IIT ASHRAM BRINGS...

Spread Your Wings

उड़ान

A QUEST FOR SCIENCE ASPIRANTS !

CLASS 10

SCIENCE APTITUDE TEST

TIME : 3 HOURS | **MAX MARK : 400** | **DATE : 28- 01- 2024**

INSTRUCTIONS

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

Caution : Class, as given on paper above MUST be correctly marked on the answer OMR sheet before attempting the paper. Wrong Class will give wrong results.

1. This booklet consists of 100 questions. Question paper consists of 4 sections. Marking scheme is given in table below:

Section	Subject	Questions No.	Making Scheme for each questions	
			Correct Answer	Wrong Answer
PART - **I**	Mental Ability	15	4	-1
PART - **II**	Mathematics	40	4	-1
PART - **III**	Physics & Chemistry	30	4	-1
PART - **IV**	Biology	15	4	-1

3. Answers have to be marked on the OMR sheet. The Question Paper contains blank spaces for your rough work. No additional sheets will be provided for rough work.
4. Blank papers, cellular phones, smart watches, log tables, slide rule, calculator and electronic devices, in any form, are not allowed.

PART - I : MENTAL ABILITY

1. A clock loses 2 minutes in a hour and another clock gains 2 minutes in every 2 hours. Both these clocks are set correctly at a certain time on Sunday and both the clocks stop simultaneously on the next day with the time shown being 9 am and 10 : 06 AM. What is the correct time at which they stopped?
   (a) 9:54 am (b) 9:44 pm
   (c) 9:46 am (d) 9:44 am

Directiont : (2 - 3)

A, B, C, D, E and F are related to each other as given here. B is F's daughter-in-law. D is A's only grand child. C is D's only uncle. A has two children F and C, One male and one female (not necessarily in the same order). E is father of C.

2. Who is the grand mother of D?.
   (a) B (b) A
   (c) C (d) D
3. If a girl G is married into the family, What is the relationship between G and D?
   (a) Mother (b) Aunt
   (c) Mother-in-low (d) Grand mother
4. How many pairs of letters are there in the word **"CASTRAPHONE"** which have as many letters between them in the word as in the alphabet?
   (a) 3 (b) 4
   (c) 5 (d) 6
5. In a certain code language **STUDENT** is written as **TUTDNES**. How will **SOURCES** be written in that code language?
   (a) SOURSEC (b) SRUOCES
   (c) SOURCES (d) SUORECS
6. Five books on five different subjects Physics, Chemistry, Mathematics, Anatomy and Botany are arranged on a shelf. The book on Mathematics is not on top or at the bottom. Chemistry book and Botany book have exactly two books between them, same as Mathematics and Physics books. Which of the following books has to be in the middle of the shelf?
   (a) Mathematics
   (b) Physics
   (c) Anatomy
   (d) Cannot be determined
7. Payal, Akhil, Rahul, Sahil and Tanuj are five persons who sit around a circular table. Tanuj is to the immediate right of Payal. Akhil and Rahul are on either side of Sahil. Who sits between Rahul and Tanuj, assuming that there is only one person between them?
   (a) Akhil (d) Payal
   (c) Sahil (d) None of these
8. On which day of the week does 5th June, 2001 fall?
   (a) Monday (b) Tuesday
   (c) Wednesday (d) Thursday
9. Pointing to a person, Raju said, "He is the only brother of my father's mother's daughter." How is the person related to Raju?
   (a) Brother (b) Father
   (c) Uncle (d) Nephew

Space for Rough Work

Direction for next (10 - 12) questions

In a class, 30% of the students gave their names to participate in the Chess and 75% to participate in the Table tennis. Three students participate in neither of these two and six students wanted to participate in both.

10. How many students are there in the class?

(a) 100 (b) 75

(c) 60 (d) 80

11. What percentage of students wants to participate only in the Chess?

(a) 30% (b) 25%

(c) 15% (d) 20%

12. What percentage of students wants to participate in only one programme – either Chess or Table tennis?

(a) 85% (b) 90%

(c) 75% (d) 20%

Direction: (13 to 14)

There is a cube in which one pair of adjacent faces is painted red; the second pair of adjacent faces is painted blue and a third pair of adjacent faces is painted green. This cube is now cut into 216 smaller but identical cubes.

13. How many small cubes are there with no red paint at all?

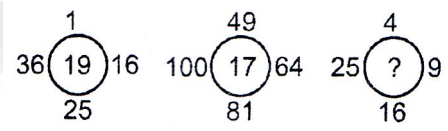
(a) 144 (b) 155

(c) 125 (d) 150

14. How many small cubes are with both red and green on their faces?

(a) 8 (b) 12

(c) 16 (d) 32

15. 

