FIITJEE INTERNAL TEST

MOCK TEST - 4

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. Where was Mazzine born in 1807?
   (A) Rome (B) Berlin
   (C) Genoa (D) Sicly
1. **C**

2. Where was International Military Tribunal set up to prosecute Nazi war criminals?
   (A) St. Petersburg (B) England
   (C) Vienna (D) Nuremberg
2. **D**

3. In 1878 the Vernacular Press Act was modelled on the
   (A) French Press Laws (B) Irish Press Laws
   (C) Scottish Press Laws (D) British Press Laws
3. **B**

4. Which one of the following states was ruled by an Italian princely house before unification of Italy?
   (A) Kingdom of Two Sicilies (B) Papal state
   (C) San Marino (D) Sardinia – Piedmont
4. **D**

5. Who, among the following formed a secret society, called 'Young Italy'?
   (A) Otto van Bismark (B) Giuseppe Mazzini
   (C) Metternich (D) Johann Gottfried Herder
5. **B**

6. Which Act was passed in 1865?
   (A) The Regulatory Act (B) The Pitt's India Act
   (C) Indian Forest Act (D) The First Factory Act
6. **C**

7. **Assertion (A):** The Spanish conquest over America was not just a result of military power but due to germs.
   Reason (R): The original inhabitants of America had no immunity against the diseases that came from Europe.
   (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
7. **A**

8. Name the place, where Indian National Congress Session was held in December 1920.
   (A) Nagpur (B) Madras
   (C) Calcutta (D) Surat
8. **A**

9. Which one of the following statements is not related to the Gandhi – Irwin Pact?
   (A) Gandhiji agreed to participate in the first Round Table Conference
   (B) The British agreed to release the political prisoners
   (C) Gandhiji decided to call off the Civil Disobedience Movement.
   (D) Gandhiji agreed to participate in the second Round Table Conference.

9 **A**

10. Name the writer of the novel 'Anandamath'.
(A) Bankim Chandra Chatterjee (B) Rabindranath Tagore
(C) Premchand (D) Jyotiba Phule
10. **A**

11. Which British Viceroy ordered the partition of Bengal?
(A) Lord Chelmsford (B) Lord Minto
(C) Lord Irwin (D) Lord Curzon
11. **D**

12. Who was Marco Polo?
(A) An explorer (B) A scientist
(C) A writer (D) A publisher
12. **A**

13. Which of the following pair of pastoralists lived in extreme north and south of India?
(A) Gujjars – Dhangars (B) Gaddis – Banjaras
(C) Gujjars – Gollas (D) Banjaras – Dhangars
13. **C**

14. **Assertion (A):** The Enabling Act of 3 March, 1933 established the dictatorship of Hitler in Germany.
Reason (R): It gave the Parliament and the chancellor more power than before.
(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
14. **C**

15. **Statement I** : After the 1905 revolution in Russia, Duma or the first elected consultative, Parliament came into existence.
Statement II : Duma was not allowed to function longer and was dissolved.
(A) Only statement I is true (B) Only statement II is true
(C) Both statements are true (D) Both statements are false
15. **C**

16. Thal, Bhor and Pal are the passes that are found in
(A) Aravali range (B) Purvanchal
(C) Himalayan range (D) Western Ghats
16. **D**

17. Statement I: Mangroves are much specialized forest ecosystems of deltaic and tidal regions bordering certain sea coasts.
Statement II: They stabilize the shoreline & act as bulwark against encroachment by sea.
(A) Only statement I is true (B) Only statement II is true
(C) Both statements are true (D) Both statements are false
17. **C**

18. Mention the sowing period of Kharif crops.
(A) June – July (B) November – December
(C) February – March (D) September - October
18. **A**

19. Which of the following is the leading tea producing state in India?
(A) Meghalaya (B) Manipur
(C) Madhya Pradesh (D) Assam
19. **D**

20. Which one of the following type of coal has highest percentage of carbon?
(A) Peat (B) Lignite
(C) Bituminous (D) Anthracite
20. **D**

21. Koderma Gaya – Hazaribagh belt of Jharkhand is the leading producer of which one of the following minerals?
(A) Copper (B) Bauxite
(C) Iron ore (D) Mica
21. **D**

22. 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) Transport
22. **C**

23. Name the nuclear power plant located in Uttar Pradesh.
(A) Tarapur Nuclear Reactor (B) Kaiga Atomic power plant
(C) Narora Atomic Power Plant (D) Kakrapar Atomic power plant
23. **C**

24. Which is the major sea port of southern most part of India?
(A) Paradip (B) Tuticorin
(C) Mumbai (D) Haldia
24. **B**

25. Which is the eastern terminal station of 'East West Corridor'?
(A) Srinagar (B) Varanasi
(C) Porbander (D) Silchar
25. **D**

26. Which type of soil is result of intense leaching due to heavy rain?
(A) Laterite (B) Black
(C) Alluvial (D) Arid
26. **A**

27. In which city Raja Sansi International airport is located.
(A) Mysore (B) Chennai
(C) Amritsar (D) Hyderabad
27. **C**

28. Which type of forest is also known as Monsoon forest?
(A) Montane forest (B) Deciduous forest
(C) Evergreen forest (D) Alpine forest
28. **B**

29. Over India Jet Streams blow south of the Himalayas, all through the year except in ___
(A) Winter (B) Summer
(C) Autumn (D) Spring
29. **B**

