

IIT ASHRAM BRINGS...

IIT ASHRAM

JEE MAINS || JEE ADVANCED || MEDICAL || FOUNDATION

SCIENCE APTITUDE
TEST (2016-17)

CLASS **9th**



SAMPLE PAPER

SOLUTIONS & ANSWER KEY

for

Part - I : Mental Ability

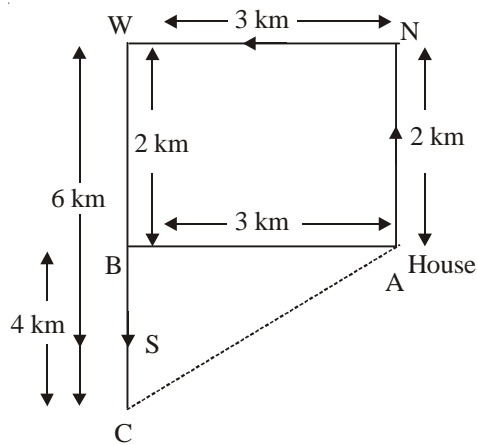
Part - II : Mathematics

Part - III : Physics/ Chemistry

Part - IV : Biology

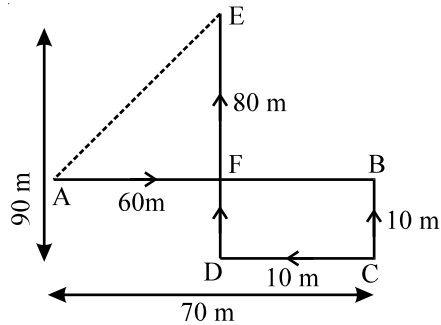
MENTAL ABILITY

1.
Sol. See the figure.



$$\begin{aligned}
 (AC)^2 &= (AB)^2 + (BC)^2 \\
 &= 9 + 16 \\
 &= 5 \text{ km.}
 \end{aligned}$$

2.
Sol. (B)



3.
Sol. Bidi smokers is a subset of Sokers and Cancer patient may be a smoker, bidi smoker and non-smoker. Hence, third object shares a common relationship with first and second object as well. Hence, diagram (b) is our answer.

4.
Sol. From the information, it is clear that the only son of woman's grandfather is the father of the woman and the father of the man's brother is the father of the man. On combining these two information together a single information emerges that the man's father is the woman's father. Hence woman is the sister of the man in the photograph. the answer is (D).

5.

Sol. Option (A) represents that A is the grandfather of T

(i) $B - T = B$ is the sister of T.

(ii) $S \times B = S$ is the father of B, here

S will be father of T [from information (i)]

(iii) $A \times S = A$ is the father of S, hence A will be grandfather of B.

6.

Sol. Study of Coin is known as 'Numismatic'. 'Paleontology' is the science dealing with study of history of mankind with the help of fossils. Hence, the answer is (C).

7.

Sol. The pattern is +5, +9, ..., +21, +25

\therefore Missing number = $15 + 13 = 28$

8.

Sol. The answer is (C) i.e. 12 because

$(7 \times 4) - (5 \times 3) = 28 - 15 = 13$ (Ist Circle)

$(8 \times 4) - (9 \times 3) = 32 - 27 = 05$ (IInd Circle)

So, $(9 \times 4) - (8 \times 3) = 36 - 24 = 12$ (IIIrd Circle)

9.

Sol. In each of the pairs except (B), the ratio of the two numbers is 7 : 8. Hence, the answer is (B)

10.

Sol. All other pairs except (D) consist of prime numbers only, while (D) consists of one composite number i.e., 14. Hence, the answer is (D).

11.

Sol. (C) Comparing the positions of the capital letters, numbers and small letters, we find a corresponds to C and 1 corresponds to a. So, a and 1 correspond to C. b corresponds to A and 2 corresponds to b. So b and 2 correspond to A. Also, 4 corresponds to D.

So, the remaining number i.e. 3 corresponds to B. so, BCCB corresponds to 3, 1, 1, 3

12.

Sol. Clearly, the first, second and third letters of each term are respectively moved one, two and three steps forward to obtain the corresponding letters of the next term. So, the missing term is EJO.

Hence, the answer is (C)

13.

Sol. Clearly, the first letters of the terms are alternate. The sequence followed by the numbers is +2, +3, +4, The last letter of each term is three steps ahead of the last letter of the preceding term. Thus, the next term would be X 17 O. Hence, the answer is (C).

14.