(a) 6 (b) 7

(c) 8 (d) 9

Space for Rough Work

PART - II : MATHEMATICS

1. Find the unit digit of $(2012)^{2011} + (2011)^{2012}$?
   (a) 0 (b) 1
   (c) 9 (d) none of these

2. If x = y then the value of $\frac{x^2+y^2}{x^2-y^2}$ is
   (a) $\frac{5}{3}$ (b) Undefined
   (c) 0 (d) none of these

3. If 2s = a + b + c, then the value of $(s-a)^2 + (s-b)^2 + (s-c)^2 + s^2 - a^2 - b^2 - c^2$ will be:
   (a) –1 (b) 1
   (c) 2 (d) 0

4. If $\left(x^4 + \frac{1}{x^4}\right) = 34$, then the value of $\left(x - \frac{1}{x}\right)$ is
   (a) 1 (b) 2
   (c) 3 (d) 4

5. In which regular polygon are the diagonals triple the number of sides?
   (a) octagon (b) nonagon
   (c) decagon (d) hexagon

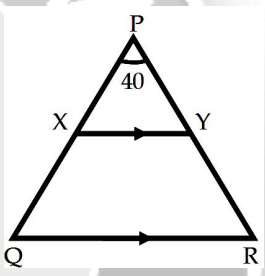
6. OPQR is a rhombus. The three vertices of a rhombus lies on a circle with centre O. If the area of rhombus is $32\sqrt{3}$ then the radius of the circle is
   (a) 4 (b) 8
   (c) 16 (d) none of these

7. If the areas of three adjacent faces of a cuboid are x, y, z respectively, then the volume of cuboid is
   (a) xyz (b) 2xyz
   (c) $\sqrt{xyz}$ (d) $3\sqrt{xyz}$

8. The ratio between the volumes of two spheres is 8:27. What is the ratio between their surface areas?
   (a) 2:3 (b) 4:5
   (c) 5:6 (d) 4:9

9. If x_1, x_2 are the roots of $ax^2 + bx + c = 0$, find the value of $(ax_1 + b)^{-3} + (ax_2 + b)^{-3}$
   (a) $\frac{a(a^2-3ab)}{a^3b^3}$ (b) $\frac{b(b^2-3ac)}{a^3b^3}$
   (c) $\frac{a(b^2-3ac)}{b^3c^3}$ (d) $\frac{b(b^2-3ac)}{a^3c^3}$

10. In Δ PQR, XY || QR, and PX = PY then $\angle Q$ =



   (a) 140° (b) 40°
   (c) 70° (d) 60°

11. The volume of the greatest sphere that can be cut off from a cylindrical log of wood of base radius 1 cm and height 5 cm is
   (a) $\frac{4}{3}\pi$ cm³ (b) $\frac{10}{3}\pi$ cm³
   (c) 5π cm³ (d) $\frac{20}{3}5\pi$ cm³

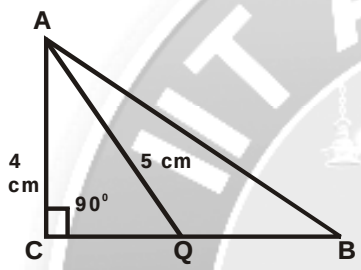
Space for Rough Work

12. The value of $4-\cfrac{5}{1+\cfrac{1}{3+\cfrac{1}{2+\cfrac{1}{4}}}}$

(a) $\frac{40}{31}$ (b) $\frac{4}{9}$

(c) $\frac{1}{8}$ (d) $\frac{31}{40}$

13. In ΔABC, $\angle C = 90^0$. If Q is the midpoint of the side $\overline{BC}$, AC = 4 cm, AQ = 5 cm, then $(AB)^2$ is



(a) 54 cm^2 (b) 50 cm^2

(c) 52 cm^2 (d) 56 cm^2

14. The area of an isosceles right angled triangle is 98 sq. cm. Then its perimeter is

(a) $14\left(2-\sqrt{2}\right)$ cm (b) $14\left(2+\sqrt{3}\right)$ cm

(c) $13\left(2+\sqrt{2}\right)$ cm (d) $14\left(2+\sqrt{2}\right)$ cm

15. If α and β are the roots of the equation $ax^2 + bx + c = 0$ then $\frac{\alpha}{a\beta+b}+\frac{\beta}{a\alpha+b}$ equals

