

FIITJEE INTERNAL TEST

MOCK TEST - 2

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. Match the following :

Group A

(states)

1. Kerala
2. Orissa
3. Madhya Pradesh
4. Andhra Pradesh

Group B

(Lakes)

- (a) Kolleru
- (b) Tawa
- (c) Vembanad
- (d) Chilka

Codes:

(A) 1 – B, 2 – C, 3 – A, 4 – D

(B) 1 – A, 2 – B, 3 – D, 4 – C

(C) 1 – D, 2 – C, 3 – A, 4 – B

(D) 1 – C, 2 – D, 3 – B, 4 – A

1. D

Sol. Lake Vembanad in Kerala, Chilka in Orissa, Tawa in Madhya Pradesh and Kolleru in Andhra Pradesh.

2. Where is Ganga river named as “Meghna”

- (A) When Ganga enters in Farakka, West Bengal
- (B) When Ganga river flow westwards
- (C) When Ganga reaches Haridwar
- (D) After joining with Brahmaputra river

2. D

Sol. Ganga river named as ‘Meghna’ after joining with Brahmaputra river.

3. Match List – I (Rivers) with List – II (Origin) and select the correct answer using the codes given below:

List – I

Rivers

- A. Godavari
- B. Krishna
- C. Narmada
- D. Vaigai

(A) A – IV, B – II, C – III, D – I

(C) A – I, B – III, C – IV, D – II

List – II

Origin

1. Cardamom hills
2. Amarnatak Hills
3. Nasik hills
4. Mahabaleshwar

(B) A – III, B – IV, C – II, D – I

(D) A – II, B – I, C – IV, D – III

3. B

Sol. Godavari → Nasik hills, Krishna → Mahabaleshwar, Narmada → Amarnatak Hills, Vaigai → Cardamom hills

4. Assertion (A): Kharif crops are grown, with the onset of monsoon in different parts of India and harvested September – October.

Reason (R): Availability of precipitation due to the western temperate cyclones helps in growing of these crops.

- (A) Both A and R are true and R explains A
- (B) Both A and R are true but R does not explain A
- (C) A is true and R is false
- (D) A is false and R is true

4. A

Sol. Both A and R are true and R explains A

5. Assertion (A): The Coriolis force is responsible for deflecting winds towards the right in the northern hemisphere and towards the left in the southern hemisphere.

Reason (R): The pressure and wind system of any area depend on the latitude and altitude of the place.

- (A) Both A and R are true and R explains A

- (B) Both A and R are true but R does not explain A
- (C) A is true and R is false
- (D) A is false and R is true

5. B

Sol. Both A and R are true but R does not explain A

6. Assertion (A) : Coal is a fossil fuel.

Reason(R): It is formed due to compression of inorganic material over millions of years.

- (A) Both A and R are true and R explains A
- (B) Both A and R are true but R does not explain A
- (C) A is true and R is false
- (D) A is false and R is true

6. C

Sol. In India, Coal is the most abundantly available fossil fuel. It is formed due to compression of plant material over millions of years.

7. Assertion (A): The sun rises in Arunachal Pradesh about two hours before Gujarat.

Reason(R): Arunachal Pradesh is on a higher latitude than Gujarat. Select the correct option from the given alternatives.

- (A) Both A and R are true and R explains A
- (B) Both A and R are true but R does not explain A
- (C) A is true and R is false
- (D) A is false and R is true

7. B

Sol. From Gujarat to Arunachal Pradesh there is a time lag of 2 hours. The latitudinal extent influences the duration of the day and night, as one moves from south to north. Arunachal Pradesh lies on the easternmost longitude hence sun rises first in the state.

8. Assertion (A): The Himalayan ranges show change in vegetation from tropical to tundra.

Reason (R) : In mountainous area with increase in altitude there is corresponding decrease in temperature, which leads to change in vegetation types.

- (A) Both A and R are true and R explains A
- (B) Both A and R are true but R does not explain A
- (C) A is true and R is false
- (D) A is false and R is true

8. A

Sol. In mountainous area, the decrease in temperature with increasing altitude leads to the corresponding change in natural vegetation

9. Which one of the following is the best strategy for environment friendly, sustainable development in Indian agriculture?

- (A) Expansion of cultivable land, increased use of super phosphate urea and effect biocides.
- (B) Wider popularization of high yielding crop varieties, better and more frequent irrigation and increased frequency of aerial sprays of inorganic fertilizers and pesticides
- (C) Mixed cropping, organic manures, nitrogen fixing plants and pest resistant crop varieties
- (D) Improved farm implements and machinery, use of potent insecticides to minimize post harvest grain losses and monoculture cropping practices.

9. C

Sol. Mixed cropping, organic manures, nitrogen fixing plants and pest resistant crop varieties.

10. Which of the following east-flowing rivers of India has rift valley due to down warping?

- (A) Damodar
- (B) Mahanadi
- (C) Son
- (D) Yamuna

10. A

Sol. Damodar river has rift valley due to down warping.

11. When you travel in Himalayas, you will see the following :

- 1. Deep gorges
- 2. U-turn river courses

3. Parallel mountain ranges
Which of the above can be said to be the evidences for Himalayas being young fold mountains?

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

11. D

Sol. All of the above process are related to the formation of Himalaya.

12. Assertion (A): After the 1905 revolution in Russia, Duma or the first elected consultative parliament came into existence.

Reason (R): The power of Tsar was curbed by it

- (A) Both A and R are true and R explains A
(B) Both A and R are true but R does not explain A
(C) A is true and R is false
(D) A is false and R is true

12. C

Sol. After 1905 revolution, Duma came into existence but not the power of Tsar was curbed by it.

13. Arrange in correct chronological order:

- I. Dawes plan
II. Crashing of the Wall Street Exchange
III. Birth of Weimar Republic
IV. Creation of Gestapo (Secret State Police)

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

13. D

Sol. Birth of Weimar Republic, Dawes plan, Crash of wall street and Gestapo creation.

14. Which dynasty was ruling in France when the French Revolution took place?

- (A) The Tudor dynasty
(B) The Bourbon family
(C) The Mughals
(D) The Czar family

14. B

Sol. The Bourbon family was ruling in France when the French Revolution took place.