Sol. Let A = 1, B = 2, C = 3, ..., Z = 26.

$$\text{Now, M} = 13 = \overline{4}$$

(remainder obtained after dividing by 9);

$$\text{S} = 19 = 1$$

(remainder obtained after dividing by 9 twice);

$$\text{T} = 20 = 2$$

(remainder obtained after dividing by 9 twice);

$$\text{R} = 18 = \overline{9}$$

(remainder obtained after dividing by 9).

$$\text{So, MASTER} = \overline{411259}.$$

$$\text{Similarly, POWDER} = \overline{765459}.$$

15.

Sol. In the given codes, the numbers are coded as shown :

$$1 \quad 3 \quad 4 \quad 7 \quad 9 \quad 5 \quad 2 \quad 6 \quad 8$$

$$A \quad Q \quad F \quad J \quad L \quad D \quad M \quad P \quad N$$

i.e., 3 as Q, 9 as L, 6 as P, 8 as N, 2 as M and 4 as F. So, 396824 is coded as QLPNMF.

16.

Sol. Using the proper signs, we get :

$$36 - 12 \div 4 + 6 \div 2 \times 3 = 36 - 3 + 3 \times 3$$

$$= 36 - 3 + 9 = 45 - 3 = 42$$

So, the correct answer is (c)

17.

Sol. **'IT' = 13**

$$\text{'ASHRAM'} = 456748$$

In this each letter Corresponds to a digit,

So, 113456748 corresponds to 'IITASHRAM'

18

Sol. From the unfolded figure of dice, we find that number opposite to 2 is 4, for 5 it is 3 and for 1 it is 6. From this result we can definitely say that figure (b), (c) and (d) can not be the answer figure as number lying on the opposite pair of surface are present on the adjacent surfaces. Hence fig (a) is our answer.

19.

Sol. Clearly, arrows and straight lines are added alternately to get subsequent figures. Also all the arrows point towards the right. Hence, fig (d) is the answer.

20.

Sol. In this case, the pin rotates 90° clockwise and the arrow rotates 90° anticlockwise in each step.

Hence, the answer is fig. (c).

MATHEMATICS

1.
Sol. Let the cost for each pen, eraser and sharper be p, e and s respectively.

$$3p + 4e + 5s = 40 \dots\dots (1)$$

$$5p + 7e + 9s = 70 \dots\dots (2)$$

Multiplying the equation (1) by 2 and subtracting the equation (2) from it, we get, $p + e + s = 10$.

Hence the total cost of one of each is Rs. 10.

2.
Sol. Let the present ages of Ram and Shyam be R years and S years respectively.

$$R = 2(R - 16) - 4 \text{ and } 3S = 7R$$

$$R = 2R - 32 - 4 \text{ and } S = \frac{7}{3}R \Rightarrow R = 36 \text{ and}$$

$$S = \frac{7}{3}(36) = 84$$

Age of Shyam seven years from now = $S + 7 = 91$ years.

3.
Sol. Dividing both numerator and denominator of $\frac{3x+y}{5x-y}$ by y it becomes $\frac{3\frac{x}{y}+1}{5\frac{x}{y}-1}$

$$\text{As } \frac{x}{y} = \frac{3}{4}, \frac{3x+y}{5x-y} = \frac{3\left(\frac{3}{4}\right)+1}{5\left(\frac{3}{4}\right)-1} = \frac{13}{11}$$

4.
Sol. Let the number be 9x and 7x

$$\frac{9x-14}{7x-14} = \frac{7}{5}$$

$$5(9x-14) = 7(7x-14) \Rightarrow 45x-70 = 49x-98$$

$$\Rightarrow 98-70 = 49x-45x \Rightarrow 28 = 4x \Rightarrow 7 = x$$

Hence the numbers are $9x = 63$ and $7x = 49$.

5.
Sol. $\frac{1}{5} = 0.2, \frac{3}{16} = \frac{8}{2} = \frac{0.375}{2} = 0.1875, \frac{2}{9} = 0.\overline{2}$

$$\frac{5}{26} = 0.19 \text{ and } \frac{3}{11} = 0.\overline{27}$$

$$\therefore \frac{3}{16} < \frac{5}{26} < \frac{1}{5} < \frac{2}{9} < \frac{3}{11}$$

$\therefore \frac{2}{9}$ will be the fourth.

6.

Sol. $x^2 + y^2 = (x + y)^2 - 2xy = 25^2 - 2(156) = 625 - 312 = 313.$

7.

