

(B) Both A and R are correct and R does not explain A

(C) Only A is correct

(D) Only R is correct

38. **A**

39. Assertion: The formation of the linguistic states has actually made the country more united

Reason: The demand for the formation of states on the basis of language was raised, some national leaders feared that it would lead to the disintegration.

(A) Both A and R are correct and R explains A

(B) Both are correct but R does not explain A.

(C) Only A is correct

(D) Only R is correct

39. **B**

40. The Indian Constitution adopted some institutional details and procedures from the following Constitution laws.

(A) The Government of India Act of 1904

(B) The Government of India Act of 1914

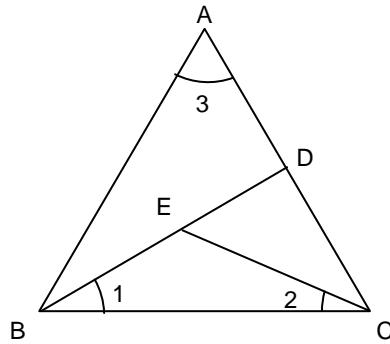
(C) The Government of India Act of 1935

(D) The Government of India Act of 1947

40. **C**

Section – II
Mathematics
(1 – 20)

1. In given figure $\angle 1 = \angle 2 = \angle 3$. If $AD = 5\text{cm}$, $DC = 4\text{cm}$ and the perimeter of $\triangle BEC$ is 13 cm then the length of BE is
 (A) 4.1 cm
 (B) 2 cm
 (C) 3.5 cm
 (D) 5 cm



1. C

Sol. Let $BE = EC = x$ then $BC = 13 - 2x$

Now use $\triangle CDB \sim \triangle CBA$

$$\frac{CD}{BC} = \frac{BC}{AC} \Rightarrow \frac{4}{13 - 2x} = \frac{13 - 2x}{9}$$

$$x = \frac{19}{2}, \frac{7}{2}$$

When $x = \frac{19}{2}$ then $13 - 2x$ will be negative.

$$\text{SO } BE = \frac{7}{2}$$

2. If $t_n = \frac{n^3 - n}{2}$, then $\sum_{n=2}^{\infty} \frac{1}{t_n}$ is

- (A) $\frac{1}{8}$ (B) $\frac{1}{4}$
 (C) $\frac{1}{2}$ (D) 1

2. C

Sol.
$$\sum_{n=2}^{\infty} \frac{1}{t_n} = \sum \frac{2}{n(n-1)(n+1)} = \sum \left(\frac{(n+1) - (n-1)}{n(n-1)(n+1)} \right)$$

$$= \sum \left(\frac{1}{n(n-1)} - \frac{1}{(n)(n+1)} \right)$$

$$= \left(\frac{1}{2 \cdot 1} - \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 2} - \frac{1}{3 \cdot 4} + \dots \right) = \frac{1}{2}$$

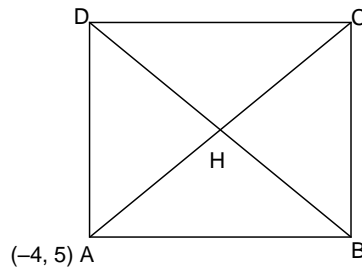
3. If $(-4, 5)$ is a vertex of a square and one of its diagonal is $7x - y + 8 = 0$. The other diagonal is:
 (A) $4x + 2y + 6 = 0$ (B) $2x - 5y + 18 = 0$
 (C) $x + 7y - 31 = 0$ (D) none of these

3. C

Sol. Let the square be ABCD

Let $A \equiv (-4, 5)$. Clearly, A does not lie on line $7x - y + 8 = 0$.

\therefore Equation of BD is $7x - y + 8 = 0$



AC is perpendicular to BD and passes through A(-4,5), therefore, equation of AC will be $x + 7y + k = 0$
 $\therefore (-4, 5)$ lie on it
 $\therefore -4 + 35 + k = 0 \Rightarrow k = -31$
 or $x + 7y - 31 = 0$

4. How many whole numbers between 100 and 800 contain the digit 2?
 (A) 200 (B) 214
 (C) 220 (D) 240

4. B

Sol. Between 100 – 199, there are 19 (= 10 + 10 – 1) numbers, which contain the digit 2.
 Between 200 – 299, there are 100 numbers, which contain the digit 2.
 Between 300 – 399, there are 19 numbers, which contain the digit 2.
 Between 400 – 499, there are 19 numbers, which contain the digit 2.
 Between 500 – 599, there are 19 numbers, which contain the digit 2.
 Between 600 – 699, there are 19 numbers, which contain the digit 2.
 Between 700 – 800, there are 19 numbers, which contain the digit 2.
 Therefore, there are total 214 (= 100 + 6 × 19) numbers, which contains the digit 2.
 Hence, choice (B) is the correct one.