15. By what name were the dalits referred by M. K. Gandhi?

- (A) Untouchables
(B) Shudras
(C) Harijans
(D) Achuths

15. C

Sol.

16. Justice Party of Madras was a party of:

- (A) judges and lawyers
(B) non-brahmins
(C) non-Muslims
(D) non-Tamils

16. B

Sol. Justice Party of Madras was a party of non-brahmins.

17. In which of the following places did the official unification of Germany as Nation state in 1871 took place?

- (A) Brussels in Germany
(B) Bonn in Prussia
(C) Moscow in Russia
(D) Versailles in France

17. D

Sol. Unification of Germany was taken place at Versailles in France.

18. Identify the false statement regarding Rowlatt Act.

- (A) It was passed by imperial legislative council which had no Indian representation
(B) It was passed by imperial legislative council in spite of opposition from Indian members
(C) Rowlatt Act allowed detention of political prisoners for a period of 2 years without trial
(D) Rowlatt Act was passed in 1920 as an outcome of Khilafat movement

18. A
Sol. Imperial legislation council has no Indian representative.
19. Which of the following statements regarding steam engine are true?
 a. James watt's discovery of Steam engine got patent
 b. The usage of steam engine was very widespread in steel industry
 c. The steam engine enhanced the industrial productivity manifold
 d. Before James watt, Newcomen invented the primitive form of steam engine
 (A) a, b, c (B) a, c, d
 (C) b, c, d (D) a, b, c
19. B
Sol. A, C and D statements are true.
20. Which of the following statements regarding Martin Luther is wrong?
 (A) He was one of the main Protestant Reformers
 (B) He published theses criticizing Roman Catholic Church
 (C) He was the first person associated with publishing of first printed book, Bible
 (D) He was the person associated with the publishing of New Testament of Bible
20. D
Sol. Martin Luther 1st published New Testament of Bible.

21. Where was Mazzine born in 1807?
 (A) Rome (B) Berlin
 (C) Genoa (D) Sicily
21. C
Sol.

22. After the persecution of Hickey, who started the publication of weekly magazine of Bengal Gazette?
 (A) Rammohan Roy (B) Gangadhar Bhattacharya
 (C) Tejbahadur (D) Abindranath Tagore
22. B
Sol. Gangadhar Bhattacharya started the publication 'Bengal Gazette'.

23. Match List – I with List – II and select the answer using the codes given below:

	List – I		List – II
A	Supervises the overall functioning of all the political institutions in the country	1	The Supreme Court
B	Distributes and redistributes work to the ministers	2	The President
C	Ministers may have different views but have to won up every decision	3	The Prime Minister
D	Determines the constitutionality of any contentious action	4	The Cabinet

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

23. B
Sol. Supervises the overall functioning of all the political institutions in the country → The President, Distributes and redistributes work to the ministers → The Prime Minister, Ministers may have different views but have to won up every decision → The Cabinet, Determines the constitutionality of any contentious action → The Supreme Court
24. Under the writ of Mandamus, the Court can
 (A) Ask the person to be produced
 (B) Order to transfer the case from one court
 (C) Ask to let a person free for a temporary period

- (D) Direct the Government to do or not to do a thing
24. D
- Sol. Under the writ of mandamus, the court can direct the government to do or not to do a thing.
25. Which of the following arguments against prescribing educational qualification for elected representatives are true?
- I. Education qualification will deprive illiterate citizens of the right to contest elections.
 II. Relevant qualification for being elected representatives is not education but ability to addresses people's problems.
 III. Educated elected representatives keep distance from the common people
 IV. It is easier for the educated elected representatives to use power for personal gains
 V. it should be left to the voters to decide how much importance is to be given to educational qualification of a candidate
- (A) I, II and IV only (B) I, II and V only
 (C) I, IV and V only (D) I, II and III only
25. B
- Sol. Education qualification will deprive illiterate citizens of the right to contest elections, Relevant qualification for being elected representatives is not education but ability to addresses people's problems and it should be left to the voters to decide how much importance is to be given to educational qualification of a candidate.
26. Fundamental Rights of the citizens are:
- (A) non-justiciable
 (B) justiciable
 (C) justiciable if the highest court feels it should be
 (D) some rights are justiciable while other are not
26. B
- Sol. Fundamental Rights of the citizen are justiciable.
27. Dictatorship is a government in which
- (A) The entire power of the government is held by a single person
 (B) The dictatorship is tolerant of any opposing group
 (C) There is individual liberty
 (D) There is freedom of speech and press
27. A
- Sol. It is a government in which the entire power of the government is help of a single person.
28. The concept of welfare state is included in which part of the Indian Constitution?
- (A) The Preamble of the Constitution
 (B) Fundamental Rights
 (C) Directive Principles of the State Policy
 (D) 4th schedule of the Constitution
28. C
- Sol. Concept of welfare state is the part of the Directive principals of the state policy.
29. The Constituent Assembly that framed the Constitution of Independent India was set up
- (A) Under the Indian Independence Act, 1947
 (B) By the Indian National Congress
 (C) Under the Cabinet Mission Plan
 (D) Through a resolution of the provisional government
29. C
- Sol. The constituent assembly was framed under 'the cabinet mission plan'.
30. The article that prohibits the employment of children in dangerous work is
- (A) Article 1 (B) Article 21
 (C) Article 23 (D) Article 24
30. D
- Sol. The article that prohibits the employment of children in dangerous work is article 24.

