IIT ASHRAM BRINGS...

IIT ASHRAM

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

SCIENCE APTITUDE TEST (2016-17)

CLASS 10^{th}

KHOJ
A Hunt for Young Scientists..!

SAMPLE PAPER

SOLUTIONS & ANSWER KEY
for

Part - I : Mental Ability

Part - II : Mathematics

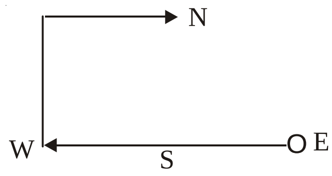
Part - III : Physics/ Chemistry

Part - IV : Biology

MENTAL ABILITY

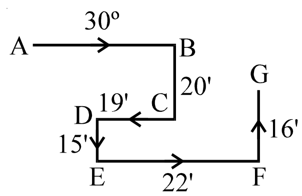
1.

Sol. (D) The following diagrams clarifies my movements.



2.

Sol. (C)



The movement of the rabbit from A to G are as show in figure. So, the rabbit's face is in North direction at the end of runs.

3.

Sol. From the relationship given in the question, we observe that each of the objects carries something in common to one another. A tennis fan can be a Cricket player as well as student. Hence diagram (a) represents this relationship. So our answer is (a).

4.

Sol. The only son of Bhaskar's father is the Bhaskar himself. This means that Bhaskar is the father of Asha. Hence, Asha is the daughther of Bhaskar. Therefore, answer is (A).

5.

Sol. From the properties of the clock we know that hands of a clock coincide once in every hour but between 11 o' clock and 1 o' clock they coincide only once. Therefore, the hands of a clock coincide 11 times in every 12 hours. Hence they will coincide (11×2) 22 times in 24 hours. So our answer is (B).

6.

Sol. The place of work of 'Sailor' is 'Ship'. Similarly the place where 'Lawyer' works is 'Court'. So, the answer is (C).

7.

Sol. The pattern is +4, +8, +12, +16, ...

$\therefore$ Missing number = 45 + 20 = 65

8.

Sol. Answer is (B) i.e. 12, because

(16 ÷ 4) + (27 ÷ 3) = 13 (Ist Circle) and

(65 ÷ 13) + (42 ÷ 7) = 5 + 6 = 11 (IInd Circle)

So, (72 ÷ 8) + (27 ÷ 9) = 9 + 3 = 12 (IIIrd Circle)

9.

Sol. In all the pairs except (A), the first number is a multiple of the second. Henc e, the answer is (A)

10.

Sol. Clearly, the given series consists of alternate letters in a reverse order. So, the missing terms would be P and N.

11.

Sol. This questions is of direct substitution method. Letters of the basic words are substituted as under.

Basic Word :	T	E	A	R	S
	↓	↓	↓	↓	↓
Coded Word :	V	W	X	Y	Z

Basic Word :	M	A	N
	↓	↓	↓
Coded Word :	1	2	3

Therefore, the coding for the word RESENTMENT will be YWZW3V1W3V. Hence, option (D) is our answer.

12.

Sol. Let A = 1, B = 2, C = 3,..., X = 24, Y = 25, Z = 26.

Then, M = 13 = 1 + 3 = 4;   O = 15 = 1 + 5 = 6;

L = 12 = 1 + 2 = 3;   T = 20 = 2 + 0 = 2;

Y = 25 = 2 + 5 = 7.

So, MOBILITY = 46293927.

Similarly, EXAMINATION = 56149512965.

13.

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

1	5	7	8	9	2	3	4	6
E	G	K	P	T	A	L	U	R

i.e., 2 as A, 3 as L, 5 as G, 4 as U and 9 as T. so, 23549 is coded as ALGUT.

14.

Sol. Putting the proper signs in the given expression, we get :

16 + 8 × 4 ÷ 2 – 4 = 16 + 16 – 4

= 32 – 4 = 28.

So, the answer is (b),

15.

Sol. Using the proper signs, we get :

Given expression $= 18 + 12 \div 6 \times 2 - 5$

$= 18 + 2 \times 2 - 5 = 18 + 4 - 5 = 22 - 5 = 17$

So, the answer is (d).