5. In the sequence 1, 2, 2, 4, 4, 4, 4, 8, 8, 8, 8, 8, 8, 8, 8, where n consecutive terms have the value n, the 1025th term is
 (A) 2^9 (B) 2^{10}
 (C) 2^{11} (D) 2^8

5. B

Sol. Let the 1025th term = 2^n . Then $1 + 2 + 4 + 8 + \dots + 2^{n-1} < 1025 \leq 1 + 2 + 4 + 8 + \dots + 2^n$
 $\therefore 2^n - 1 < 1025 \leq 2^{n+1} - 1$
 or $2^n < 1026 \leq 2^{n+1}$ or $2^{n+1} \geq 1026 > 1024$
 $\Rightarrow 2^{n+1} > 2^{10}$
 $n+1 > 10$
 $n > 9 \Rightarrow n = 10$.

6. Find the value of $\operatorname{cosec} 10^\circ - \sqrt{3} \sec 10^\circ$
 (A) 4 (B) 2
 (C) 0 (D) -1

6. A

Sol. $\operatorname{cosec} 10^\circ - \sqrt{3} \sec 10^\circ$
 $= \frac{1}{\sin 10^\circ} - \frac{\sqrt{3}}{\cos 10^\circ}$
 $= \frac{\cos 10^\circ - \sqrt{3} \sin 10^\circ}{\sin 10^\circ \cos 10^\circ}$

Dividing numerator and denominator by $\frac{1}{2}$

$$\frac{\frac{1}{2}\cos 10^\circ - \frac{\sqrt{3}}{2}\sin 10^\circ}{\frac{1}{2}\sin 10^\circ \cos 10^\circ}$$

$$\Rightarrow \frac{\sin(30 - 10^\circ)}{\frac{1}{2} \times \frac{1}{2} (2\sin 10 \cos 10^\circ)}$$

$$= \frac{\sin 20^\circ}{\frac{1}{4}\sin 20^\circ} = 4$$

7. If α is a root of equation $4x^2 + 2x - 1 = 0$ and $f(x) = 4x^3 - 3x + 1$, then $2(f(\alpha) + \alpha)$ is :
 (A) 0 (B) -1
 (C) 1 (D) none of these

7. C

Sol. Given, $4\alpha^2 + 2\alpha - 1 = 0 \Rightarrow 4\alpha^2 = 1 - 2\alpha$

$$f(\alpha) = 4\alpha^3 - 3\alpha + 1 = \alpha(1 - 2\alpha) - 3\alpha + 1$$

$$= -2\alpha^2 - 2\alpha + 1 = \frac{1}{2}(-4\alpha^2 - 4\alpha + 2)$$

$$= \frac{1}{2}(2\alpha - 1 - 4\alpha + 2) = \frac{1}{2}(1 - 2\alpha)$$

$$= 2(f(\alpha) + \alpha) = 2\left\{\frac{1}{2}(1 - 2\alpha) + \alpha\right\}$$

$$= 2\left(\frac{1 - 2\alpha + 2\alpha}{2}\right) = 1$$

8. AD is a diameter of a circle. Two more circles pass through A and intersect AD in B and C respectively, such that AB and AC are diameters of these circles and $AD > AC > AB$. If the circumference of the middle circle is average of the circumference of the other two, then given $AB = 4$ units and $CD = 2$ units, what is the area, (in sq units) of the largest circle?
 (A) 128π (B) 64π
 (C) 48π (D) 16π

8. D

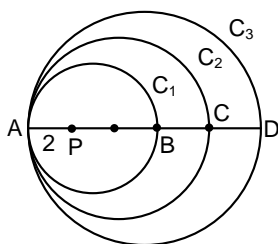
Sol. Let C_1, C_2 and C_3 be the circumference of the circle and $BC = x$.
 According to the given condition,

$$C_2 = \frac{C_1 + C_3}{2} \quad \dots(i)$$

$$\text{Here, } C_1 = 2\pi \times 2 = 4\pi$$

$$\text{Now, } AC = 4 + x$$

$$AC = 4 + x$$



$$\therefore C_2 = 2\pi \frac{(4 + x)}{2} = \pi(4 + x)$$

and $C_3 = 2\pi \frac{(6+x)}{2} = (6+x)\pi$

From equation (i), $\pi(4+x) = \frac{4\pi + (6+x)\pi}{2}$

$\Rightarrow 10 + x = 8 + 2x$

$\Rightarrow x = 2$

\therefore Radius of largest circle

$= \frac{4+2+2}{2}$

$= 4$

\therefore Area of largest circle

$= 4^2 \pi = 16 \pi$

9. If $ab - b + 1 = 0$ and $bc - c + 1 = 0$, then what is value of $(a - ac)$?

(A) -1

(B) 0

(C) 1

(D) 2

9. C

Sol. Given, $ab - b + 1 = 0$

$\Rightarrow b(a - 1) = -1$

$\Rightarrow b = \frac{1}{1-a} \dots(i)$

Also, $bc - c + 1 = 0$

$\Rightarrow b = \frac{-1+c}{c} \dots(ii)$

From equations (i) and (ii), we get

$\Rightarrow c = (1 - a)(-1 + c)$

$\Rightarrow c = -1 + c + a - ac$

$\therefore a - ac = 1$

10. The ratio of the roots of the equation $ax^2 + bx + c = 0$ is same as the ratio of the roots of the equation $px^2 + qx + r = 0$. If D_1 and D_2 are the discriminants of $ax^2 + bx + c = 0$ and $px^2 + qx + r = 0$ respectively then $D_1 : D_2 =$