31. Which one of the following statements is not the feature of Indian constitution?
 (A) Double citizenship
 (B) presidential form of government
 (C) Integrated judicial system
 (D) All of the above
31. A
 Sol. Double citizenship is not the feature of Indian Constitution.
32. Prudential reason of power sharing are
 (A) the stability of political order
 (B) to reduce the possibility of conflict between social groups
 (C) a fair share of minority
 (D) All of the above
32. B
 Sol. To reduce the possibility of conflict between social groups is the prudential reason of power sharing.
33. The social differences based on choices are
 (A) theism and atheism (B) selection of education
 (C) selection of occupation (D) all of these
33. D
 Sol. The social difference based on choices includes all concepts.
34. Consider the following statements.
 (i) Equitable allocation of resources.
 (ii) Generation of employment.
 (iii) Tax concession to big corporate.
 (iv) Universalization of public distribution.
 Which of the factors given above can bring inclusive growth in our country?
 (A) (i), (ii), (iii) (B) (i), (ii), (iv)
 (C) (i), (iii), (iv) (D) (ii), (iii), (iv)
34. B
 Sol. Equitable allocation of resources, generation of employment and universalization of public distribution.
35. Which of the following is wrongly related to Antyodaya Anna Yojana?
 (A) Antyodaya Anna Yojana was launched in December 2000.
 (B) 20 crore families have been covered under the Antyodaya Anna Yojana.
 (C) Wheat is supplied at the rate of Rs.6 and rice at the rate of Rs. 7 under this scheme.
 (D) None of the above
35. C
 Sol. Wheat is supplied at the rate of Rs 6 and rice at Rs. 7 is a wrong statement.
36. Consider the following statements about Globalization.
 a. The most common route for investment by MNC's in countries around the world is to buy existing local companies.
 b. Investment made by Multinational companies is called foreign investment.
 c. Cargill Foods, an American company purchased and Indian company called Parakh Foods.
 d. Ford Motors is one of the biggest German Automobile manufacturer.
 Which of the given statements are True?
 (A) a, c, d (B) a, b, c
 (C) b, c, d (D) a, b, c, d
36. B
 Sol. The most common route for investment by MNC's in countries around the world is to buy existing local companies, investment made by Multinational companies is called foreign

investment and cargill Foods, an American company purchased and Indian company called Parakh Foods.

37. The consumer movement across the world arose due to
(A) unfair trade practices that prevailed in the market
(B) dissatisfaction of the consumers
(C) lack of legal system to protect consumers from exploitation
(D) All of these
37. D
- Sol. Unfair trade practices that prevailed in the market, dissatisfaction of the consumers and lack of legal system to protect consumers from exploitation.
38. Which of the following sector is contributing the most towards the GDP in India?
(A) Primary (B) Secondary
(C) Tertiary (D) None of these
38. C
- Sol. Tertiary sector is contributing the most towards the GDP in India.
39. HDI stands for
(A) Human resource Depreciation Index
(B) Human Development Index
(C) Human resources Development Index
(D) None of these
39. B
- Sol. HDI stands for Human Development Index.
40. Consider the following statement:
I. The self help group is a small voluntary association of poor people.
II. They preferably form the same socio-eco background.
III. Usually the number of members in one SHG does not exceed twenty
Which of the following statements is/are correct?
(A) Only II and III (B) II and II
(C) Only I (D) All I, II and III
40. D
- Sol. All the above statements about SHG are correct.

Section – II

Mathematics

(1 – 20)

1. When the natural numbers 1, 2, 3,, 500 are written, then the digit 3 is used n times in this way. The value of n is:
(A) 100 (B) 200
(C) 300 (D) 280
1. B
- Sol. $5 \times (3, 13, 23, 33, 43, 53, 63, 73, 83, 93) + 5 (30, 31, 32, 33, 34, 35, 36, 37, 38, 39) + (301, 302, 303, 304, \dots, 399)$
 $= 5 \times 10 + 5 \times 10 + 100 = 200$
2. The number of integral solutions of the equation $7\left(y + \frac{1}{y}\right) - 2\left(y^2 + \frac{1}{y^2}\right) = 9$ is
(A) 0 (B) 1
(C) 2 (D) 3
2. B

Sol. Let $y + \frac{1}{y} = t \Rightarrow y^2 + \frac{1}{y^2} = t^2 = 2$

The given equation reduces to:

$$7t - 2(t^2 - 2) = 9$$

$$\Rightarrow 2t^2 - 7t + 5 = 0$$

$$t = 1,$$

$$y + \frac{1}{y} = 1$$

$$\Rightarrow y^2 - y + 1 = 0$$

This equation has no real solutions

$$t = \frac{5}{2}$$

$$y + \frac{1}{y} = \frac{5}{2}$$

$$\Rightarrow 2y^2 - 5y + 2 = 0$$

$$\Rightarrow y = \frac{1}{2}, y = 2$$

So number of integral solutions = 1

3. If $x = 3 + \sqrt{5}$ then find the value of $x^4 - 12x^3 + 44x^2 - 48x + 17$

(A) 0

(B) 2

(C) -1

(D) 1

3. D

Sol. $(x - 3)^2 = \sqrt{5}$

$$x^2 - 6x + 9 = 5$$

$$x^2 - 6x + 4 = 0$$

$$x^4 - 12x^3 + 44x^2 - 48x + 17$$

$$x^2(x^2 - 6x + 4) - 6x^3 + 40x^2 - 48x + 17$$

$$-6x(x^2 - 6x + 4) + 4x^2 + 24x + 17$$

$$4(x^2 - 6x + 4) + 1 = 1$$

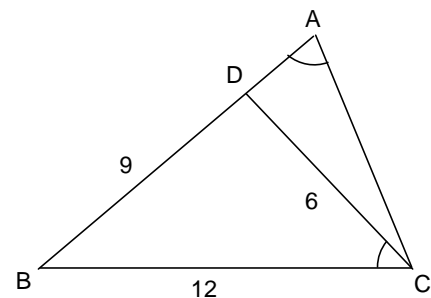
4. Consider the triangle ABC shown in the following figure where $BC = 12$ cm, $DB = 9$ cm, $CD = 6$ cm and $\angle BCD = \angle BAC$. What is the ratio of the perimeter of the triangle ADC to that of the triangle BDC?