Sol. $\left(\left(\frac{11}{12}\right)^2\right)^{\frac{1}{2}} \times \left(\left(\frac{12}{11}\right)^3\right)^{\frac{2}{3}} \times \frac{12}{11}$
 $= \frac{11}{12} \times \left(\frac{12}{11}\right)^2 \times \frac{12}{11} = \left(\frac{12}{11}\right)^2 = \frac{144}{121}$

8.

Sol. Rewriting the above expression with a common denominator, =

$$\frac{6(4 - \sqrt{7}) + 3(4 + \sqrt{7})}{(4 + \sqrt{7})(4 - \sqrt{7})} = \frac{36 - 3\sqrt{7}}{4^2 - (\sqrt{7})^2}$$
$$= \frac{3(12 - \sqrt{7})}{9} = \frac{12 - \sqrt{7}}{3}$$

9.

Sol. Let the number be x.

36% of x = 756

$$\frac{36}{100} \times x = 756$$

$$x = 756 \times \frac{100}{36} = 21 \times 100 \Rightarrow x = 2100$$

54% of 2100 is $\frac{54}{100} \times 2100 = 1134$

10.

Sol. $CP = SP \times \left(\frac{100}{100 + \text{profit}\%}\right)$
 $= 585 \times \left(\frac{100}{100 + 30}\right) = \text{Rs.}450$

11.

Sol. Simple interest = $\frac{(24000)(6)(15)}{100} = \text{Rs.}21600$

Total amount that Mr. Mehta will get = 24000 + 21600 = Rs. 45600

12.

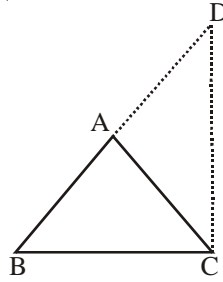
Sol. Sum of the three numbers = (20) (3) = 60

Third number = 60 - (sum of other two numbers)

60 - 42 = 18

13.

Sol. Given : A ΔABC such that $AB = AC$. Side BA is produced to D such that $AB = AD$.



Construction : Join CD.

To prove : $\angle BCD = 90^\circ$

Proof : In ΔABC , we have $AB = AC$

$$\Rightarrow \angle ACB = \angle ABC \dots(i) \left[\begin{array}{l} \because \text{Angles opp. to} \\ \text{equal sides are equal} \end{array} \right]$$

Now, $AB = AD$

[Given]

$\therefore AD = AC$

[$\because AB = AC$]

Thus, in ΔADC , we have

$$AD = AC$$

$$\Rightarrow \angle ACD = \angle ADC$$

.... (ii)

[\because Angles opp. to equal sides are equal]

Adding (i) and (ii), we get

$$\angle ACB + \angle ACD = \angle ABC + \angle ADC$$

$$\Rightarrow \angle BCD = \angle ABC + \angle BDC$$

[$\because \angle ADC = \angle BDC$]

$$\Rightarrow \angle BCD + \angle BCD = \angle ABC + \angle BCD$$

[Adding $\angle BCD$
on both side]

$$\Rightarrow 2 \angle BCD = 180^\circ \text{ [}\because \text{Sum of the angles of a } \Delta \text{ is } 180^\circ\text{]}$$

Hence, $\angle BCD$ is a right angle.

14.

Sol. Let the distance between school and house be x km.

$$\frac{x}{3} - \frac{x}{5} = \frac{24}{60} \Rightarrow \frac{5x - 3x}{15} = \frac{2}{5} \Rightarrow \frac{2x}{15} = \frac{2}{5}$$

$$\Rightarrow 10x = 30 \Rightarrow x = 3\text{km}$$

15.

Sol. (d)

The number of letters in the given word is four.

The number of three letter words that can be formed using these four letter is $= 4 \times 3 \times 2 = 24$

16.

Sol. (a) $7x^2 - 11xy - 7y^2 = 7(x^2 - y^2) - 11xy = -11 - 56\sqrt{3}$

17.

Sol. (c) $a^{m^n} = a^{mn} \Rightarrow m^n = mn$

$$\Rightarrow m^{n-1} = n \Rightarrow m = (n)^{\frac{1}{n-1}}$$

18.