(A) $\frac{a^2}{q^2}$

(B) $\frac{a^2}{p^2}$

(C) $\frac{b^2}{q^2}$

(D) None of these

10. C

Sol. Let α_1, β_1 be the roots of $ax^2 + bx + c = 0$ and α_2, β_2 be the roots of $px^2 + qx + r = 0$, then,

$\frac{\alpha_1}{\beta_1} = \frac{\alpha_2}{\beta_2} \Rightarrow \frac{\alpha_1 + \beta_1}{\alpha_1 - \beta_1} = \frac{\alpha_2 + \beta_2}{\alpha_2 - \beta_2}$

$\Rightarrow \frac{(\alpha_1 + \beta_1)^2}{(\alpha_1 - \beta_1)^2} = \frac{(\alpha_2 + \beta_2)^2}{(\alpha_2 - \beta_2)^2}$

$\Rightarrow \frac{(\alpha_1 + \beta_1)^2}{(\alpha_1 + \beta_1)^2 - 4\alpha_1\beta_1} = \frac{(\alpha_2 + \beta_2)^2}{(\alpha_2 + \beta_2)^2 - 4\alpha_2\beta_2} = \frac{b^2 / a^2}{\frac{b^2 - 4ac}{a^2}}$

$= \frac{q^2 / p^2}{\frac{q^2 - 4rp}{p^2}} = \frac{b^2}{D_1} = \frac{q^2}{D_2}$

$\Rightarrow \frac{D_1}{D_2} = \frac{b^2}{q^2}$

11. Three dice are thrown simultaneously. The probability of getting a total of atleast 5 of the numbers appearing on their top is
- (A) $\frac{5}{54}$ (B) $\frac{7}{54}$
 (C) $\frac{48}{54}$ (D) $\frac{53}{54}$

11. D

Sol. If three dice are thrown simultaneously,
 Total outcomes $\Rightarrow 6 \times 6 \times 6 = 216$

$$P(E) = 1 - P(\bar{E})$$

Where $P(\bar{E}) =$ Probability of getting the sum less than 5. i.e. (1, 1, 1), (1, 1, 2), (1, 2, 1), (2, 1, 1)

$$P(E) = 1 - \frac{4}{216} = \frac{212}{216} = \frac{53}{54}$$

12. If $x = (16^3 + 17^3 + 18^3 + 19^3)$, then x divided by 70 leaves a remainder of:

- (A) 0 (B) 1
 (C) 69 (D) 35

12. A

Sol.
$$\frac{16^3 + 17^3 + 18^3 + 19^3}{70} = \frac{16^3 + 19^3 + 17^3 + 18^3}{70}$$

$$= \frac{(16+19)(16^2 + 19^2 - 16 \times 19) + (17+18)(17^2 + 18^2 - 17 \times 18)}{70}$$

$$= \frac{35(16^2 + 19^2 - 16 \times 19 + 17^2 + 18^2 - 17 \times 18)}{70}$$

$$= \frac{35 \times 2m}{70} \quad (\text{which is divisible by 70})$$

Hence, remainder is zero.

Here $2m = (16^2 + 19^2 - 16 \times 19 + 17^2 + 18^2 - 17 \times 18)$

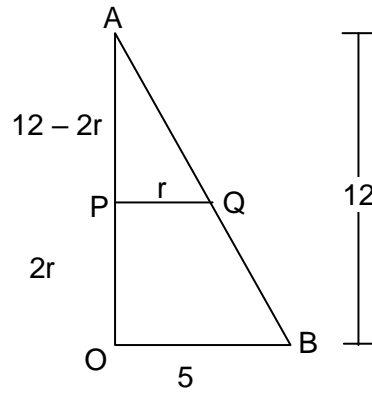
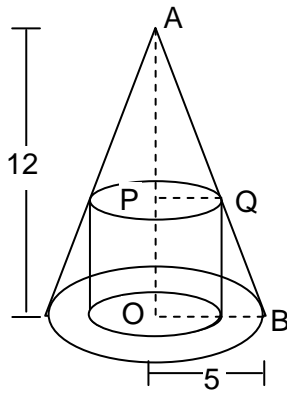
13. A right circular cylinder with its diameter equal to its height is inscribed in a right circular cone. The cone has diameter 10 and altitude 12, and the axes of the cylinder and cone coincide. What is the radius of the cylinder?

- (A) $\frac{8}{3}$ (B) $\frac{30}{11}$
 (C) 3 (D) $\frac{25}{8}$

13. B

Sol. Let the cylinder have radius r and height 2r. Since $\triangle APQ$ is similar to $\triangle AOB$, we have

$$\frac{12 - 2r}{r} = \frac{12}{5}, \text{ so } r = \frac{30}{11}.$$



14. Which term of the A.P. 51, 47, 43,....is a cube of itself?

- (A) 11 (B) 12
(C) 13 (D) 14

14. D

Sol. Let x be the required term. So $x^3 = x$

$$\text{or } x^3 - x = 0$$

$$\text{or } x(x^2 - 1) = 0$$

$$\text{or } x(x-1)(x+1) = 0$$

Either $x = 0, 1$ or -1

Now, the first term of the A.P. $a = 51$

Common difference, $d = -4$

Therefore, general term

$$= a + (n-1)d$$

$$= 51 + (n-1)(-4)$$

$$= 51 - 4n + 4 = 55 - 4n$$

If $55 - 4n = 0$, then $4n = 55$ or $n = \frac{55}{4}$, which is not a natural number.