(A) $\frac{7}{9}$

(B) $\frac{8}{9}$

(C) $\frac{6}{9}$

(D) $\frac{5}{9}$



4. A

Sol. Here $\triangle BCD \sim \triangle BAC$

Hence from the property of similar triangles

$$\frac{AB}{12} = \frac{12}{9} \text{ Hence } AB = 16$$

$$\frac{AC}{6} = \frac{12}{9} \text{ Hence } AC = 8$$

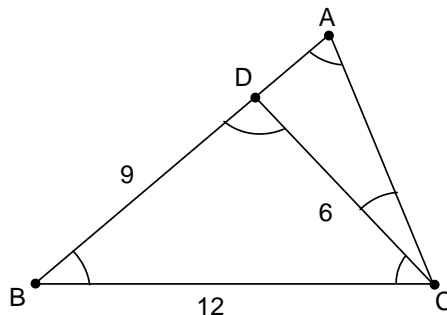
$$\text{Hence } AD = 7$$

$$AC = 8$$

$$S_{ADC} = 8 + 7 + 6 = 21$$

$$S_{BDC} = 27$$

$$\text{Hence ratio} = \frac{21}{27} = \frac{7}{9}$$



5. The number of common terms in the two sequences 17, 21, 25.....417 and 16, 21, 26,.....466 is
 (A) 78 (B) 19
 (C) 20 (D) 77

5. C

Sol. Total number of terms in the sequence 17, 21, 25.....417 is equal to $\frac{417-17}{4} + 1 = 101$

Total number of terms in the sequence 16, 21, 26....466 is equal to $\frac{466-16}{5} + 1 = 91$

n^{th} term of the first sequence = $4n + 13$

m^{th} term of the second sequence = $5m + 11$

As per the information given in the question $4n + 13 = 5m + 11$

$\Rightarrow 5m - 4n = 2$

Possible integral values of n that satisfy $5m = 2 + 4n$ are (2, 7, 12,.....97)

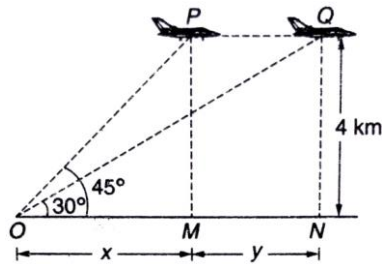
Therefore, the total number of terms common in both the sequences is 20

6. The angle of elevation of an aeroplane from a point on the ground is 45° and after 12 sec, the angle of elevation changes to 30° . If the aeroplane is flying at a constant height of 4 km, find the speed of the aeroplane (in km/hr).

- (A) $1200(\sqrt{3}-1)$ (B) $1200(\sqrt{3}+1)$
 (C) $600(\sqrt{3}-1)$ (D) $600(\sqrt{3}+1)$

6. A

Sol. Let P and Q be two positions of the aeroplane being watched from the point O. Let $OM = x$ and $MN = y$, where PM and QN are the perpendiculars from P and Q upon the horizontal ground. According to the given informations $PM = QN = 4$ km. $\angle MOP = 45^\circ$ and $\angle NOQ = 30^\circ$



In the triangle OMP, we get

$$\tan 45^\circ = \frac{PM}{OM} = \frac{4}{x} \text{ or } 1 = \frac{4}{x} \Rightarrow x = 4 \text{ km}$$

In the triangle ONQ, we get

$$\tan 30^\circ = \frac{QN}{ON} = \frac{4}{x+y} \text{ or } \frac{1}{\sqrt{3}} = \frac{4}{x+y} \Rightarrow x+y = 4\sqrt{3}$$

or $y = 4\sqrt{3} - 4$ ($\because x = 4$)

Hence, the aeroplane travels $4\sqrt{3} - 4$ km in 12 seconds.

Thus, the speed of the aeroplane.

$$v = \frac{4\sqrt{3}-4}{12} \text{ km/sec} = \frac{\sqrt{3}-1}{3} \text{ km/sec}$$

$$= (\sqrt{3}-1) \times \frac{3600}{3} \text{ km/hr} = 1200(\sqrt{3}-1) \text{ km/hr}$$

7. If $3\cos\alpha = 2\cos(\alpha - 2\beta)$, then $\tan(\alpha - \beta) \tan\beta =$

- (A) 5 (B) -5

(C) $\frac{1}{5}$

(D) $-\frac{1}{5}$

7. C

Sol. Given, $3 \cos \alpha = 2 \cos(\alpha - 2\beta)$

$$\Rightarrow 3 \cos(\alpha - \beta + \beta) = 2 \cos(\alpha - \beta - \beta)$$

$$\Rightarrow 3 \cos(\theta + \beta) = 2 \cos(\theta - \beta), \quad [\text{where } \theta = \alpha - \beta]$$

$$\Rightarrow \frac{3}{2} = \frac{\cos(\theta - \beta)}{\cos(\theta + \beta)} \Rightarrow \frac{5}{1} = \frac{2 \cos \theta \cos \beta}{2 \sin \theta \sin \beta}$$

[By componendo and dividendo]

$$\Rightarrow \tan \theta \cdot \tan \beta = \frac{1}{5}$$

$$\Rightarrow \tan(\alpha - \beta) \tan \beta = \frac{1}{5}$$

8. If $f(x+y) = f(x) + f(y) - xy - 1$ for all $x, y \in \mathbb{R}$ and $f(1) = 1$, then the value of $-515 \sum_{r=1}^5 f(r)$

must be:

(A) 6725

(B) 7725

(C) 8725

(D) none of these

8. B

Sol. $\therefore f(2) = f(1+1) = f(1) + (1) - 1 - 1$
 $= 1 + 1 - 1 - 1 = 0$

$$f(3) = f(2+1) = f(2) + f(1) - 2 - 1 = 0 + 1 - 2 - 1 = -2$$

$$f(4) = f(2+2) = f(2) + f(2) - 4 - 1$$
$$= 0 + 0 - 5 = -5$$

and $f(5) = f(1+4) = f(1) + f(4) - 4 - 1$
 $= 1 - 5 - 5 = -9$

$$\therefore -515 \sum_{r=1}^5 f(r) = -515(f(1) + f(2) + f(3) + f(4) + f(5))$$
$$= -515(1 + 0 - 2 - 5 - 9)$$
$$= -515 \times -15$$
$$= 7725$$

9. The length of three medians of a triangle are 9, 12 and 15 cm. Find the area of triangle.

(A) 48 cm²

(B) 144 cm²

(C) 54 cm²

(D) 72 cm²

9. D

Sol. Area of triangle = $\frac{4}{3}$ × area of triangle formed by medians

$$= \frac{4}{3} \times 54 = 72 \text{ cm}^2$$

10. Vikram and Abhishek have some books with them. Once Abhishek said to Vikram that if Vikram gives 3 books to Abhishek then Vikram will have only $\frac{1}{2}$ of the books that Abhishek will have with him. Then Vikram asked frankly that if Abhishek gives him only two books (to Vikram), then Abhishek will have as many books as Vikram will have. The total number of books that Vikram and Abhishek have with them is:

(A) 25

(B) 56

(C) 30

(D) can't be determined

10. C

Sol. Let the Vikram has x books and Abhishek has y books with them, then

$$2(x - 3) = (y + 3)$$

$$2x - 6 = y + 3$$

$$\Rightarrow 2x - y = 9 \quad \dots(i)$$

and $(x + 2) = (y - 2)$

$$\Rightarrow x - y = -4 \quad \dots(ii)$$

Solving equations (i) and (ii), we get $x = 13$ and $y = 17$ thus $x + y = 30$.