30. What is the length of coast line of India?
(A) 7500 km (B) 7800 km
(C) 7516.6 km (D) 1520.50 km
30. **C**

31. Seasonal unemployment is faced by
(A) people working in industry (B) people working in service sector
(C) people working in agriculture (D) people working in trading activity
31. **C**

32. Which of the following is a 'barrier' on foreign trade?
(A) Tax on import (B) Ease of doing business
(C) Sales tax (D) Tax on local trade
32. **A**

33. What is the main activity in the Palampur Village?
(A) Dairy (B) Farming
(C) Transport (D) Manufacturing
33. **B**

34. Suppose you have to buy a packet bottle for drinking water in your journey. Which logo will you like to see to be sure about its quality?
(A) Copyright (B) Hallmark
(C) NSSO (D) FSSAI
34 **D**

35. The work force population includes people of which age?
(A) 60 - 70 years (B) 59 – 65 years
(C) 6 – 14 years (D) 15 – 59 years
35. **D**

36. Which one of the following is considered the best form of government?
(A) Democracy (B) Dictatorship
(C) Monarchy (D) Military Rule
36. **A**

37. A money-bill in the Parliament can be introduced only with the prior recommendations of the:
(A) President of India (B) State Cabinet
(C) Speaker of the Lok Sabha (D) Rajya Sabha
37. **A**

38. Which one of the following facilities is offered by the 'Election Commission' to a recognized political party?
(A) Party name (B) Election funds
(C) Election symbol (D) Manifesto
38. **C**

39. Who was the temporary Chairman of the Constituent Assembly?
(A) Dr. Rajendra Prasad (B) Dr. Ambedkar
(C) Dr. Sachindanand Sindha (D) Pt. Jawaharlal Nehru
39. C

40. How much time did it take to make the Indian Constitution?
(A) 1 year, 11 months and 18 days (B) 2 years, 10 months and 18 days
(C) 2 years, 11 months and 18 days (D) 2 year, 6 months and 18 days
40. **C**

Section – II
Mathematics
(1 – 20)

1. The value of $\cos x^o - \sin x^o \, (0 \le x < 45)$ is
(A) 0
(B) positive
(C) negative
(D) sometimes negative and sometimes positive

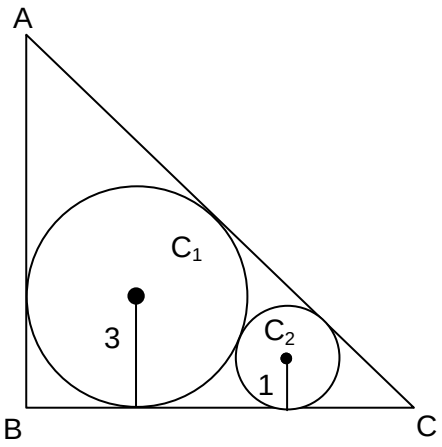
1. B

Sol. $0 \le x < 45, \cos x > \sin x$

$\Rightarrow \cos x - \sin x > 0$

2. In the adjoining figure, ABC is a triangle in which $\angle B = 90^o$ and its incircle C_1 has radius 3. A circle C_2 of radius 1 touches sides AC, BC and the circle C_1. Then length AB is equal to

(A) $3 + 6\sqrt{3}$ (B) $10 + 3\sqrt{2}$
(C) $10 + 2\sqrt{3}$ (D) $9 + 3\sqrt{3}$



2. D

Sol. $IO_1 = DE = GF$

$= \sqrt{16 - 4} = 2\sqrt{3}$

Now, $\Delta CO,E \sim \Delta COD$

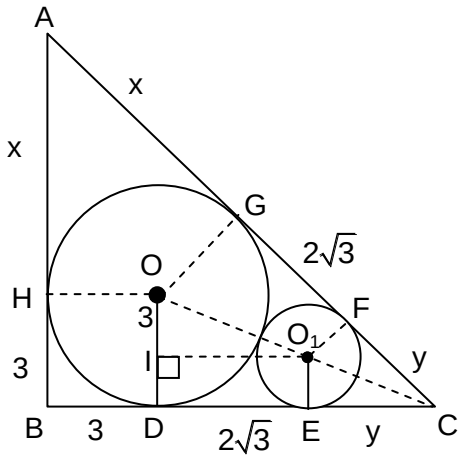
$\frac{y}{y + 2\sqrt{3}} = \frac{1}{3}$

$y = \sqrt{3}$

$(3 + x)^2 + \left(3 + 3\sqrt{3}\right)^2 = \left(x + 3\sqrt{3}\right)^2$

$x = 6 + 3\sqrt{3}$

$AB = 3 + 6 + 3\sqrt{3} = 9 + 3\sqrt{3}$



3. How many four – digit numbers (base 10), $N = \overline{abcd}$, satisfy all three of the following conditions?
(i) $4000 \le N \le 6000$; (ii) N is a multiple of 5, (iii) $3 \le b < c \le 6$
(A) 10 (B) 18
(C) 24 (D) 36

3. C

Sol. Condition (i) requires that a be one of the two digits, 4 or 5. Condition (ii) requires that d be one of the two digits, 0 or 5. Condition (iii) requires that the ordered pair (b, c) be one of these six ordered pairs:

(3, 4), (3, 5), (3, 6), (4, 5), (4, 6), (5, 6).

Therefore, there are $2 \times 2 \times 6 = 24$ numbers N satisfying the conditions.

4. Both roots of the quadratic equation $x^2 - 63x + k = 0$ are prime numbers. What is the number of possible values of k?