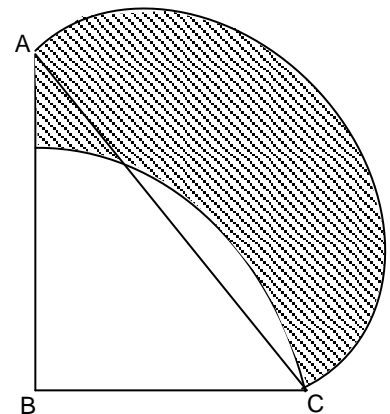
If $55 - 4n = 1$, then $4n = 54$ or $n = \frac{54}{4}$, which is not a natural number.

If $55 - 4n = -1$, then $4n = 56$ or $n = \frac{56}{4} = 14$

Thus 14th term of the A.P. is the cube of itself.

15. In the given figure, ABC is a right angled triangle, $\angle B = 90^\circ$, $AB = 20$ cm and $BC = 15$ cm. With AC as diameter a semicircle is drawn and with BC as radius a quarter circle is drawn. Find the area of shaded region. (Use $\pi = \frac{22}{7}$)

- (A) 190.25 cm²
(B) 210.50 cm²
(C) 218.75 cm²
(D) 230 cm²



15. C

Sol. $AB = 20$ cm, $BC = 15$ cm $\Rightarrow AC = 25$ cm

$$\begin{aligned} \text{Shaded area} &= \frac{1}{2} \times 15 \times 20 + \frac{1}{2} \times \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2} - \frac{1}{4} \times \frac{22}{7} \times 15 \times 15 \\ &= 218.75 \text{ cm}^2 \end{aligned}$$

16. If $u_i = \frac{x_i - 25}{10}$, $\sum_{i=1}^n f_i u_i = 20$, $\sum_{i=1}^n f = 100$ then $\bar{x} =$
- (A) 21 (B) 25
(C) 27 (D) 28

16. C

Sol. By using formula $\bar{x} = A + \frac{\sum fu}{\sum f} \times h$

$$\text{We get } \bar{x} = 25 + \frac{20}{100} \times 10 = 27$$

17. If $\sec \theta + \tan \theta = k$, (θ is acute angle) then $\cos \theta =$

- (A) $\frac{k^2 + 1}{2k}$ (B) $\frac{2k}{k^2 + 1}$
(C) $\frac{k}{k^2 + 1}$ (D) $\frac{k}{k^2 - 1}$

17. B

Sol. $\sec \theta + \tan \theta = k$

$$\sec \theta - \tan \theta = \frac{1}{k}$$

$$\Rightarrow \sec \theta = \frac{1}{2} \left(k + \frac{1}{k} \right) = \frac{k^2 + 1}{2k}$$

$$\text{So, } \cos \theta = \frac{2k}{k^2 + 1}$$

18. At the foot of a mountain the elevation of its summit is 45° after ascending 500 m towards the mountain up a slope of 30° inclination the elevation is found to be 60° . Find the height of the mountain.

- (A) $500(\sqrt{3} + 1)$ m (B) $250(\sqrt{3} + 1)$ m
(C) $250(\sqrt{3} - 1)$ m (D) $500(\sqrt{3} - 1)$ m

18. B

Sol. In ΔSFO

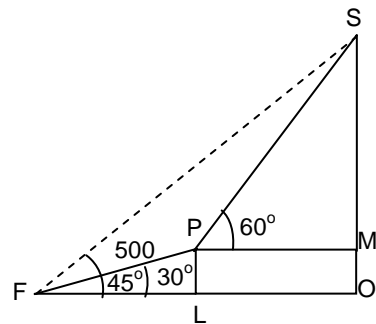
Let SO be h

$$\text{Then } \tan 45^\circ = \frac{OS}{OF}$$

$$OF = \frac{OS}{\tan 45} = 'h'$$

In ΔPFL

$$\sin 30^\circ = \frac{PL}{PF}$$



$$PL = 500 \times \frac{1}{2} = 250 \text{ m}$$

$$MS = (h - 250) \text{ m} \quad (1)$$

$$\cos 30^\circ = \frac{FL}{500} \Rightarrow FL = \frac{500 \times \sqrt{3}}{2} = 250\sqrt{3}$$

$$LO = h - 250\sqrt{3} \quad (2)$$

LO = PM

In ΔPMS

Sol. Let AB and DC produced to meet at point E.