11. The unit digit of $(316)^{3^{4n}} + 1$ is:

(A) 4 (B) 5

(C) 1 (D) 7

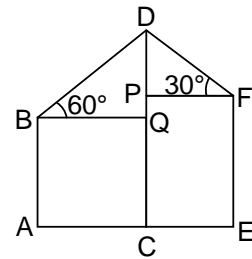
11. D

Sol. The unit digit of $(316)^{3^{4n}}$ is always 6.

So the unit digit of $(316)^{3^{4n}} + 1$ will be 7.

12. In the given figure AB, CD and EF are three towers. The angle of elevation of the top of the tower CD from the top of the tower AB is 60° and that from EF is 30° . $BD = 2\sqrt{3}$ m, $CD : EF = 5 : 4$ and $DF = 4$ m. What is the height of the tower AB?

- (A) 6 m
 (B) 12 m
 (C) 7 m
 (D) None of these



12. C

Sol. $\frac{DQ}{BD} = \sin 60^\circ \Rightarrow DQ = BD \times \frac{\sqrt{3}}{2} = 3$ m

and $\frac{DP}{DF} = \sin 30^\circ = \frac{1}{2}$

$\therefore DP = 2$ m ($\because DF = 4$ m)

$\therefore PQ = 3 - 2 = 1$ m

Let $AB = CQ = x$ m

$\therefore \frac{CD}{EF} = \frac{5}{4}$

$$\frac{x + 3}{x + 1} = \frac{5}{4} \Rightarrow x = 7 \text{ m}$$

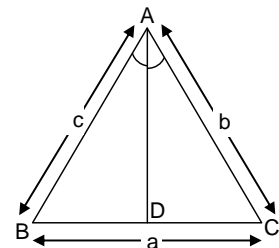
13. In a triangle ABC, AD is the angle bisector of $\angle BAC$ and $\angle BAD = 60^\circ$. What is the length of AD?

(A) $\frac{b + c}{bc}$

(B) $\frac{bc}{b + c}$

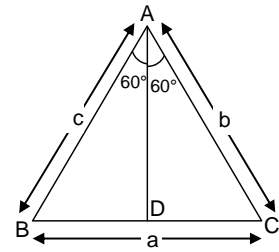
(C) $\sqrt{b^2 + c^2}$

(D) $\frac{(b + c)^2}{bc}$



13. B

Sol. Let $AD = h$ (say)
 Then area of $\triangle ABC$
 $= \frac{1}{2}bc \sin 120^\circ = \frac{\sqrt{3}}{4}bc$
 Area of $\triangle BAD = \frac{1}{2}ch \sin 60^\circ$
 $= \frac{\sqrt{3}}{4}ch$



and area of $\triangle CAD = \frac{1}{2}bh \sin 60^\circ = \frac{\sqrt{3}}{4}bh$
 Now, $A(\triangle ABC) = A(\triangle BAD) + A(\triangle CAD)$
 $\frac{\sqrt{3}}{4}bc = \frac{\sqrt{3}}{4}ch + \frac{\sqrt{3}}{4}bh$
 $\Rightarrow bc = h(b + c)$
 $\Rightarrow h = \frac{bc}{b + c}$

14. The least number which when divided by 2, 3, 4, 5 and 6 leaves the remainder 1 in each case. If the same number is divided by 7 it leaves no remainder. The number is:
 (A) 231 (B) 301
 (C) 371 (D) 441

14. B

Sol. The required number $= (\text{LCM of } 2, 3, 4, 5, 6)k + 1 = 7\ell = 60k + 1 = 7\ell$

$$\Rightarrow \frac{60k + 1}{7} = \ell$$

Now put the least possible value of k such that ℓ must be a positive integer. Hence at $k = 5$, ℓ is an integer. Thus, the required value is $60 \times 5 + 1 = 301$.

15. Let p and q be the roots of the equation $x^2 - 2x + A = 0$ and let r and s be the roots of the equation $x^2 - 18x + B = 0$. If $p < q < r < s$ are in arithmetic progression, then A, B respectively equal to:
 (A) 8, 17 (B) 3, 7
 (C) -3, 11 (D) none of these

15. D

Sol. p, q, r, s are in arithmetic progression

Let say, $p = a - 3d, q = a - d, r = a + d, s = a + 3d$

$$\text{Then, } p + q = 2(a - 2d) = 2 \Rightarrow a - 2d = 1 \quad \dots(i)$$

$$r + s = 18 = 2(a + 2d) \Rightarrow a + 2d = 9 \quad \dots(ii)$$

by equation (i) and (ii),

$$a = 5 \text{ and } d = 2$$

$$\therefore p = -1, q = 3, r = 7, s = 11$$

$$A = pq = -3$$

$$B = rs = 77$$

16. There were five sections in a paper. The average score of Aditi in first 3 sections was 83 and the average in the last 3 sections was 97 and the average of all the sections (i.e., whole paper) was 92, then her score in the third section was:
 (A) 85 (B) 92
 (C) 88 (D) none of these

16. D

Sol. $a + b + c + d + e = 5 \times 92 = 460$

$$a + b + c = 3 \times 83 = 249$$

$$c + d + e = 3 \times 97 = 291$$

$$\therefore c = (a + b + c) + (c + d + e) - (a + b + c + d + e)$$

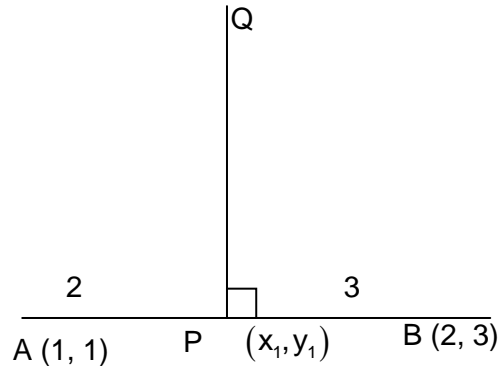
$$\text{or } c = 540 - 460 \text{ or } c = 80$$