16.

Sol. On interchanging + and ×, we get the equation as

$10 \times 10 \div 10 - 10 + 10 = 10$

or $10 \times 1 - 10 + 10 = 10$

or $10 = 10$, which is true.

17.

Sol. Here, the number 2 appears in three dice, namely (i), (ii) and (iv). In these dice, we observe that the numbers 2, 4, 1 and 6 appear adjacent to 3. So, none of these numbers can be present opposite 2. The only number left is 5.

Hence, 5 is present on the face opposite 2.

18.

Sol. Here, the arrow rotates one step clockwise in every subsequent figure.

∴ The answer is fig (b).

19.

Sol. Clearly, each of the symbols moves one step CW in every step. Also, the symbols get replaced by new symbols one by one in an ACW direction. Thus, to obtain fig. (C), the symbols in (B) should move one step CW and the triangle should get

replaced by a new symbol.

Hence, the answer is (c).

20.

Sol. **'IT' = 13**

'ASHRAM' = 456748

In this each letter Corresponds to a digit,

So, 113456748 corresponds to 'IITASHRAM'

MATHEMATICS

1.

Sol. (c) $x = \dfrac{\sqrt{a}+\dfrac{1}{\sqrt{a}}}{2} \Rightarrow x^2 - 1 = \dfrac{\left(\sqrt{a}-\dfrac{1}{\sqrt{a}}\right)^2}{4}$

$\therefore \dfrac{\sqrt{x^2-1}}{x-\sqrt{x^2-1}} = \dfrac{1}{2}(a-1)$

2.

Sol. (d) $x = \dfrac{111110}{111111} = \dfrac{111111-1}{111111} = 1-\dfrac{1}{111111} = 1-\dfrac{6}{666666}$

$y = \dfrac{222221}{222223} = 1-\dfrac{2}{222223} = 1-\dfrac{6}{666669}$

$z = \dfrac{333331}{333334} = 1-\dfrac{3}{333334} = 1-\dfrac{6}{666668}$ Hence $y > z > x$.

3.

Sol.

$x = 3 + 3^{\frac{1}{3}} + 3^{\frac{2}{3}}$

$x - 3 = 3^{\frac{1}{3}} + 3^{\frac{2}{3}}$

$(x-3)^3 = \left(3^{\frac{1}{3}} + 3^{\frac{2}{3}}\right)^3$

$x^3 - 3.x^2.3 + 3.x.3^2 - 3^3 = \left(3^{\frac{1}{3}}\right)^3 + 3.3^{\frac{1}{3}}3^{\frac{2}{3}}\left(3^{\frac{1}{3}} + 3^{\frac{2}{3}}\right) + \left(3^{\frac{2}{3}}\right)^3$

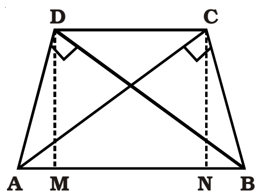
$x^3 - 9x^2 + 27x - 27 = 3 + 9(x - 3) + 9$

$x^3 - 9x^2 + 27x - 27 - 12 - 9x + 27 = 0$

$x^3 - 9x^2 + 18x - 12 = 0$

4.

Sol. BD = AC = 20 cm
(by Pythagorus theorem)



$\therefore DM = \dfrac{AD \times BD}{AB}$

$\therefore DM = \dfrac{15 \times 20}{25} = 12\text{cm}$, also CN = DM

$\therefore AM = \dfrac{AD^2}{AB}$ $\left[\because \Delta AMD \sim \Delta ADB \Rightarrow \dfrac{AM}{AD} = \dfrac{DM}{DB} = \dfrac{AD}{AB}\right]$

$\therefore AM = \dfrac{15 \times 15}{25} = 9$ cm, also AM = BN $[\because AD = CB]$

$\therefore$ MN = AB – (AM + BN) = 25 – (18) = 7 cm

But MN = CD = 7 cm

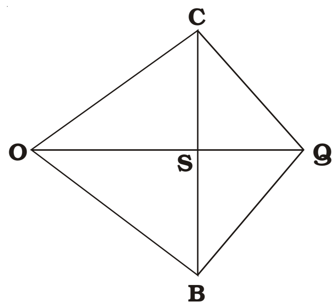
$\therefore$ **Area of trapezium** $= \frac{1}{2} \times (CD + AB) \times DM$

$= \frac{1}{2} \times 32 \times 12 = 192 \text{ cm}^2$ | similar Δ's |

5.