Then in $\triangle ADE \rightarrow$

$$\angle A + \angle D + \angle E = 180^\circ$$

$$\Rightarrow \angle E = 90^\circ \text{ (because } \angle A + \angle D = 90^\circ \text{)}$$

$$\triangle ACE \rightarrow AC^2 = AE^2 + CE^2 \quad \dots\dots\dots(i)$$

$$\triangle BDE \rightarrow BD^2 = BE^2 + DE^2 \quad \dots\dots\dots(ii)$$

Now, in $\triangle AED$

$$AD^2 = AE^2 + DE^2 \quad \dots\dots\dots(iii)$$

In $\triangle BEC \rightarrow$

$$BC^2 = BE^2 + CE^2 \quad \dots\dots\dots(iv)$$

$$(i) + (ii) \Rightarrow AC^2 + BD^2 = AE^2 + BE^2 + CE^2 + DE^2$$

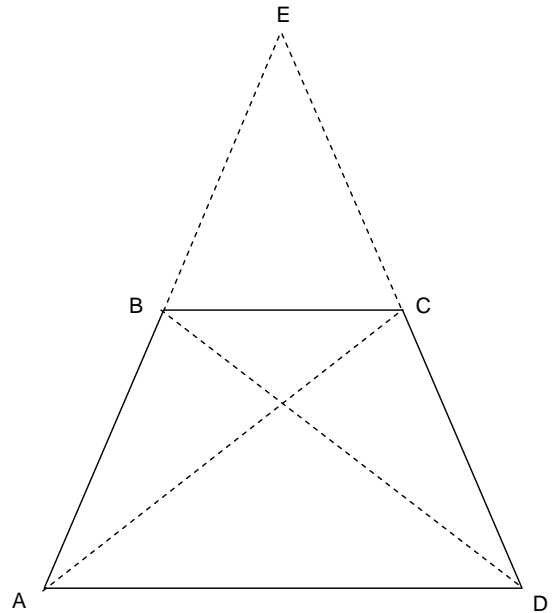
$$(iii) + (iv) \Rightarrow AD^2 + BC^2 = AE^2 + BE^2 + CE^2 + DE^2$$

$$\therefore AC^2 + BD^2 = AD^2 + BC^2$$

$$\Rightarrow BC^2 - BD^2 = AC^2 - AD^2$$

$$= 12^2 - 7^2$$

$$= 95$$

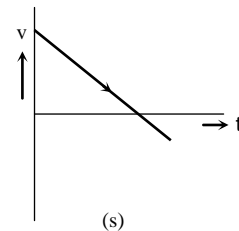
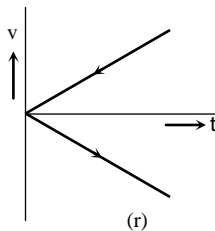
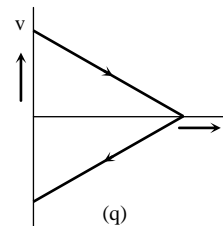
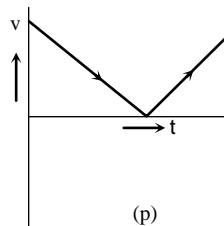


Section – III

Physics

(1 – 13)

1. A ball is thrown vertically upwards. Which of the following graph/graphs represent velocity-time graph of the ball during its flight (air resistance is neglected)



(A) p

(C) r

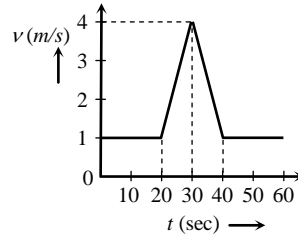
(B) q

(D) s

1. D

Sol. In the positive region the velocity decreases linearly (during rise) and in the negative region velocity increases linearly (during fall) and the direction is opposite to each other during rise and fall, hence fall is shown in the negative region.

2. Velocity-time ($v-t$) graph for a moving object is shown in the figure. Total displacement of the object during the time interval when there is non-zero acceleration and retardation is



- (A) 60 m
(B) 50 m
(C) 30 m
(D) 40 m

2. B

Sol. Between time interval 20 sec to 40 sec, there is non-zero acceleration and retardation.

Hence distance travelled during this interval
 = Area between time interval 20 sec to 40 sec
 = $\frac{1}{2} \times 20 \times 3 + 20 \times 1 = 30 + 20 = 50 \text{ m}$.

3. A cylinder is filled with a liquid of density ρ upto a height h . If the cylinder is placed in a lift which is moving upwards with an acceleration a , then the pressure on the bottom is

- (A) $\rho h (g - a)$
(B) ρgh
(C) $\frac{1}{2} \rho gh$
(D) $\rho h (g + a)$

3. D

Sol. $P = \rho gh + \rho ah$
 = $\rho h (g + a)$

4. A body of mass m is moving in a circle of radius r with a constant speed V . The force on the body is $\frac{mv^2}{r}$ and is directed towards the centre. What is the average power delivered in moving the body half the circumference of the circle.

- (A) $\frac{mv^3}{r}$
(B) zero
(C) $\frac{mv^2}{r^2}$
(D) $\frac{\pi r^2}{mv^2}$

4. B

Sol. $P = F \cdot V$,
 \therefore Force is always perpendicular to velocity.
 Thus $P = 0$

5. A particle is projected with initial velocity u in the vertically upwards direction, find the distance covered in the last t second, while the particle is going up.