17. Find the equation of a line which divides the line segment joining the points (1, 1) and (2, 3) in the ratio 2 : 3 perpendicularly

- (A) $5x - 5y + 2 = 0$ (B) $5x + 5y + 2 = 0$
 (C) $x + 2y - 5 = 0$ (D) $x + 2y + 7 = 0$

17. C

Sol. $x_1 = \frac{2 \times 2 + 3 \times 1}{2 + 3} = \frac{7}{5}$
 $y = \frac{2 \times 3 + 3 \times 1}{2 + 3} = \frac{9}{5}$
 $m_{AB} \times m_{PQ} = -1$
 $PQ \equiv y - \frac{9}{5} = \left(\frac{-1}{2}\right)\left(x - \frac{7}{5}\right)$
 $x + 2y - 5 = 0$



18. The mean of n observations is \bar{x} . If each observation is divided by p then q is added to each observation, the new mean is :

- (A) $\frac{\bar{x}}{q} + p$ (B) $\frac{\bar{x} + pq}{q}$
 (C) $\frac{\bar{x} + pq}{p}$ (D) None of these

18. C

Sol. Mean = \bar{x}
 New mean if

(i) each observation is divided by $p \Rightarrow \frac{\bar{x}}{p}$
 (ii) each observation is added to $q \Rightarrow \frac{\bar{x}}{p} + q$
 $= \frac{\bar{x} + pq}{p}$

19. The sides AB, BC of a square ABCD of side length $2 + \sqrt{2}$ units are tangent to a circle. The vertex D lies on the circumference of the circle. The radius of the circle is

- (A) 2 units (B) 3 units
 (C) 2.5 units (D) $(\sqrt{2} + 1)$ units

19. A

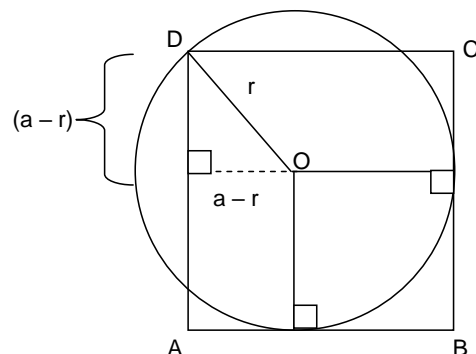
Sol. Let O be the centre of the circle

$$r^2 = (a - r)^2 + (a - r)^2$$

$$r = \sqrt{2}(a - r)$$

$$a = \frac{r}{\sqrt{2}}(\sqrt{2} + 1)$$

$$2 + \sqrt{2} = \frac{r}{\sqrt{2}}(\sqrt{2} + 1)$$



$$\sqrt{2}(\sqrt{2} + 1) = \frac{r}{\sqrt{2}}(\sqrt{2} + 1)$$

$r = 2$ units.

20. Two opposite vertices of a rectangle are (1, 3) and (5, 1). If the other two vertices of the rectangle lie on the line $y - x + \lambda = 0$ then $\lambda =$

(A) -1 (B) 2
(C) 1 (D) None of these

20. C

Sol. A and C lie on $y - x + \alpha = 0$.

Let coordinate of A be $(t, t - \lambda)$ and C be

$(p, p - \lambda)$

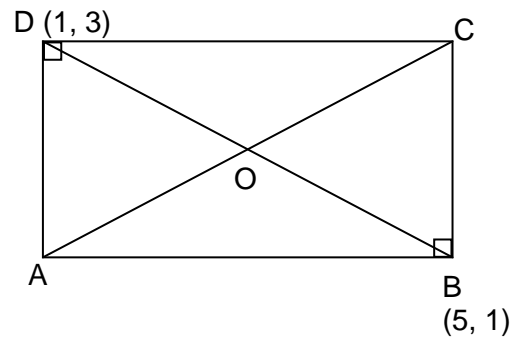
$$O \equiv \left(\frac{1+5}{2}, \frac{3+1}{2} \right) \Rightarrow (3, 2) \text{ (Mid - point of BD)}$$

$$\frac{t+p}{2} = 3, \frac{t-\lambda+p-\lambda}{2} = 2 \text{ (Mid point of AC)}$$

$$t+p = 6, \frac{t+p-2\lambda}{2} = 2$$

$$t+p = 2\lambda + 4$$

$$6 = 2\lambda + 4 \Rightarrow \lambda = 1$$



Section – III

Physics

(1 – 13)

1. If the refractive indices of alcohol and benzene with respect to air are 1.36 and 1.50 respectively, then the refractive index of benzene with respect to alcohol is

(A) 1.10 (B) 1.20
(C) 0.90 (D) 1.00

1. A

Sol. alcohol $\mu_{\text{benzene}} = \mu_{\text{benzene}} / \mu_{\text{alcohol}} = 1.5/1.36 = 1.10$

2. A ray of light suffers total internal reflection when it goes from

(A) Air to water (B) Water to glass
(C) Air to glass (D) Glass to water

2. D

Sol. For total internal reflection to take place:

1. Light must travel from an optically denser to an optically rarer medium and
2. Angle of incidence should be greater than the critical angle of incidence.

3. Magnetic field in a region is directed into the page. A wire carrying current in vertically upward direction will experience force

(A) Zero (B) Due right
(C) Upwards (D) Downwards

3. A

Sol. Force, $F = BIL \sin\theta$.

4. A radioactive element ${}_Z X^A$ emits an α -particle and changes into

(A) ${}_{Z-2} Y^A$ (B) ${}_Z Y^{A-4}$
(C) ${}_{Z-2} Y^{A-4}$ (D) ${}_{Z+2} Y^A$

4. C

Sol. ${}_Z X^A \longrightarrow {}_2 \text{He}^4 + {}_{Z-2} Y^{A-4}$
(α -particle)

5. A particle experiences constant acceleration for 20 seconds after starting from rest. If it travels a distance s_1 in the first 10 seconds and distance s_2 in the next 10 seconds, then
- (A) $s_2 = s_1$ (B) $s_2 = 2s_1$
 (C) $s_2 = 3s_1$ (D) $s_2 = 4s_1$

5. C

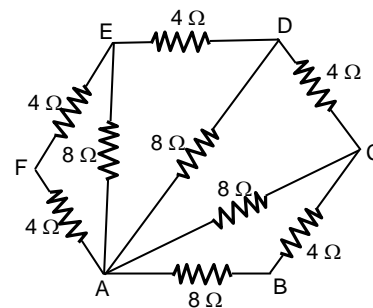
Sol. $S_1 = \frac{1}{2}a(10)^2 = 50 a$

$S = \frac{1}{2}a(20)^2 = 200 a$

$S_2 = S - S_1 = 150 a$

Thus, $S_2 = 3S_1$.