(a) $\frac{2}{a}$ (b) $\frac{2}{b}$

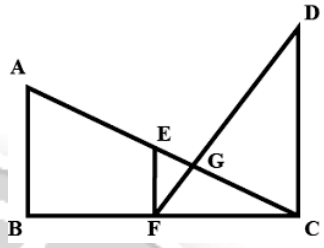
(c) $\frac{2}{c}$ (d) $\frac{-2}{a}$

16. The sum of the series $45^2 - 43^2 + 44^2 - 42^2 + 43^2 - 41^2 + 42^2 - 40^2 +$..... up to 30 terms

(a) 1110 (b) 2220

(c) 3330 (d) 4440

17. If AB, EF and CD are parallel in given figure and EG = 5cm, GC = 10 cm, AB = 15 cm, DC =18cm, then EF + AC.



(a) 35 (b) 34

(c) 24 (d) 25

18. If $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$ of an AP then find the sum of 24 terms of A.P.

(a) 455 (b) 730

(c) 800 (d) 900

19. If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$ then $\cos\theta - \sin\theta =$ ..... .

(a) $\sqrt{2}\tan\theta$ (b) $\sqrt{2}\sin\theta$

(c) $\frac{\sqrt{2}}{\cos\theta+\sin\theta}$ (d) None

20. The biggest surd among $\sqrt[3]{2}, \sqrt{3}, \sqrt[3]{5}$ is___

(a) $\sqrt[3]{2}$ (b) $\sqrt{3}$

(c) $\sqrt[3]{5}$ (d) None

21. If the centroid of the triangle formed by (7,x), (y,-6) and (9,10) is at (6,3) then (x,y):

(a) (4, 5) (b) (5, 4)

(c) (-5,-2) (d) (5, 2)

22. A quadratic polynomial when divided by (x + 2) leaves remainder of 1 and when divided by (x - 1) leaves remainder of 4. What will be the remainder if it is divided by (x + 2)(x - 1).

(a) 1 (b) 4

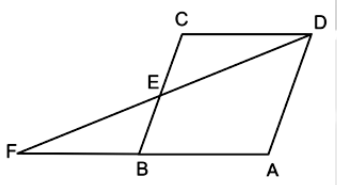
(c) x + 3 (d) x - 3

Space for Rough Work

23. For which of the following values of k will 3x + (k + 3)y = 1 and kx + 6y = 4 have a unique solution?
(a) 3
(b) -6
(c) 6
(d) Any value except 3 and -6

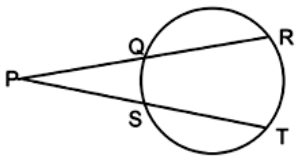
24. Find the GCD of the numbers p and q where $p = 2^3 \times 3^2 \times 7^2 \times 11^6$ and
$q = 2^2 \times 3^1 \times 5^4 \times 11^2 \times 13^2$.
(a) 776 (b) 1452
(c) 1164 (d) 2028

25. ABCD is a parallelogram and E is the midpoint of BC as shown in the figure. If DE and AB when produced meet at F, then AF is equal to



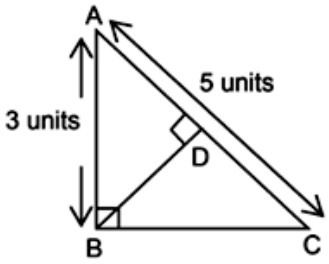
(a) $\frac{3}{2}$AB (b) 2 AB
(c) 3 AB (d) $\frac{4}{3}$AB

26. In the figure, PQ = 4 cm, QR = 14 cm and PS = 3 cm. Find ST.



(a) 24 (b) 21
(c) 15 (d) 12

27. Find the length of side AD in the figure given below:



(a) 1.8 units (b) 0.8 units
(c) 2.8 units (d) 3.8 units

28. If (-7, 8), (-3, 9) and (-5, 6) are the vertices of a parallelogram taken in that order. Find the coordinates of the fourth vertex.
(a) (-9, 5) (b) (-8, 4)
(c) (-8, 5) (d) (-9, 4)

29. A father's present age is 6 times his son's present age. Thirty years later father's age will be ten years less than twice the son's age. After how many years will the son's age be half of the father's present age?
(a) 20 (b) 30
(c) 10 (d) 15