- (A) gt^2
(B) $2gt^2$
(C) $\frac{1}{2}gt^2$
(D) $\frac{3}{4}gt^2$

5. C

Sol. $S_1 = \frac{u^2}{2g}$; $S_2 = ut_1 - \frac{1}{2}gt_1^2$; $t_1 = \left(\frac{u}{g} - t \right)$
 $S = S_1 - S_2 = \frac{1}{2}gt^2$

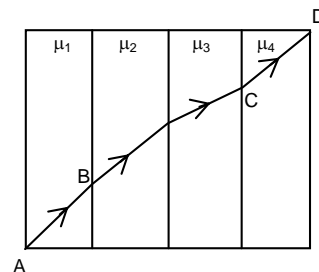
6. A block of mass 0.1 kg is held against a wall by applying a horizontal force of 5 N on the block. If the coefficient of friction between the block and the wall is 0.5, the magnitude of the frictional force acting on the block is
 (A) 2.5 N (B) 0.98 N
 (C) 4.9 N (D) 0.49 N

6. B

Sol. $F_L = \mu N = 0.5 \times 5 = 2.5 \text{ N}$;
 Since $mg < F_L$;
 Hence friction = $mg = 0.98 \text{ N}$

7. A ray of light through four transparent media with refractive indices μ_1, μ_2, μ_3 and μ_4 is shown in figure. The surfaces of all media are parallel. If the emergent ray CD is parallel to the incident ray AB we must have

- (A) $\mu_1 = \mu_2$ (B) $\mu_2 = \mu_3$
 (C) $\mu_3 = \mu_4$ (D) $\mu_4 = \mu_1$



7. D

Sol. Using $\mu_1 \sin i = \mu_2 \sin r$ for each surface we get, $\mu_1 = \mu_4$.

8. The critical angle of a prism is 30° . The velocity of light in the medium of the prism is:
 (A) $1.5 \times 10^8 \text{ m/s}$ (B) $3 \times 10^8 \text{ m/s}$
 (C) $4.5 \times 10^8 \text{ m/s}$ (D) none of these

8. A

Sol. $\sin C = \frac{1}{\mu} \Rightarrow \mu = 2$.

$$v = \frac{c}{\mu} = \frac{3 \times 10^8}{2} = 1.5 \times 10^8 \text{ m/s.}$$

9. A magnet moves into a coil of wire, inducing a current in the wire. If the magnet is pulled back out of the coil in the opposite direction as it went into the coil, which of the following will occur?

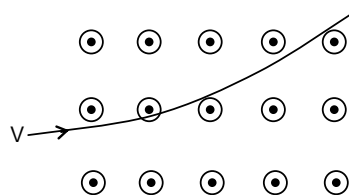
- (A) There will be a current produced in the coil in the same direction as before
 (B) There will be a current produced in the coil in the opposite direction as before
 (C) There will be no current produced in the coil
 (D) The current produced must be stronger than before

9. B

Sol. Magnetic flux linked with the coil starts decreasing in same direction therefore induced current will be in such a manner so that it can oppose its cause.

10. A particle enters the region of a uniform magnetic field as shown in figure. The path of the particle inside the field is shown by a dark line. The particle is

- (A) electrically neutral
 (B) positively charged
 (C) negatively charged
 (D) nothing definite can be said about the nature of the charge as the information given is inadequate.



10. C

Sol. Using Fleming's left hand rule.

11. Two solid sphere of radii r and $2r$, made of the same material are kept in contact. The mutual gravitational force of attraction between them is proportional to

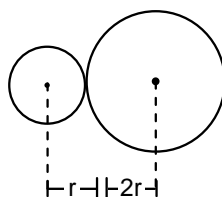
- (A) $\frac{1}{r^4}$ (B) $\frac{1}{r^2}$
 (C) r^2 (D) r^4

11. D

Sol.
$$F = \frac{G m_1 m_2}{(3r)^2}$$

$$= \frac{G \left(\frac{4}{3} \pi r^3\right) \rho \left(\frac{4}{3} \pi (2r)^3\right) \rho}{9r^2}$$

$$F \propto r^4$$



12. Two resistors of resistance r_1 and r_2 ($r_1 > r_2$) are joined in parallel. The equivalent resistance R is such that

- (A) $R > r_1 + r_2$ (B) $r_2 < R < r_1 + r_2$
 (C) $r_1 < R < r_2$ (D) $R < r_2 < r_1$

12. D

- Sol. The equivalent resistance in parallel combination is less than the minimum resistor in the combination. So, $R < r_2 < r_1$.

13. In a vessel of 1.2 m depth, upto what height the water should be filled so that now it appears to be half filled if viewed from the top? (μ of water = $\frac{4}{3}$)

- (A) 60 cm (B) 75 cm
 (C) 80 cm (D) 100 cm

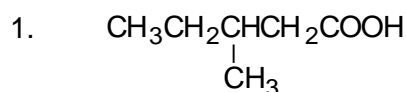
13. C

Sol. $y = \frac{x}{\mu} \Rightarrow 60 = \frac{x}{\frac{4}{3}} \Rightarrow x = h = 80 \text{ cm}$

Section – IV

Chemistry

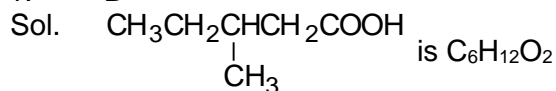
(1 – 13)



What is the empirical mass of the above compound?