(A) 0 (B) 1

(C) 2 (D) 4

4. B

Sol. Let p and q be two primes that are roots of $x^2 - 63x + k = 0$. Then $x^2 - 63x + k = (x-p)(x-q) = x^2 - (p+q)x + p.q$, So $p + q = 63$ and p . q = k. Since 63 is odd, one of the primes must be 2 and the other 61. Thus there is exactly one possible value for k, namely k = p . q = 2 . 61 = 122.

5. Two rays with common endpoint O form a 30^o angle. Point A lies on one ray, point B on the other ray, and AB = 1. The maximum possible length of OB is

(A) 1 (B) $\frac{1+\sqrt{3}}{\sqrt{2}}$

(C) $\sqrt{3}$ (D) 2

5. D

Sol. By the Law of Sines,

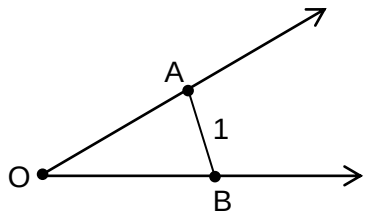
$$\frac{OB}{\sin\angle OAB} = \frac{AB}{\sin\angle AOB} = \frac{1}{1/2},$$

So

$$OB = 2\sin\angle OAB \le 2\sin 90^o = 2,$$

with equality if and only if

$$\angle OAB = 90^o$$



6. A list of integers has mode 32 and mean 22. The smallest number in the list is 10. The median m of the list is a member of the list. If the list member m were replaced by m + 10, the mean and median of the new list would be 24 and m + 10, respectively. If m were instead replaced by m – 8, the median of the new list would be m – 4. What is m?

(A) 16 (B) 17

(C) 18 (D) 20

6. D

Sol. When 10 is added to a number in the list, the mean increases by 2, so there must be five numbers in the original list whose sum is 5 . 22 = 110. Since 10 is the smallest number in the list and m is the median, we may assume $10 \le a \le m \le b \le c$, denoting the other members of the list by a, b and c. Since the mode is 32, we must have b = c = 32; otherwise, $10 + m + a + b + c$ would be larger than 110. So $a + m = 36$. Since decreasing m by 8 decreases the median by 4, a must be 4 less than m. Solving a + m = 36 and m – a = 4 for m gives m = 20.

7. Six numbers from a list of nine integers are 7, 8, 3, 5, 9 and 5. The largest possible value of the median of all nine numbers in this list is

(A) 5 (B) 6

(C) 7 (D) 8

7. D

Sol. The largest possible median will occur when the three numbers not given are larger than those given. Let a, b and c denote the three missing numbers, where $9 \le a \le b \le c$. Ranked from smallest to largest, the list is 3, 5, 5, 7, 8, 9, a, b, c, so the median value is 8.

8. At the end of 1994 Walter was half as old as his grandmother. The sum of the years in which they were born is 3844. How old will Walter be at the end of 1999?

(A) 48 (B) 49

(C) 53 (D) 55

8. C

Sol Let ω and 2ω denote the ages of Walter and his grandmother, respectively, at the end of 1994. Then their respective years of birth are $1994-\omega$ and $1994-2\omega$. Hence $(1994-\omega)+(1994-2\omega)=3844$, and it follows that $\omega=48$ and Walter's age at the end of 1999 will be 53.

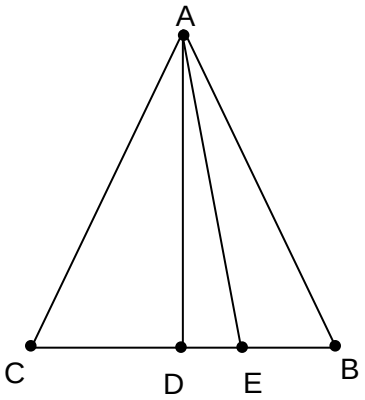
9. In triangle ABC, AB = 13, BC = 14, and AC = 15. Let D denote the midpoint of $\overline{BC}$ and let E denote the intersection of $\overline{BC}$ with the bisector of angle BAC. Which of the following is closest to the area of the triangle ADE?

(A) 2 (B) 2.5

(C) 3 (D) 3.5

9. C

Sol. Since the edges of the triangle are known, we can use Heron's Formula to find the area. The area of triangle ABC is $\sqrt{(21)(8)(7)(6)}$, which is 84, so the altitude from vertex A is $\frac{2(84)}{14}=12$. The mid point D divides $\overline{BC}$ into two segments of length 7, and the bisector of angle BAC divides $\overline{BC}$ into segments of length $14\left(\frac{13}{28}\right)=6.5$ and $14\left(\frac{15}{28}\right)=7.5$ (since the angle bisector divides the opposite side into lengths proportional to the remaining two sides). Thus the triangle ADE has been DE = 7 – 6.5 = 0.5 and altitude 12, so its area is 3.



10. Letters A, B, C and D represent four different digits selected from 0, 1, 2,…..,9. If $\frac{(A+B)}{(C+D)}$ is an integer that is as large as possible what is the value of A + B?

(A) 13 (B) 14

(C) 15 (D) 17

10. D

Sol. We need to make the numerator large while making the denominator small. The smallest the denominator can be is 0 + 1 =1. The largest the numerator can be is 9 + 8 = 17. The fraction $\frac{17}{1}$ is an integer, so A + B = 17.