30. If $\sin^4\theta - \cos^4\theta = k^4$, then $\sin^2\theta - \cos^2\theta$ is ____.
(a) K (b) K^3
(c) K^2 (d) K^4

31. $\frac{\tan^3\theta - 1}{\tan\theta - 1}$ = _____.
(a) $\sec^2\theta + \tan\theta$ (b) $\sec^2\theta - \tan\theta$
(c) 0 (d) $\tan\theta - \sec^2\theta$

32. If a mode exceeds a mean by 12, then the mode exceeds the median by _____.
(a) 4 (b) 8
(c) 6 (d) 10

Space for Rough Work

33. If $2\sin\theta+3\cos\theta=2$, then $3\sin\theta-2\cos\theta=?$

(a) ±3 (b) ±1

(c) 0 (d) ±2

34. The mean of the values 1, 2, 3, ... , n with respective frequencies x, 2x, 3x ..... , nx is:

(a) $\frac{n}{2}$ (b) $\frac{n+1}{2}$

(c) $\frac{2n+1}{2}$ (d) $\frac{2n+1}{3}$

35. Upper part of a vertical tree which is broken over by the winds just touches the ground and makes an angle of 30° with the ground. If the length of the broken part is 20 metres, then the remaining part of the tree is of length

(a) 20 metres (b) $10\sqrt{3}$ metres

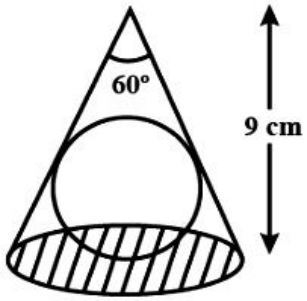
(c) 10 metres (d) $10\sqrt{2}$ metres

36. If an angles of elevation of the top of a tower from two points distant x and y (x > y) from its foot are 30° and 60° respectively, then the height of the tower is–

(a) $\sqrt{x+y}$ (b) $\sqrt{xy}$

(c) $\sqrt{x-y}$ (d) $\sqrt{\frac{x}{y}}$

37. A sphere is placed in a cone of height 9 cm as shown in figure. The volume of sphere if it touches lateral surface and base of cone is



(a) $3\ \pi\ cm^3$ (b) $12\ \pi\ cm^3$

(c) $24\ \pi\ cm^3$ (d) $36\ \pi\ cm^3$

38. Acuboidal metal of dimensions 44 cm x 30 cm x 15 cm was melted and cast into a cylinder of height 28 cm. Its radius is

(a) 20 cm (b) 15 cm

(c) 10 cm (d) 25 cm

39. The radius of a wheel is 25 c.m. The number of revolutions it will make to travel a distance of 11 km. will be

(a) 2800 (b) 4000

(c) 5500 (d) 7000

40. If the radius of circle is diminished by 10% then its area is diminished by :

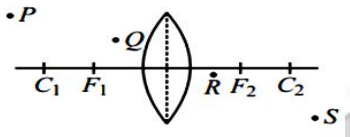
(a) 10% (b) 19%

(c) 20% (d) 36%

Space for Rough Work

PART - III : PHYSICS & CHEMISTRY

1. The given figure shows a converging lens. The focal length and centre of curvature of the lens are marked along with four random points, P, Q, R and S. Which of the following set of points correctly represents the position of object and corresponding position of image?



	Position of object	Position of image
(a)	P	R
(b)	Q	S
(c)	P	S
(d)	Q	P

2. Two identical spheres of radius R, made of a material of density ρ, are in contact with each other. If the gravitational attraction between them is F, then

(a) $F \propto \frac{\rho^2}{R^2}$ (b) $F \propto \rho^2 R^4$

(c) $F \propto \frac{\rho^4}{R^6}$ (d) $F \propto \rho^4 R^4$

3. Two resistance wires of the same material and of equal lengths and equal diameters are connected in series in a simple electric circuit consisting of a voltage source of voltage V. Now, the same wires are connected in parallel in the same circuit for the same time but voltage source is replaced by another voltage source of voltage 2V. The ratio of the total heat produced in the two cases is

(a) 1 : 1 (b) 1 : 4

(c) 1 : 8 (d) 1 : 16

4. An electric current passes through a straight wire. Magnetic compass are placed at the points X and Y.

(a) Their needles will not deflect.

(b) Only one of the needles will deflect.

(c) The needles will deflect in the same direction

(d) The needles will deffect in the opposite directions.