Sol. (c) Let $\frac{p}{q} = \frac{9}{2}$, $\frac{r}{s} = \frac{3}{4}$

$$\frac{9}{2} = 4.5, \quad \frac{3}{4} = 0.75$$

$\therefore \frac{9}{2}, \frac{3}{4}$ are terminating decimals.

i) $\frac{9}{2} + \frac{3}{4} = \frac{18+3}{4} = \frac{21}{4} = 5.25$ is terminating decimal.

ii) $\frac{9}{2} \times \frac{3}{4} = \frac{27}{8} = 3.375$ is terminating decimal.

iii) $\frac{4}{3} = 1.333\dots$ is non terminating repeating decimal.

$\frac{3}{4}$ is terminating decimal.

$\therefore \frac{4}{3} \div \frac{3}{4} = \frac{4}{3} \times \frac{4}{3} = \frac{16}{9} = 1.777\dots$ is non terminating decimal.

19.

Sol. (a) Converting each of the given fractions into decimal form, we get

$$\frac{1}{3} = 0.33, \frac{2}{5} = 0.4, \frac{4}{7} = 0.57, \frac{3}{5} = 0.6, \frac{5}{6} = 0.833, \frac{6}{7} = 0.857$$

Clearly $0.33 < 0.4 < 0.57 < 0.6 < 0.833 < 0.857$

$$\text{So } \frac{1}{3} < \frac{2}{5} < \frac{4}{7} < \frac{3}{5} < \frac{5}{6} < \frac{6}{7}.$$

20.

Sol. (d) $\sqrt{p} + \sqrt{q} = \sqrt{r}$

$$p + q + 2\sqrt{pq} = r$$

$$r = p + q + 2\sqrt{pq} > p + q$$

$\Rightarrow r > p + q$, but it is not possible in any triangle.

21.

Sol. $\because (x + y + z) = 0$

$$\Rightarrow x^2 + y^2 + z^2 + 2(xy + yz + zx) = 0$$

$$\Rightarrow x^2 + y^2 + z^2 = -2(xy + yz + zx)$$

$$\Rightarrow (x^2 + y^2 + z^2)^2 = 4(xy + yz + zx)^2$$

$$\Rightarrow x^4 + y^4 + z^4 + 2(x^2y^2 + y^2z^2 + z^2x^2)$$

$$= 4[x^2y^2 + y^2z^2 + z^2x^2 + 2xyz(x + y + z)]$$

$$\therefore x^4 + y^4 + z^4 = 2(x^2y^2 + y^2z^2 + z^2x^2) \quad [\because (x + y + z) = 0]$$

$$\therefore \frac{x^2y^2 + y^2z^2 + z^2x^2}{x^4 + y^4 + z^4} = \frac{1}{2}$$

Hence (b) is the correct option.

22.

Sol. Let $f(x + 3) = q_0x^4 + q_1x^3 + q_2x^2 + q_3x + q_4$

Then q_1, q_2, q_3, q_4 are the remainders of $f(x)$ when divided by $(x - 3)^4, (x - 3)^3, (x - 3)^2, (x - 3)$ respectively and $q_0 = 1$

\therefore Divide $f(x)$ successively by $(x - 3)$ as follows.

$$\begin{array}{r|rrrrr}
 & 1 & -12 & 17 & -9 & 7 \\
 3 & - & 3 & -27 & -30 & -117 \\
 \hline
 & 1 & -9 & -10 & -39 & -110 \longrightarrow q_4 \\
 3 & 0 & 3 & -18 & -84 \\
 \hline
 & 1 & -6 & -28 & -123 \longrightarrow q_3 \\
 3 & 0 & 3 & -9 \\
 \hline
 & 1 & -3 & -37 \longrightarrow q_2 \\
 3 & 0 & 3 \\
 \hline
 & 1 & 0 \longrightarrow q_1
 \end{array}$$

$$\therefore f(x + 3) = x^4 - 37x^2 - 123x - 110$$

23.

Sol. $f(x) - g(x) = 9x^4 + 12x^2 + 4 = (3x)^2 + 2 \times 3x \times 2 + 2^2$

$$\sqrt{f(x) - g(x)} = 3x^2 + 2$$

\therefore degree of $\sqrt{f(x) - g(x)}$ is 2

24.

Sol. Let $x^2 - 4x + 6 = 18$

$$\Rightarrow x^2 - 4x - 12 = 0$$

$$\Rightarrow (x - 6)(x + 2) = 0$$

$$\Rightarrow x = 6 \text{ or } -2$$

\therefore The value of $x^2 - 4x + 6$ is 18 at $x = -2$ or 6.

25.