11. In triangle ABC, $3\sin A + 4\cos B = 6$ and $4\sin B + 3\cos A = 1$. Then $\angle C$ in degrees is

(A) 30 (B) 60
(C) 150 (D) 120

11. A

Sol. Square both sides of the equations and add the results to obtain

$$9\left(\sin^2 A + \cos^2 A\right) + 16\left(\sin^2 B + \cos^2 B\right)$$
$$+24\left(\sin A\cos B + \sin B\cos A\right) = 37$$

Hence, $24\sin(A+B) = 12$. Thus $\sin(A+B) = \frac{1}{2} \Rightarrow A + B = 150^o$ or $A + B = 30^o$

If $A + B = 150^o$ then $\angle C = 30^o$ and if $A + B = 30^o$ then $\angle C = 150^o$ which is impossible because it would imply that $A < 30^o$ and consequently that $3\sin A + 4\cos B < 3.\frac{1}{2} + 4 < 6$, a contradiction. Therefore $\angle C = 30^o$.

12. Two different prime numbers between 4 and 18 are chosen. When their sum is subtracted from their product, which of the following numbers could be obtained?

(A) 21 (B) 60
(C) 119 (D) 180

12. C

Sol. There are five prime numbers between 4 and 18 : 5, 7, 11, 13 and 17. Hence the product of any two of these is odd and the sum is even. Because $xy - (x + y) = (x - 1)(y - 1) - 1$ increases as either x or y increases (since both x and y are bigger than 1), the answer must be an odd number that is no smaller than 23 = 5 . 7 – (5 + 7) and no larger than 191 = 13 . 17 – (13 + 17). The only possibility among the options is 119.

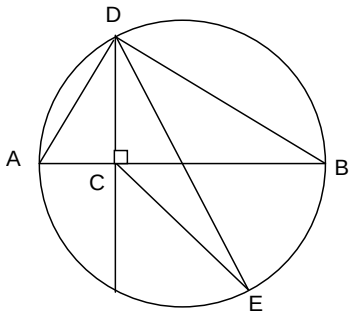
13. Let N, T and S be nonnegative integers such that $N + T + S = 12$. What is the maximum value of $NTS + NT + TS + SN$?

(A) 62 (B) 72
(C) 73 (D) 112

13. D

Sol. Note that $NTS + NT + TS + SN =$ $(N+1)(T+1)(S+1) - (N+T+S) - 1 = pqr - 13$, where p, q, and r are positive integers whose sum is 15. Now pqr is largest when p = 5, q = 5, and r = 5. Thus the answer is 5 . 5 . 5 – 13 = 112.

14. Let $\overline{AB}$ be a diameter of a circle and C be a point on $\overline{AB}$ with 2AC = BC . Let D and E be points on the circle such that $\overline{DC} \perp \overline{AB}$ and $\overline{DE}$ is a second diameter. What is the ratio of the area of ΔDCE to the area of ΔABD?

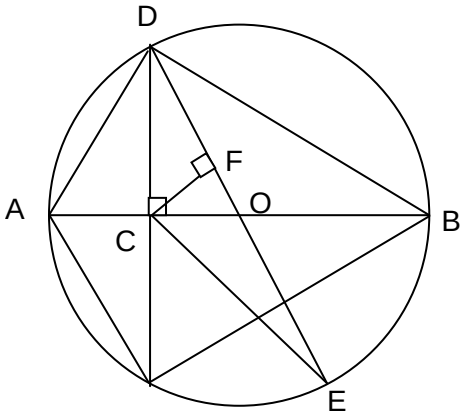


(A) $\frac{1}{6}$ (B) $\frac{1}{4}$

(C) $\frac{1}{3}$ (D) $\frac{1}{2}$

14. C

Sol. Let O be the center of the circle. Each of ΔDCE and ΔABD has a diameter of the circle as a side. Thus the ratio of their areas is the ratio of the two altitudes to the diameters. These altitudes are $\overline{DC}$ and the altitude from C to $\overline{DO}$ in ΔDCE. Let F be the foot of this second altitude. Since ΔCFO is similar to ΔDCO,



$$\frac{\text{Area}(\Delta DCE)}{\text{Area}(\Delta ABD)} = \frac{CF}{DC} = \frac{CO}{DO} = \frac{AO - AC}{DO} = \frac{\frac{1}{2}AB - \frac{1}{3}AB}{\frac{1}{2}AB} = \frac{1}{3}.$$

15. The quadratic equation $x^2 + mx + n = 0$ has roots that are twice those of $x^2 + px + m = 0$, and none of m, n, and p is zero. What is the value of $\frac{n}{p}$?

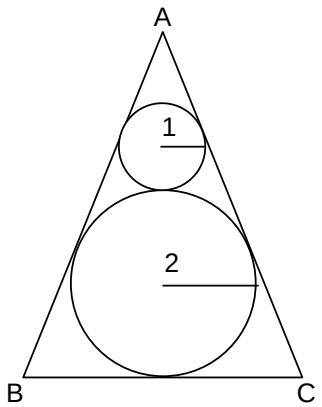
(A) 1 (B) 2

(C) 4 (D) 8

15. D

Sol. The roots of $\left(\frac{x}{2}\right)^2 + p\left(\frac{x}{2}\right) + m = 0$ are twice those of $x^2 + px + m = 0$. Since the first equation has the same roots as the equation $x^2 + 2px + 4m = 0$, we have $m = 2p$ and $n = 4m$, so $\frac{n}{p} = 8$.

16. A circle of radius 1 is tangent to a circle of radius 2. The sides of ΔABC are tangent to the circles as shown, and the sides $\overline{AB}$ and $\overline{AC}$ are equal. What is the area of ΔABC?