5. If the current I through a resistor is increased by 100% (assume that temperature remains unchanged), the increase in power dissipated will be

(a) 100 % (b) 200 %

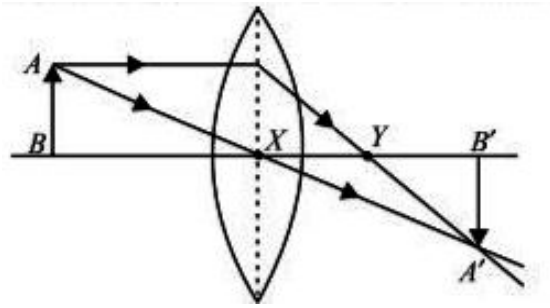
(c) 300 % (d) 400 %

6. Mr. Tiwari, who cannot see objects nearer than 1 m from his eyes, wants to read a book placed at a distance of 25 cm clearly. The nature and the power of lens required by Mr. Tiwari are

	Nature of the lens	Power of the lens
(a)	Convex	+5 D
(b)	Concave	-5D
(c)	Convex	+3 D
(d)	Concave	-3D

Space for Rough Work

7. The given figure shows a ray diagram for the image formation of an object AB by a convex lens.



If A'B' < AB, then

(a) BX = B'X (b) XY>YB'

(c) 2XY = BX (d) BY=3YB'

8. A boy of mass 50 kg, runs up a flight of 120 stairs, each measuring a height of 25 cm, in one minute and 40 seconds. If g=10 m s^{-2} then the power of the boy is

(a) 150 W (b) 750 W

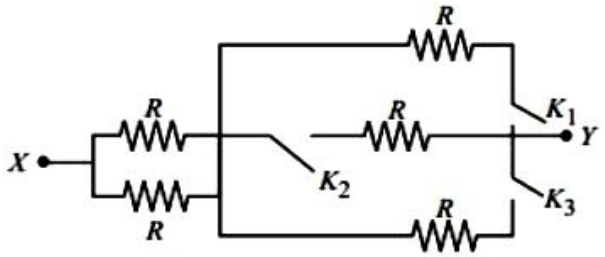
(c) 500 W (d) 250 W

9. The plot represents the flow of current through a wire at three different times. The ratio of charges flowing through the wire at different intervals is

(a) 1 : 2 : 3 (b) 1 : 1 : 1

(c) 3 : 2 : 2 (d) 2 : 3 : 3

10. A network is constructed using five resistors, each of resistance R, and three switches K_1, K_2, and K_3, Which switch combination will give rise to maximum total resistance between points X and Y?



	K_1	K_2	K_3
(a)	Open	Closed	Open
(b)	Open	Closed	Closed
(c)	Closed	Closed	Closed
(d)	Closed	Open	Closed

11. An old man suffering from vision defect has to place book away at a distance of 40 cm to read. For clear vision what is the power of the lens required to correct his vision?

(a) 1 D (b) 1.5 D

(c) 2 D (d) 2.5 D

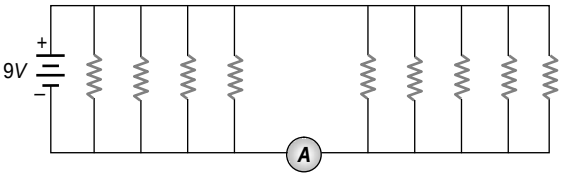
12. A wire of resistance 5Ω is bent into a circular loop and the resistance between its diametrically opposite points is measured to be R. Now, it is stretched so that its length is increased by twice its original. Again, it is bent into a bigger circular loop and the resistance between its diametrically opposite points is measured to be R'. Then R : R' will be

(a) 1 : 4 (b) 9 : 1

(c) 1 : 9 (d) 1 : 1

Space for Rough Work

13. If each resistance in the figure is of 9 then reading of ammeter is



(a) 5 A (b) 8 A
(c) 2 A (d) 9 A

14. SI unit of Work is
(a) N (b) W
(c) J (d) D

15. What is unit of Power of lens.
(a) N (b) D
(c) J (d) W

16. The oxidation state of iodine in $H_4IO_6^-$ is:
(a) +7 (b) –1
(c) +5 (d) +1

17. In acidic medium, reaction $MnO_4^- \rightleftharpoons Mn^{2+}$ is an example of
(a) Oxidation by three electrons
(b) Reduction by three electrons
(c) Oxidation by five electrons
(d) Reduction by five electrons

18. The aqueous solution having pH 11 is how many times more basic than aqueous solution having pH 8 ?
(a) 3 (b) 30
(c) 300 (d) 1000

19. The substance which indicates the presence of acid or base by change of its smell is known as:
(a) household indicator
(b) acid-base indicator
(c) olfactory indicator
(d) none of these