Sol. Let the given polynomial be $P(x)$.

$$\text{At } x=2, P(2)=16a+16-12+2b-4=0$$

$$\Rightarrow 16a+2b=0$$

$$\Rightarrow 8a+b=0 \text{-----(1)}$$

$$\text{At } x=-2, P(-2)=16a-16-12-2b-4=0$$

$$\Rightarrow 8a-b=16 \text{-----(2)}$$

Solving equation (1) & (2),

$$16a=16 \Rightarrow a=1;$$

$$b=-8.$$

Ans:-(A)

26.

Sol. $\frac{16}{35}$

27.

Sol. Since $\frac{2}{3}$ rd journey is left, it means Suresh has travelled only $\frac{1}{3}$ rd of his journey which

is equal to 33. Thus i.e., $\frac{1}{3}x = 33 \Rightarrow x = 99 \text{ km}$

28.

Sol.

$$\frac{(0.3)^{1/3} \left(\frac{1}{27}\right)^{1/4} (9)^{1/6} (0.81)^{2/3}}{(0.9)^{2/3} (3)^{-1/2} \left(\frac{1}{3}\right)^{-2} (243)^{-1/4}} = \frac{\left(\frac{3}{10}\right)^{1/3} \left(\frac{1}{3}\right)^{3/4} (3)^{1/3} \left(\frac{81}{100}\right)^{2/3}}{\left(\frac{9}{10}\right)^{2/3} \left(\frac{1}{3}\right)^{1/2} (3)^2 (3)^{-5/4}}$$

$$= \frac{3^{\frac{1}{3} + \frac{1}{3} - \frac{3}{4} + \frac{8}{3}} \times 10^{-\frac{1}{3} - \frac{4}{3}}}{3^{\frac{4}{3} + 2 - \frac{1}{2} - \frac{5}{4}} \times 10^{-\frac{2}{3}}} = \frac{3^{31/12} \times 10^{-5/3}}{3^{19/12} \times 10^{-2/3}} = 3 \times 10^{-1} = \frac{3}{10} = 0.3$$

29.

Sol. $a + b + c = 12 \therefore (a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ac) = 144$

$$\Rightarrow a^2 + b^2 + c^2 + 2 \times 47 = 144 \Rightarrow a^2 + b^2 + c^2 = 50$$

$$\therefore \mathbf{a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ac) = 12(50 - 47) = 12 \times 3 = 36}$$

30.

Sol. In $\triangle SPQ$ and $\triangle RQP$, we have

$$PS = QR \quad \text{[Given]}$$

$$\angle SPQ = \angle RQP \quad \text{[Given]}$$

$$PQ = PQ \quad \text{[Common]}$$

Therefore, by SAS criterion of congruence, we have

$$\triangle SPQ \cong \triangle RQP \Rightarrow SQ = RP \text{ and } \angle QPR = \angle PQS$$

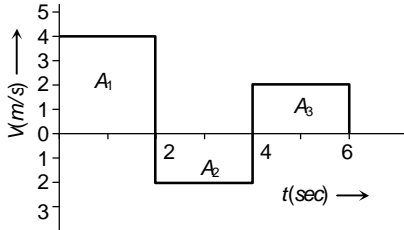
PHYSICS & CHEMISTRY

1.

SOL: (b) Time average velocity $= \frac{v_1 + v_2 + v_3}{3} = \frac{3 + 4 + 5}{3} = 4 \text{ m/s}$

2.

SOL: (a) Displacement = Summation of all the area with sign
 $= (A_1) + (-A_2) + (A_3) = (2 \times 4) + (-2 \times 2) + (2 \times 2)$



\therefore Displacement = 8 m

Distance = Summation of all the areas without sign

$= |A_1| + |-A_2| + |A_3| = |8| + |-4| + |4| = 8 + 4 + 4$

\therefore Distance = 16 m.

3.

SOL: (d) $S \propto u^2 \Rightarrow \frac{S_1}{S_2} = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$

4.

SOL: (a) Distance covered in 5th second,

$$S_{5^{th}} = u + \frac{a}{2}(2n-1) = 0 + \frac{a}{2}(2 \times 5 - 1) = \frac{9a}{2}$$

and distance covered in 5 second,

$$S_5 = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2} \times a \times 25 = \frac{25a}{2}$$

$$\therefore \frac{S_{5^{th}}}{S_5} = \frac{9}{25}$$

5.

sol: (b)

$$(2v)^2 - v^2 = 2g(2h)$$

$$\frac{v^2}{2g} = \frac{2h}{3}$$

$$h_{\max} = h + \frac{2h}{3} = \frac{5h}{3}$$

6.