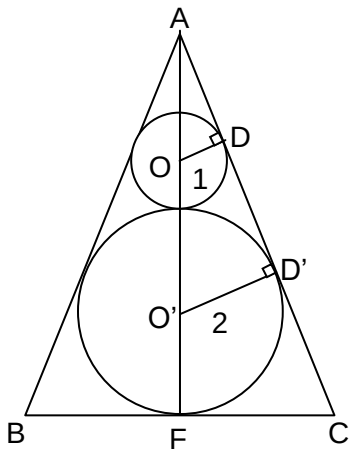


(A) $\frac{35}{2}$ (B) $15\sqrt{2}$

(C) $\frac{64}{3}$ (D) $16\sqrt{2}$

16. D

Sol. Let O and O' denote the centres of the smaller and larger circles, respectively. Let D and D' be the points on $\overline{AC}$ that are also on the smaller and larger circles, respectively.



Since ΔADO and $AD'O'$ are similar right triangles, we have

$\frac{AO}{1} = \frac{AO'}{2} = \frac{AO+3}{2}$, so AO = 3

As a consequence, $AD = \sqrt{AO^2 - OD^2} = \sqrt{9-1} = 2\sqrt{2}$.

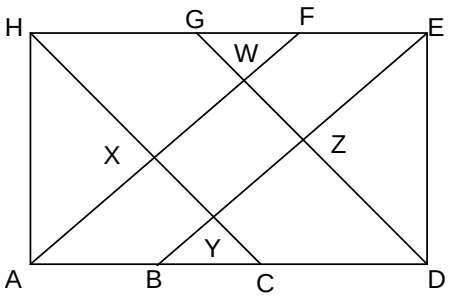
Let F be the midpoint of $\overline{BC}$. Since ΔADO and ΔAFC are similar right triangles, we have

$\frac{FC}{1} = \frac{AF}{AD} = \frac{AO+OO'+O'F}{AD} = \frac{3+3+2}{2\sqrt{2}} = 2\sqrt{2}$

Thus $BC = 2FC = 4\sqrt{2}, AF = 8$, and

$\text{Area}(\Delta ABC) = \frac{1}{2}.BC.AF = \frac{1}{2}.4\sqrt{2}.8 = 16\sqrt{2}$.

17. In a rectangle ADEH, points B and C trisect $\overline{AD}$, and points F and G trisect $\overline{HE}$. In addition, AH = AC = 2. What is the area of quadrilateral WXYZ shown in the figure?



(A) $\frac{1}{2}$ (B) $\frac{\sqrt{2}}{2}$

(C) $\frac{\sqrt{3}}{2}$ (D) $\frac{2\sqrt{2}}{3}$

17. A

Sol. First note that since point B and C trisect $\overline{AD}$, and points G and F trisect $\overline{HE}$, we have $HG = GF = EF = AB = BC = CD = 1$.

Also, $\overline{HG}$ is parallel to $\overline{CD}$ and $HG = CD$, So CDGH is a parallelogram. Similarly, $\overline{AB}$ is parallel to $\overline{FE}$ and AB = FE, so ABEF is a parallelogram. As a consequence, WXYZ is a parallelogram, and since HG = CD = AB = FE, it is a rhombus.

Because AH = AC = 2, the rectangle ACFH is a square of side length 2. Its diagonals $\overline{AF}$ and $\overline{CH}$ have length $2\sqrt{2}$ and form a right angle at X. As a consequence, the rhombus W X Y Z is a square. In isosceles ΔHXF we have HX = XF $= \sqrt{2}$. In addition, $HG = \frac{1}{2}HF$.

So, $XW = \frac{1}{2}XF = \frac{1}{2}\sqrt{2}$, and $\text{Area}(\text{Square W X Y Z}) = (XW)^2 = \frac{1}{2}$.

18. ABCD is a parallelogram in which AB = 21 cm, BC = 13 cm and BD = 14 cm. Find AC

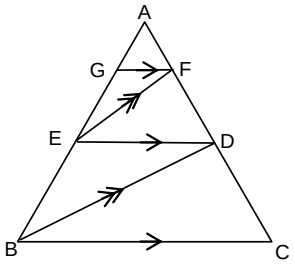
(A) 16 cm (B) 32 cm

(C) 24 cm (D) 28 cm

18. B

Sol. Let diagonals AC and BD intersect at O then by Apollonius Theorem,
$AB^2 + BC^2 = 2\left(AO^2 + BO^2\right)$
$\Rightarrow AO = 16 \text{ cm} \Rightarrow AC = 32 \text{ cm}$

19. In the given figure, AG = GE and $GF \| ED, EF \| BD$ and $ED \| BC$. Find $\dfrac{ar(EFG)}{ar(BCDE)}$



(A) $\frac{1}{12}$ (B) $\frac{1}{2}$
(C) $\frac{2}{3}$ (D) $\frac{1}{6}$

19. A
Sol. By converse of mid point theorem, we can see that G, F, E and D are midpoints of AE, AD, AB and AC respectively. Therefore GF, EF, ED and BD are medians in triangles AFE, AED, ADB and ABC.
Now let $ar(AGF) = x$ then $ar(AEF) = 2x = ar(EFD), ar(AED) = 4x = ar(EDB)$ and $ar(ABD) = 8x = ar(BDC)$
$\Rightarrow ar(EFG) : ar(BCDE) = 1:12$

20. A polynomial $f(x)$ satisfies $(2-x)f(x) - 2f(3-x) = -x^3 + 5x - 18$ for all real numbers x. Find $f(0)$.
(A) 3 (B) 5
(C) 6 (D) 7