6. In the figure below shows a network of resistances. The effective resistance between points A and B of network is
- (A) $(16/3) \Omega$
 (B) 16Ω
 (C) 8Ω
 (D) 4Ω



6. D

Sol. Resistance between AF and FE are in series and the combination is in parallel with resistance between AE and so on.

7. When a stone of mass m is falling on the earth of mass M , the acceleration of the earth will be
- (A) zero (B) $\frac{mg}{M}$
 (C) $\frac{Mg}{m}$ (D) g

7. B

Sol. Force on earth is equal and opposite of force on stone.

As force on stone = mg .

Hence force on earth = mg .

And acceleration of earth = $\frac{mg}{M}$.

8. A vessel of water is placed on the floor of an elevator. How does the pressure at the bottom of the vessel change if the elevator moves up with uniform acceleration a ?
- (A) Increases by $h\rho a$ (B) Decreases by $h\rho a$
 (C) No change in pressure (D) None of these

8. A

Sol. Pressure at base when elevator is at rest = $P_1 = P_0 + h\rho g$

Pressure when elevator moves up with acceleration a .

$P_2 = P_0 + h\rho(g + a)$

Change $\Delta P = P_2 - P_1 = h\rho a$

9. An artificial satellite is revolving close to the earth. Its orbital velocity does not depend upon
- (A) the radius of earth (B) the orbital radius
 (C) the mass of earth (D) the mass of satellite

9. D

Sol. $v_0 = \sqrt{\frac{GM_e}{r}} = \sqrt{gR_e}$

10. A ball of mass m is thrown in air with speed v_1 from a height h_1 and it is caught at a height $h_2 > h_1$ when its speed becomes v_2 . Find the work done on the ball by the air resistance.
- (A) $mg(h_2 - h_1) + \frac{1}{2}m(v_2^2 - v_1^2)$ (B) $mg(h_2 + h_1) + \frac{1}{2}m(v_2^2 + v_1^2)$
 (C) $mg(h_2 + h_1) + \frac{1}{2}m(v_2^2 - v_1^2)$ (D) $mg(h_2 - h_1) - \frac{1}{2}m(v_2^2 + v_1^2)$

10. A

Sol. Using work energy theorem

$$\frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2 = -mg(h_2 - h_1) + W_{\text{air resistance}}$$

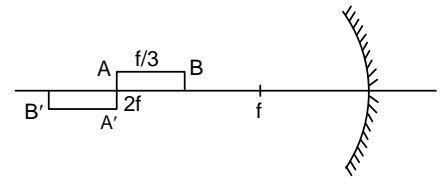
$$\frac{1}{2}m(v_2^2 - v_1^2) + mg(h_2 - h_1) = W_{\text{(air resistance)}}$$

11. A thin rod of length $f/3$ lies along the axis of a concave mirror of focal length f . One end of its magnified image touches an end of the rod. The length of the image is

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

11. B

Sol. Since image is magnified, object will lie between f and $2f$ and one end of its image touches one end of object. Hence that end is at centre of curvature.



For B; $u = 2f - \frac{f}{3} = \frac{5f}{3}$

Using mirror formula $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$$\Rightarrow \frac{1}{v} - \frac{1}{5f/3} = \frac{1}{-f}$$

$$\Rightarrow \frac{1}{v} = \frac{3}{5f} - \frac{1}{f} = -\frac{2}{5f}$$

$$\Rightarrow v = \frac{5f}{2}. \text{ Hence, length of image is } = \frac{5f}{2} - 2f = \frac{f}{2}.$$

12. Why does a horse need to pull harder during the first few steps in pulling the cart?

- (A) Limiting friction is greater than dynamic friction.
 (B) Sliding friction is greater than rolling friction.
 (C) No frictional force acts after the cart comes in motion.
 (D) Air friction is greater during first few steps of motion.

12. A

Sol. As limiting friction $>$ dynamic friction, hence force required to start the motion is higher than the force required to maintain it against force of friction.

13. A progressive wave of frequency 500 Hz is travelling with a speed of 350 ms^{-1} . A compressional maximum appears at a place at a given instant. The minimum time interval after which a rarefaction maximum occurs at the same point is

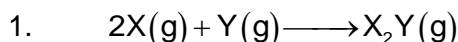
- (A) $\frac{1}{250} \text{ s}$ (B) $\frac{1}{500} \text{ s}$
 (C) $\frac{1}{1000} \text{ s}$ (D) $\frac{1}{350} \text{ s}$

13. C

Sol. $T = 1/f = 1/500 \text{ s}$

So, $T/2 = (\frac{1}{2}) \times 1/500 = 1/1000 \text{ s}.$

Section – IV
Chemistry
(1 – 13)



In the above reaction, $X_2Y(g)$ displays

- (A) the properties of 'X'
(B) the properties of 'Y'
(C) neither the properties of X nor that of Y
(D) none of these is correct

1. C

Sol. X_2Y is compound, compound do not show the property of its constituent element.