20. At what pH level does the decay of teeth take place inside mouth ?
(a) 7.0 (b) 5.0 to 7.0
(c) 7.0 to 7.2 (d) 7.3 to 14

21. BF_3 is acid according to :
(a) Lewis
(b) Arrhenius
(c) Bronsted and Lowery
(d) Madam Curie

22. Which of the following is a Lewis base ?
(a) H_2O (b) HCl
(c) NH_4^+ (d) CH_4

23. The slag obtained during the extraction of copper pyrites is composed mainly of :
(a) Cu_2S (b) $FeSiO_3$
(c) $CuSiO_3$ (d) SiO_2

24. Which of the following metals cannot be reduced by carbon?
(a) Magnesium (b) Iron
(c) Zinc (d) Lead

25. The nature of metal oxide is
(a) basic (b) acidic
(c) neutral (d) none of these

26. Which of the following does not belong to the same homologous series?
(a) CH_4 (b) C_2H_6
(c) C_3H_8 (d) C_4H_8

27. Which of the following salts does not contain water of crystallisation?
(a) Blue vitriol (b) Baking soda
(c) Washing soda (d) Gypsum

28. Aqua-regia is
(a) $HNO_3 + HCl$ (b) $HNO_3 + 3HCl$
(c) $3HNO_3 + HCl$ (d) $H_2SO_4 + 3HCl$

29. When lime stone is heated strongly, it gives off. In metallurgy this process is known as
(a) Calcination (b) Roasting
(c) Smelting (d) Ore dressing

30. Which of the following processes involves smelting
(a) $ZnCO_3 \rightarrow ZnO \rightarrow CO_2$
(b) $Fe_2O_3 \rightarrow 3C \rightarrow 2Fe \rightarrow 3CO$
(c) $2PbS \rightarrow 3O_2 \rightarrow 2PbO \rightarrow 2SO_2$
. (d) $Al_2O_3.2H_2O \rightarrow Al_2O_3 \rightarrow 2H_2O$

Space for Rough Work

PART - IV : BIOLOGY

1. Epiglottis is
   (a) a cartilaginous flap that guards the opening of larynx.
   (b) a membranous structure present in pharynx.
   (c) a muscle that guards the opening of nasal cavity
   (d) A cartilaginous flap that guards opening of pharynx
2. One hemoglobin carries how many molecules of O^2
   (a) 4 (b) 2
   (c) 6 (d) 8
3. Most of the carbon dioxide in the blood is carried in the form of
   (a) carbonic acid
   (b) bicarbonates
   (c) carbaminohemoglobin
   (d) dissolved CO^2
4. Fallopian tube is also known as
   (a) Uterus (b) Ureter
   (c) Vas deferens (d) Oviduct
5. Scion is the term used in relation to-
   (a) Embryology (b) Grafting
   (c) Agamospermy (d) Emasculation
6. Chief function of the flower-
   (a) Help in pollination
   (b) Made the beauty of plant
   (c) Help inthe reproduction
   (d) Secrete the enzyme
7. The hardest substance in the human body
   (a) Dentine (b) Keretin
   (c) Chondrin (d) Enamel
8. Nephrons are Concerned with
   (a) Circulatory system
   (b) Integumentary System
   (c) respiratory System
   (d) Exceretory System
9. Fruits are often shipped in containers with higher CO_2 to prevent.
   (a) Infection of fruits by fungi
   (b) Overriping of fruit
   (c) Fermentation of fruits
   (d) Insects and pests protection
10. Liver secretes bile which has :
    (a) heparin (b) amylase
    (c) lipase (d) no enzyme
11. Tropism of ..... is seen in leaf of 'touch me not' plant.
    (a) Touch (b) Smell related
    (c) Vision related (d) Taste related
12. Muscle cells can change their shape and bring change in arrangement which is the result of response of .....
    (a) Nervous electrical impulse
    (b) Reflex action
    (c) Transport of nerve impulse
    (d) Movement - locomotion
13. The ability of a cell to divide into several cells during reproduction in Plasmodium is called
    (a) budding (b) reduction division
    (c) binary fission (d) multiple fission
14. Characters that are transmitted from parents to offspring during reproduction show
    (a) only similarities with parents
    (b) only variations with parents
    (c) both similarities and variations with parents
    (d) Neither similarities Nor variations
15. A feature of reproduction that is common to Amoeba, Spirogyra and Yeast is that
    (a) they reproduce asexualiy
    (b) they are all unicellular
    (c) they reproduce only sexually
    (d) they are all multicellular

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