20. D
Sol. Set x = 0 and x = 3 to obtain the system
$\begin{cases} 2f(0) - 2f(3) = -18, \\ -f(3) - 2f(0) = -30 \end{cases}$
We can solve for $f(0)$ from the system and obtain $f(0) = 7$

Section – III
Physics
(1 – 13)

1. The atom bomb is based on
(A) chemical reaction (B) nuclear fission
(C) nuclear fusion (D) atomic collision

1. B
Sol. An atom bomb is based on nuclear fission.

2. Energy required to accelerate a car from 10 ms^{-1} to 20 ms^{-1} compared with that required to accelerate it from 0 to 10 ms^{-1} is
(A) twice (B) three times
(C) four times (D) same

2. B
Sol. Case 1:

Energy required, $E_1 = ½ m (20^2 - 10^2) = 150m$ J
Case 2:
Energy required, $E_2 = ½ m (10^2 – 0^2) = 50m$ J
$E_1/E_2 = 150m/50m = 3$.

3. If R is the radius of the earth, then the height above the earth's surface where the value of "acceleration due to gravity" will be half its value at the earth's surface, is
(A) R (B) $\sqrt{2}$R
(C) $(2-\sqrt{2})$R (D) $(\sqrt{2}-1)$R

3. D

Sol. $g_h = g[\frac{R}{R+h}]^2$

⇨ $g/2 = g[\frac{R}{R+h}]^2$

⇨ $\frac{1}{\sqrt{2}} = \frac{R}{R+h}$

⇨ $R+ h = \sqrt{2}R$

⇨ $h = R(\sqrt{2} - 1)$

4. Light of certain colour has 2000 waves per millimetre in air. What will be wavelength of this light in medium of refractive index 1.25?
(A) 1000 Å (B) 2000 Å
(C) 3000 Å (D) 4000 Å

4. D

Sol. Wavelength in air = distance/ no. of waves
= 1/2000 mm = 5000 Å

So, $\lambda_{air} = 5000$ Å

$\lambda_{med} = \frac{\lambda_{air}}{n_{med}}$;

$\lambda_{med} = \frac{5000}{1.25} = 4000$ Å

5. A person standing near the edge of the top of a building throws two balls A and B. The ball A is thrown vertically upward and B is thrown vertically downward with the same speed.
The ball A hits the ground with a speed v_A and the ball B hits the ground with a speed v_B. We have
(A) $v_A > v_B$
(B) $v_A < v_B$
(C) $v_A = v_B$
(D) The relation between v_A and v_B depends on height of the building above the ground

5. C

Sol. Using 3rd equation of motion in both cases.
$V_A^2 = U^2 + 2(–g) (–h) \rightarrow$ upward
$V_B^2 = U^2 + 2gh \rightarrow$ downward

6. The critical angle for light going from medium x into medium y is θ. The speed of light in medium x is v. The speed of light in medium y is

(A) $v(1 - \cos\theta)$ (B) $\frac{v}{\sin\theta}$

(C) $\frac{v}{\cos\theta}$ (D) $v\cos\theta$

6. B

Sol. $\text{Sin}\,\theta = \frac{1}{n_{xy}} = \frac{n_y}{n_x} = \frac{v_x}{v_y}$

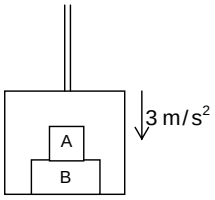
$v_y = \frac{v_x}{\sin\theta} = \frac{v}{\sin\theta}$

7. The frequency of a source is 20 kHz. The frequencies of the sound waves produced by it in water and air will
(A) be the same as that of the source
(B) depend upon the velocity of the waves in these media
(C) depend upon the wavelength of the waves in these media
(D) depend upon the density of the media

7. A

Sol. Frequency is a property of source.

8. The elevator shown in figure is descending with an acceleration of 3 m/s^2. The mass of the block A is 1 kg. The force exerted by the block B on A is
(A) 3 N
(B) 4 N
(C) 6 N
(D) 7 N



8. D

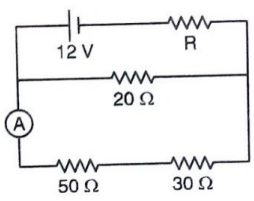
Sol. The force exerted by the block B on A, is equal to the force exerted by block A on B, $F = m(g - a)$.

9. A sphere has a hollow portion which is one-third of its total volume. It floats in water with four-fifth of its volume immersed. The specific gravity of its material is
(A) 0.9 (B) 1.2
(C) 1.8 (D) 2.4

9. B

Sol. Actual volume of material of sphere = 2V/3
Upthrust = wt. of water displaced = 1000 × (4V/5)g = 800Vg
While floating, Wt. of sphere = upthrust
$\rho \times (2V/3)g = 800Vg$
$\rho = 1200\ kg/m^3$
Specific gravity = relative density = 1200/1000 = 1.2.