- (A) 48 (B) 58
 (C) 72 (D) 80

1. B



And its empirical formula is $\text{C}_3\text{H}_6\text{O}$

So empirical mass is $3 \times 12 + 6 \times 1 + 1 \times 16$
 $= 36 + 6 + 16 = 58$

2. Which of the following ray contains particles whose mass depends on the source of formation of the ray?

- (A) Cathode ray (B) Anode ray
 (C) Alpha ray (D) X-ray

2. B

- Sol. Anode rays are the gaseous cation.

3. Which of the following ion has the largest ionic radius?

- (A) Na^+ (B) Mg^{2+}
(C) Al^{3+} (D) K^+

3. D

Sol. Ionic radius $\propto \frac{1}{\text{Nuclear charge}}$

4. One mole of which of the following acid needs maximum amount of NaOH for neutralization reaction?

- (A) H_3BO_3 (B) H_2SO_4
(C) HClO_4 (D) HNO_3

4. B

Sol. $\text{H}_2\text{SO}_4 + 2\text{NaOH} \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$

5. Which of the following substance form two different organic compounds when reacts with water in acidic medium?

- (A) $\text{CH}_3\text{CH}_2\text{Cl}$ (B) $\text{CH}_3\text{CH}_2\text{COOCH}_3$
(C) $\text{CH}_3\text{CH}_2\text{COOH}$ (D) $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{O} - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$

5. B

Sol. $\text{CH}_3\text{CH}_2\text{COOCH}_3 \xrightarrow[\text{H}^+]{\text{H}_2\text{O}} \text{CH}_3\text{CH}_2\text{COOH} + \text{CH}_3\text{OH}$

6. What is the pH of water at 80°C ?

- (A) More than 7 (B) Less than 7
(C) Equal to 7 (D) More than 14

6. B

Sol. pH of water is less than 7 at 80°C

7. The ionization energy of hydrogen atom is 13.6 eV. What will be the ionization energy of He^+ ?

- (A) 13.6 eV (B) 54.4 eV
(C) 122.4 eV (D) Zero

7. B

Sol. Ionization energy of $\text{He}^+ = 13.6 \times 2^2 = 13.6 \times 4$

8. What is the wavelength of the radiation emitted producing a line in the Lyman series when an electron falls from fourth stationary state in hydrogen atom? ($R_H = 1.1 \times 10^7 \text{ m}^{-1}$)

- (A) 96.97 nm (B) 969.7 nm
(C) 9.697 nm (D) None

8. A

Sol. $n_1 = 1, n_2 = 4$

$$\frac{1}{\lambda} = R_H \left[\frac{1}{1^2} - \frac{1}{4^2} \right] = 1.1 \times 10^7 \text{ m}^{-1} \left(\frac{15}{16} \right)$$
$$\Rightarrow \lambda = \frac{1}{1.03125 \times 10^7} = \frac{10^{-7} \times 10^{-2} \times 10^2}{1.03125} \text{ m}$$
$$= \frac{100}{1.03125} \text{ nm} = 96.97 \text{ nm}$$

9. The molarity of water is

- (A) 5.55 mol/L (B) 18.0 mol/L
(C) 55.55 mol/L (D) 10.0 mol/L

9. C

- Sol. Molarity(M) = Mole of water present per lit
 $1 \text{ lt H}_2\text{O} = 1000 \text{ g} = \frac{1000}{18} \text{ mol} = 55.55 \text{ molL}^{-1}$
10. At the boiling point of a liquid its vapour pressure is ____atmospheric pressure.
 (A) less than (B) greater than
 (C) equal to (D) none of these
10. **C**
- Sol. At boiling point vapour pressure is equal to atmospheric pressure.
11. All gases will occupy zero volume when the temperature is reduced to
 (A) 273°C (B) 273°A
 (C) -273.15°C (D) 0°C
11. **C**
- Sol. At -273.15°C = 0 K , gaseous volume becomes zero
12. Which of the following represents the incorrect set of the four quantum number of 4f-electrons?
 (A) 4, 3, 2, $+\frac{1}{2}$ (B) 4, 2, 1, 0
 (C) 4, 3, -2, $\frac{1}{2}$ (D) 4, 3, 1, $-\frac{1}{2}$
12. **B**
- Sol. For 4f electrons
 $n = 4, l = 3, m = -3 \text{ to } +3 = \pm 1/2$
13. 254 g of iodine and 142 g of chlorine are made to react completely to give a mixture of ICl and ICl₃. How many moles of each are formed?
 (A) 0.1 mol of ICl and 0.1 mol of ICl₃ (B) 1.0 mol of ICl and 1.0 mol of ICl₃
 (C) 0.5 mol of ICl and 0.1 mol of ICl₃ (D) 0.5 mol of ICl and 1.0 mol of ICl₃
13. **B**
- Sol. $\text{I}_2 + 2\text{Cl}_2 \longrightarrow \text{ICl} + \text{ICl}_3$
 $1 \text{ mol} + 2 \text{ mol} \longrightarrow 1 \text{ mol} + 1 \text{ mol}$
 Given
 $\text{I}_2 = 254 \text{ g} = 1 \text{ mol}$
 $\text{Cl}_2 = 142 \text{ g} = 2 \text{ mol}$
 $\Rightarrow \text{ICl} = 1 \text{ mol and ICl}_3 = 1 \text{ mol}$