2. The purity of a solid can be checked by determining its

- (A) solubility in a suitable solvent
(B) melting point
(C) coordination number in the crystal lattice
(D) mechanical strength

2. B

Sol The purity of a solid can be checked by determining its melting point

3. 'X' is a substance which chemically combines with impurities associated with the ore to form easily fusible mass 'Y'. Here X and Y are respectively

- (A) Flux, slag (B) Slag, flux
(C) Gangue, slag (D) Reductant, flux

3. A

Sol
$$\begin{array}{ccc} \text{Gangue} + \text{Flux} & \rightarrow & \text{Slag} \\ X & & Y \end{array}$$

4. The maximum no. of electrons on a principal shell is

- (A) n^2 (B) n
(C) $2n^2$ (D) $3n^2$

4. C

Sol The maximum no. of electrons on a principal shell is $2n^2$

5. Arrange the following in order to decreasing basic character: MgO, K_2O , Na_2O , CaO

- (A) $MgO > K_2O > Na_2O > CaO$ (B) $K_2O > Na_2O > MgO > CaO$
(C) $K_2O > Na_2O > CaO > MgO$ (D) $CaO > MgO > Na_2O > K_2O$

5. C

Sol. Decreasing basic character is $K_2O > Na_2O > CaO > MgO$

6. The pH of a 0.025 M solution of KOH is

- (A) 1.60 (B) 3.69
(C) 10.31 (D) 12.40

6. D

Sol $pOH = -\log H^+$
 $pOH = -\log 25 \times 10^{-3}$
 $pOH = 3 \log 10 - \log 25$
 $pOH = 3 - 2 \log 5 \Rightarrow 3 - (2 \times 0.693) \Rightarrow 3 - 1.39 = 1.61$
so, $pH = 14 - pOH = 14 - 1.61 = 12.40$

7. Copper sulphate is the salt of

- (A) a weak acid and a strong base (B) a weak acid and a weak base
(C) a strong acid and a weak base (D) a strong acid and a strong base

7. C

- Sol As copper sulphate (CuSO_4) is made up of strong acid i.e., H_2SO_4 and a weak base i.e. $\text{Cu}(\text{OH})_2$
8. What is the empirical mass of $\text{CH}_3\text{COOC}_2\text{H}_5$?
 (A) 38 (B) 72
 (C) 56 (D) 44
8. D
- Sol Empirical formula of compound is $\text{C}_2\text{H}_4\text{O} = 44$
9. Which of the following is incorrect?
 (A) Chalcocite – Copper (B) Magnetite – Iron
 (C) Calamine – Aluminium (D) Galena – Lead
9. C
- Sol. Calamine(ZnCO_3) is an ore of zinc
10. What volume of alcohol and water must be mixed together to prepare 250 mL of 60% v/v solution of alcohol in water?
 (A) Alcohol = 50 mL and water = 100 mL (B) Alcohol = 150 mL and water = 50 mL
 (C) Alcohol = 100 mL and water = 150 mL (D) Alcohol = 150 mL and water = 100 mL
10. D
- Sol. $V / V\% = \frac{\text{Vol. of solute}}{\text{Vol. of solution}} \times 100$
11. 8 grams of oxygen at NTP contain:
 (A) 1.5×10^{23} molecules (B) 3.0×10^{23} molecules
 (C) 6.023×10^{23} molecules (D) 1.5×10^{22} molecules
11. D
- Sol. 32 g of oxygen contains 6.022×10^{23} molecules
 So 8 gm oxygen contains $\frac{6.022 \times 10^{23} \times 8}{32} = 1.5 \times 10^{23}$
12. How many H atoms are in 3.4 g of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$?
 (A) 6.0×10^{23} (B) 1.3×10^{23}
 (C) 3.8×10^{22} (D) 6.0×10^{21}
12. B
- Sol. Molecular mass of $\text{C}_{12}\text{H}_{22}\text{O}_{11} = 342$ u
 $\text{H atoms} = \frac{3.4}{342} \times 6.022 \times 10^{23} \times 22 = 1.3 \times 10^{23}$
13. I. $\text{Zn} + \text{CuSO}_4(\text{aq}) \longrightarrow \text{Reaction occurs}$
 II. $\text{Zn} + \text{Al}_2(\text{SO}_4)_3(\text{aq}) \longrightarrow \text{Reaction does not occurs}$
 III. $\text{Zn} + \text{AgNO}_3(\text{aq}) \longrightarrow \text{Reaction does not occurs}$
 IV $\text{Zn} + \text{PbNO}_3(\text{aq}) \longrightarrow \text{Reaction occurs}$
 Which of the above statement is not correct?
 (A) I (B) II
 (C) III (D) IV
13. C
- Sol. As per reactivity series Zn will displace Ag from $\text{AgNO}_3(\text{aq})$

Section – V

Biology

(1 –14)

1. The membrane around the vacuole is known as
(A) Tonoplast (B) Elaioplast
(C) Cytoplast (D) Amyloplast
1. A
2. Where does the light reaction takes place?
(A) Grana (B) Stroma
(C) Cytoplasm (D) Endoplasmic reticulum
2. A
3. _____ is a protein deficiency disorder
(A) Scurvy (B) Anaemia
(C) Kwashiorkor (D) None of the above
3. C
4. The cells of cork are dead and have a chemical in their walls that makes them impervious to gases and water. The chemical is
(A) lignin (B) suberin
(C) cutin (D) wax
4. B
5. Which one of the following is not a male accessory gland ?
(A) Seminal vesicle (B) Ampulla
(C) Prostate (D) Bulbourethral gland
5. B
6. Among the following which one is not a method of vegetative propagation.
(A) Budding (B) Layering
(C) Sowing (D) Tissue culture
6. C
7. _____ is the observable set of characteristics of an organism.
(A) Phenotype (B) Genes
(C) DNA (D) None of these
7. A
8. _____ is not a characteristic feature of the respiratory surface
(A) Dry (B) Thin
(C) Permeable (D) Moist
8. A
9. Which of the following has the thickest wall?
(A) Right ventricle (B) Left ventricle
(C) Right atrium (D) Left atrium
9. B
10. The constituents which do not form eco-system are
(A) Biotic constituents (B) Plastic bags
(C) Abiotic constituents (D) All of these
10. B

11. Name the site of fertilisation in human beings:
(A) Vas deferens (B) uterus
(C) Fallopian tube (D) cervix
11. C
12. The basic functional unit of human kidney is
(A) nephridia (B) nephron
(C) artery (D) Henle's loop
12. B
13. The normal diastolic blood pressure in a normal healthy adult human is
(A) 80 mm Hg (B) 60 mm Hg
(C) 90 mm Hg (D) 110 mm Hg
13. A
14. Choose the incorrect statement about insulin
(A) It is produced from pancreas
(B) It regulates the growth and development of the body
(C) It regulates blood sugar level
(D) Insufficient secretion of insulin will cause diabetes
14. B