10. In the given circuit, the ammeter A, assumed to have negligible resistance, reads 0.1 A. The value of R is
(A) 6 Ω
(B) 8 Ω
(C) 16 Ω
(D)) 20 Ω



10. B

Sol. V across (80 Ω = 50 Ω +30 Ω) resistor = 0.1 × 80 = 8 V

$I_{20\Omega}$= 8/20 = 0.4 A

So, R = (12−8) / 0.5 = 8 Ω

11. In a hydraulic press, f and F are the forces acting on the small piston and the large piston having diameters d and D respectively. Then f / F is

(A) $\frac{D^2}{d^2}$ (B) $\frac{d}{D}$

(C) $\frac{d^2}{D^2}$ (D) $\sqrt{\frac{D}{d}}$

11. C

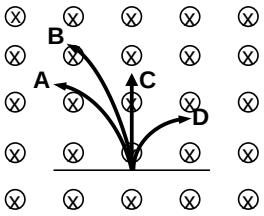
Sol. According to Pascal`s law

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$\frac{f}{\pi(d/2)(d/2)} = \frac{F}{\pi(D/2)(D/2)}$$

$$\therefore \frac{f}{F} = \frac{d \times d}{D \times D} = d^2/D^2 .$$

12. A neutron, a proton, an electron and an α-particle enter a region of uniform magnetic field with equal velocities. The magnetic field is perpendicular and directed into the paper. The tracks of particles are labelled A, B,C and D, as in figure. The electron follows the track:



(A) A (B) B

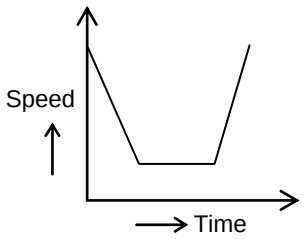
(C) C (D) D

12. D

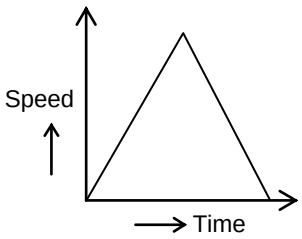
Sol. Using Fleming`s left hand rule.

13. Which graph represents the case of a cricket ball thrown vertically upwards is returning to the hands of the thrower?

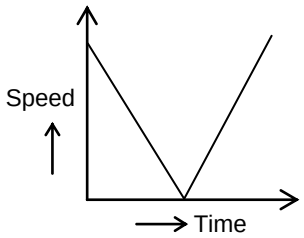
(A)



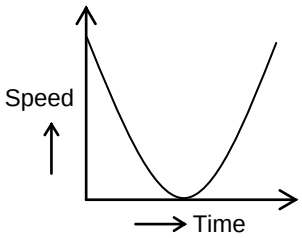
(B)



(C)



(D)



13. C

Sol. While going up speed of the object is decreasing uniformly and it becomes zero at the top. While coming down its speed increases uniformly.

Section – IV
Chemistry
(1 – 13)

1. On mixing ethyl acetate with aqueous sodium chloride, the composition of the resultant solution is:
   (A) $CH_3COOC_2H_5$ + NaCl (B) $CH_3COONa + C_2H_5OH$
   (C) $CH_3COCl + C_2H_5OH$ + NaOH (D) $CH_3Cl + C_2H_5COONa$

1. B

Sol. On mixing ethyl acetate with aqueous sodium chloride, the composition of the resultant solution is $CH_3COONa + C_2H_5OH$.

2. In a period, form the left to right, the electron affinity increases, but alkaline earth metals have lower electron affinity than alkali metals because
   (A) Alkaline earth metals have lesser atomic radius than alkali metals
   (B) Alkaline earth metals have higher electomagnetavity than alkali metals
   (C) Alkaline earth metals have completely filled s-orbitals
   (D) Alkaline earath metals have lesser electronegativity than alkali metals

2. C

Sol. In a period, form the left to right, the electron affinity increases, but alkaline earth metals have lower electron affinity than alkali metals because alkaline earth metals have completely filled s-orbitals.

3. Which of the following process is associated with release of energy?
   (A) $Li \longrightarrow Li^+ + e^{\ominus}$ (B) $O^{\ominus} + e^{\ominus} \longrightarrow O^{2-}$
   (C) $Cl^{\oplus} + e^{\ominus} \longrightarrow Cl$ (D) $Be + e^{\ominus} \longrightarrow Be^{\ominus}$

3. C

Sol. $Cl^{\oplus} + e^{\ominus} \longrightarrow Cl$ process is associated with release of energy.

4. Which of the following is correct order of atomic radii?
   (A) Li > Be > B > O > C > N (B) O < N < C < B < Be < Li
   (C) Li < Be < B < C < N < O (D) O < C < N < Be < B < Li

4. B

Sol. O < N < C < B < Be < Li is the correct order of atomic radii.

5. Which one of the folloiwng four metal would be displaced from the soution of salts by other three metals?
   (A) Mg (B) Ag
   (C) Zn (D) Cu

5. B

Sol. Ag would be displaced from the soution of salts by other three metals.

6. In an element (X) number of electron is 15 and number of neutrons is 16. It reacts with hydrogen to form XH_3. What are the number of electrons present in its second shell and what is the nature of this element?
   (A) 5, Metal (B) 8, Metal
   (C) 8, Non-metal (D) 5, Non-metal

6. C

Sol. 8, Non-metal. .

7. Which is a redox reaction?

(A) $2CuI_2 \longrightarrow CuI + I_2$

(B) $NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$

(C) $NH_4Cl + NaOH \longrightarrow NH_3 + NaCl + H_2O$

(D) $Cr_2(SO_4)_3 + 6KOH \longrightarrow 2Cr(OH)_3 + 3K_2SO_4$

7. A

Sol. $2CuI_2 \longrightarrow CuI + I_2$ is a redox reaction.

8. X is formed by partial replacement of hydroxyl groups of a diacidic base by an acidic radical. The number of ionisable hydroxyl groups in X is

(A) 0 (B) 1

(C) 2 (D) 3

8. B

Sol. The number of ionisable hydroxyl groups in X is 1.

9. Silver jewellery becomes black on prolonged exposure to air. It is due to the formation of

(A) Ag_3N (B) Ag_2O

(C) Ag_2S and Ag_3N (D) Ag_2S

9. D

Sol. Silver jewellery becomes black on prolonged exposure to air. It is due to the formation of Ag_2S.