Section – V

Biology

(1 –14)

1. Dark reaction in photosynthesis is called so because
 (A) It can occur in dark also
 (B) It does not depend on light energy
 (C) It cannot occur during day light
 (D) It occurs more rapidly at night
1. **B**
- Sol. Dark reaction in photosynthesis is called so because it does not depend on light energy.

2. Read the following statements with reference to the villi of small intestine.
(i) They have very thin walls.
(ii) They have a network of thin and small blood vessels close to the surface.
(iii) They have small pores through which food can easily pass.
(iv) They are finger-like projections.

Identify those statements which enable the villi to absorb digested food.

- (A) (i), (ii) and (iv)
(B) (ii), (iii) and (iv)
(C) (iii) and (iv)
(D) (i) and (iv)

2. A

Sol. The villi of small intestine are finger-like projections, They have very thin walls. They have a network of thin and small blood vessels close to the surface.

3. When yeast ferments glucose, the products obtained are

- (A) Ethanol and CO₂
(B) Methanol and CO₂
(C) Ethanol and water
(D) Water and CO₂.

3. A

Sol. When yeast ferments glucose Ethanol and CO₂ are released.

4. In humans, right auricle receives _____ blood from _____

- (A) Oxygenated, aorta
(B) Deoxygenated, vena cava
(C) Oxygenated, vena cava
(D) Deoxygenated, aorta

4. B

Sol. Right auricle of human heart receives deoxygenated blood from vena cava.

5. In which of the following are the largest amounts of nitrogen excreted from a mammalian body?

- (A) Breath
(B) Sweat
(C) Urine
(D) none of these

5. C

Sol. The largest amount of Nitrogen excreted from mammalian body in the form of urine.

6. Which among the following are not the functions of testes at puberty?

- (i) Formation of germ cells
(ii) Secretion of testosterone
(iii) Development of placenta
(iv) Secretion of estrogen
(A) (i) and (ii)
(B) (i) and (iii)
(C) (ii) and (iv)
(D) (iii) and (iv)

6. D

Sol. Development of placenta and secretion of the estrogen takes place in the body of female.

7. The ratio of number of chromosomes in a human zygote and a human sperm is:

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

7. A

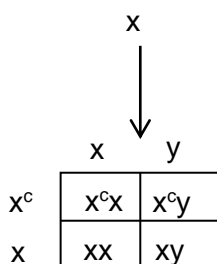
Sol. Human zygote is diploid and human sperm is haploid

8. Which endocrine gland is considered as "master gland "
 (A) hypothalamus
 (B) pituitary
 (C) thyroid
 (D) Adrenal

8. B
 Sol. Pituitary gland is considered as master gland

9. What will be the condition of the progeny if the father is normal, while the mother has one gene for colour blindness on one of the X chromosomes?
 (A) Only daughters are colour blind
 (B) Both sons and daughters will be colour blind
 (C) 50 percent colour blind sons and 50% normal sons
 (D) 50 percent colour blind daughters and 50% colour blind sons

9. C
 Sol. Normal Father xy Carrier Female $x^c x$



$x^c x$ – Carrier daughter
 xx – Normal daughter
 $x^c y$ – Colour blind son
 xy – Normal Son

So, 50% son will be colour blind and 50% will be normal.

10. Those organs which have different basic structure but have similar appearance and perform similar functions are called
 (A) Fossils
 (B) Analogous organs
 (C) Homologous organs
 (D) Speciation

10. B
 Sol. Organs which have different basic structure but have similar appearance and perform similar functions are called Analogous organs.

11. Which of the following is responsible for turning yellow Taj Mahal?
 (A) Nitrogen dioxide
 (B) Sulphur
 (C) Chlorine
 (D) Sulphur dioxide

11. D
 Sol. Sulphur dioxide turns the colour Taj Mahal white to yellow.

12. Many of the people suffer from the problem of acnes and feel annoyed of the ugly skin texture caused due to the acne spots. Can you guess the microorganism causing these acne?
(A) H1N1 virus
(B) Trypanosoma
(C) Leishmania
(D) Staphylococcus

12. D

Sol. Staphylococcus bacteria causes acne in in the human beings.

13. Growing foetus derive nutrition from mother's blood through
(A) Uterus
(B) Fallopian tube
(C) Placenta
(D) Cervix

13. C

Sol. Foetus derives nutrition from mother's blood through placenta.

14. Syngamy means
(A) fusion of gametes
(B) fusion of cytoplasm
(C) fusion of two similar spores
(D) fusion of two dissimilar spores.

14. A

Sol. The fusion of gametes known as syngamy