SOL: (b) $t = \sqrt{\frac{2h}{g}} \Rightarrow \frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}}$

7.

SOL: (b) $u = 100 \text{ m/s}, v = 0, s = 0.06 \text{ m}$

$$\text{Retardation} = a = \frac{u^2}{2s} = \frac{(100)^2}{2 \times 0.06} = \frac{1 \times 10^6}{12}$$

$$\therefore \text{Force} = ma = \frac{5 \times 10^{-3} \times 1 \times 10^6}{12} = \frac{5000}{12} = 417 \text{ N}$$

8.

Sol: (d)

$$v^2 - u^2 = 2ax$$

$$a = \frac{-u^2}{2x} = \frac{-1}{2x}$$

Given that force needed to stop the body is F

$$\Rightarrow F = ma = \frac{-m}{2x}$$

$$(v')^2 - (u')^2 = 2a'x$$

$$a' = \frac{-(u')^2}{2x} = \frac{-9}{2x}$$

$$a' = \frac{-9}{2x}$$

Then the new force needed to stop the body is $F' = ma'$

$$= \frac{-9m}{2x}$$
$$F' = 9F$$

9.

SOL: (c) The acceleration of a rocket is given by

$$a = \frac{v}{m} \left(\frac{\Delta m}{\Delta t} \right) - g = \frac{400}{100} \left(\frac{6}{1} \right) - 10$$
$$= (24 - 10) = 14 \text{ m/s}^2$$

10.

SOL: (c) $a = \frac{m_2 - m_1}{m_1 + m_2} g = \frac{10 - 5}{10 + 5} g = \frac{g}{3}$

11.

sol: (A)

Initially particle was at rest. By the application of force its momentum increases.

Final momentum of the particle = Area of $F-t$ graph

$\Rightarrow mu = \text{Area of semi circle}$

$$mu = \frac{\pi r^2}{2}$$

$$= \frac{\pi \times 5 \times 5}{2}$$

$$u = \frac{25\pi}{2m}$$

12.

Sol: (b) Due to inertia of direction.

13.

Sol: (a) Gravitational force does not depend on the medium.

14.

Sol: (b) The value of g at the height h from the surface of earth

$$g' = g \left(1 - \frac{2h}{R} \right)$$

The value of g at depth x below the surface of earth

$$g' = g \left(1 - \frac{x}{R} \right)$$

These two are given equal, hence $\left(1 - \frac{2h}{R} \right) = \left(1 - \frac{x}{R} \right)$

On solving, we get $x = 2h$

15.

Sol: (a)

$$0^\circ\text{C} = 273 \text{ K}$$

The change in temperature of a body on Celsius = The change in temperature of a body on kelvin

$$\text{i.e } \Delta\text{C} \propto \Delta\text{K}$$

\Rightarrow The graph is straight line intersect on +y - axis

16.

Sol: (b)

Reflecting surface absorb some of the incident light on every reflection.

17.

Sol. (c)

In glass medium speed of violet color is minimum & red color is maximum

BIOLOGY

1. (d) Ribosomes are specially for production of protein.
2. (a) Cow directly feed grass so it is a primary consumer.
3. (c) Each ecosystem completes with a series of organism. Production required for production consumer - who receive nutrition from producer and Decomposer for maintain the balance in environment.
4. (b) Chloroplast is the chief site of photosynthesis.
5. (a) Gram (legume family) plant have more protein value from other plants.
6. (c) Secondary growth is increasing the width (girth) of plant. its due to rapid division of lateral meristem.
7. (c) only a virus and a protein molecule can see the microscope with 1 nm resolution other things like frog egg and plant chloroplast have larger size molecule.
8. (d) DNA found in Nucleus as genetic information, mitochondria for formation of ADP. and In chloroplast for making ATP (A Temporary complex)
9. Totipotency is the ability cell in which it can form any type of cell by the further division.
10. Gills of fish perform respiration, excretion and osmoregulation.
11. Tongue is voluntary it perform function which we provide by our Brain.
12. Anaerobically participating organism for nitrogen cycle are Denitrifying bacteria.
13. (c) Fungal cell have cell wall as well as storage material is Glycogen.
14. Anabolic means synthesis - so these organelles do
Ribosome - protein synthesis
Rough ER - protein synthesis
Smooth ER - lipid synthesis
15. Green manure helps in incorporation of potassium, phosphate and nitrogen salt value in soil.
16. Large Ear helps in cooling of Body due to heat exchange.