10. Which of the following has maximum number of molecules?

(A) 7 gram nitrogen (g) (B) 26 gram nitrous oxide (g)

(C) 2 grams hydrogen (g) (D) 16 grams oxygen (g)

10. C

Sol. 2 grams hydrogen (g) has maximum number of molecules.

11. If 0.5 molesof $BaCl_2$ is mixed with 0.2 moles of Na_3PO_4, the maximum molesof $Ba_3(PO_4)_2$ obtained is

(A) 0.2 (B) 0.5

(C) 0.3 (D) 0.1

11. D

Sol. $3\ BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaCl$

Limiting reagent is Na_3PO_4, the number of moles of $Ba_3(PO_4)_2$ produced = $\frac{0.2}{2} = 0.1$moles.

12. When ice melts, its particles

(A) gain energy and begin to move (B) move far away and gain energy

(C) lose energy and begin to move (D) move far away and lose energy

12. A

Sol. When ice melts, its particles gain energy and begin to move.

13. Discoveries of isotopes and isobars contradict some of the postutates of ___ atomic theory.

(A) Bohr's (B) Dalton's

(C) Rutherford's (D) Thomson's

13. B

Sol. Discoveries of isotopes and isobars contradict some of the postutates of Dalton's atomic theory.

Section – V

Biology

(1 –14)

1. Oxidation of glucose mainly takes place in _____
   (A) Heart (B) mitochondria
   (C) chloroplast (D) Golgi body

1. B

Sol. Oxidation of glucose mainly takes place in mitochondria.

2. The first stable compound formed during Calvin cycle is
   (A) Rubisco (B) 3–phosphoglyceric acid
   (C) Pyruvate (D) Acetyl CoA

2. B

Sol. The first stable compound formed during Calvin cycle is 3–phosphoglyceric acid.

3. Blood group A can be given only to persons with blood group:
   (A) B (B) AB
   (C) O (D) A and AB

3. D

Sol. Blood group A can be given only to persons with blood group A and AB.

4. The respiratory organ of cockroach is
   (A) skin (B) lungs
   (C) trachea (D) gills

4. C

Sol. The respiratory organ of cockroach is trachea.

5. Protein digestion starts in:
   (A) mouth (B) stomach
   (C) duodenum (D) small intestine

5. B

Sol. Protein digestion starts in stomach.

6. Growth of pollen tube towards the ovule is an example of:
   (A) hydrotropism (B) chemotropism
   (C) geotropism (D) phototropism

6. B

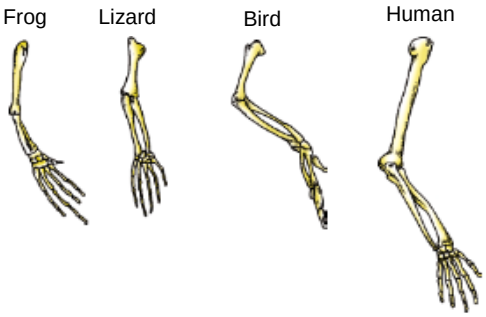
Sol. Growth of pollen tube towards the ovule is an example of chemotropism.

7. Less secretion of growth hormones leads to
   (A) Gigantism (B) Dwarfism
   (C) Goitre (D) Diabetes

7. B

Sol. Less secretion of growth hormones leads to Dwarfism.

8. This diagram shows



(a) Convergent evolution (b) Homologous organ
(c) Analogous organ (d) Both (b) and (c)

8. B

Sol. It's an example of homologous evolution.

9. Which of the following is upright in all the ecosystems?
(A) Pyramid of number (B) Pyramid of energy
(C) Pyramid of biomass (D) All the above

9. B

Sol. Pyramid of energy is always upright in all ecosystems.

10. Hunger, temperature, thirst and water balance in our body are controlled by
(A) Cerebellum (B) Hypothalamus
(C) Cerebrum (D) None of these

10. B

Sol. Hunger, temperature, thirst and water balance in our body are controlled by hypothalamus.

11. There are how many pairs of spinal nerves in a human?
(A) 8 (B) 12
(C) 25 (D) 31

11. D

Sol. 31 pairs of spinal nerves are present in humans.

12. Fertilization is the fusion of
(A) diploid spermatozoa with diploid ovum to form diploid zygote
(B) haploid spermatozoa with diploid ovum to form diploid zygote
(C) diploid spermatozoa with haploid ovum to form diploid zygote
(D) haploid spermatozoa with haploid ovum to form diploid zygote

12. D

Sol. Fertilization is the fusion of haploid spermatozoa with haploid ovum to form diploid zygote.

13. A color-blind mother and normal father would have:
(A) color-blind son and carrier daughters (B) color-blind sons and daughters
(C) all color-blind (D) all normal

13. A

Sol. A color-blind mother and normal father would have color-blind son and carrier daughters.

14. Which two organelles are present in both plant and animal cells?
(A) Cell wall & Cytoplasm (B) Plastid & Mitochondria
(C) Cell Membrane & Cytoplasm (D) Cell Membrane & Plastid

14. C

Sol. Cell Membrane & Cytoplasm are present in both plant and animal cells.

ANSWER KEYS
MOCK TEST – 4
for
NTSE STAGE – I
(All Class X Batches)

Mental Ability Test

QP CODE:

ANSWERS
Section – I
Social Science

Section – II
Mathematics

Section – III
Physics

Section – IV
Chemistry

Section – V
Biology

Hints & Solutions