Sol. **OQ = OB = OC = r (say)**

$\angle AOD = \angle BOC = 120^0$



$\therefore \ \angle BOQ = \angle COQ = 60^0$ $\qquad \therefore \ \frac{SB}{OB} = \sin 60^0 = \frac{\sqrt{3}}{2} \Rightarrow SB = \frac{r\sqrt{3}}{2}$

$\therefore \ BC = 2SB = r\sqrt{3}$

Area of quadrilateral BQCO $= \frac{1}{2} \times BC \times OQ$

$= \frac{1}{2} \times r\sqrt{3} \times r = \frac{r^2\sqrt{3}}{2} \text{ cm}^2$

$\therefore$ **Area of both the quadrilateral**

$= 2\left(\frac{r^2\sqrt{3}}{2}\right) = r^2\sqrt{3} \text{ cm}^2$ | Area of a quadrilateral |

6.

Sol. $AD^2 + CD^2 = AC^2$

$AD^2 + (3BD)^2 = AC^2$

$AD^2 + 9BD^2 = AC^2$

$AD^2 + BD^2 + 8BD^2 = AC^2$

$AB^2 + 8 \times \left(\frac{1}{4}BC\right)^2 = AC^2$

$AB^2 + 8 \times \frac{1}{16} \times BC^2 = AC^2$

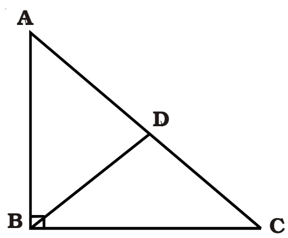
$\frac{2AB^2 + BC^2}{2} = AC^2$ $\qquad 2AB^2 + BC^2 = 2AC^2$

7.

Sol. **BD = 53 cm**

$\therefore$ **AD = CD = BD = 53 cm**

$\therefore$ **AC = 2 × 53 = 106 cm**



AB + BC + AC = 2 × 126 cm = 252 cm $\therefore$ AB + BC = 146 cm

Let AB = x cm $\therefore$ BC = (146 – x) cm

$\therefore$ $AB^2 + BC^2 = AC^2$

$x^2 + (146 - x)^2 = (106)^2$ ....(1)

Solving the equation (1), we get x = 56 and BC = 90

8.

Sol. ΔACQ, $CQ = \sqrt{AQ^2 - AC^2} = \sqrt{5^2 - 4^2} = 3$

Q is midpoint of BC.

BC = 2 CQ = 2 × 3 = 6 cm

$AB^2 = AC^2 + BC^2 = 4^2 + 6^2 = 52$ cm^2

9.

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.

	1	−12	17	−9	7	
3	–	3	−27	−30	−117	
	1	−9	−10	−39	−110	→ q_4
3	0	3	−18	−84		
	1	−6	−28	−123 → q_3		
3	0	3	−9			
	1	−3	−37 → q_2			
3	0	3				
	1	0 → q_1				

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

10.

Sol. At x=y, all the options A,B,C are zero.

Also, at y=z & z=x all the options A,B,C are zero.

So, Ans(D)

11.

Sol. $2\frac{351}{370}$

12.

Sol. Let the capacity of drum be x, then $\frac{3}{4}x - 15 = \frac{7}{12}x \Rightarrow \frac{9x - 7x}{12} = 15 \Rightarrow x = 90$

Alternatively : If you consider option (b) then $90 \times \frac{3}{4} - 15 = 90 \times \frac{7}{12}$

Alternatively : The decrease in amount = $\frac{x}{6} = 15 \Rightarrow x = 90$ litre.

13.

Sol. $$\frac{4^n \times 20^{m-1} \times 12^{m-n} \times 15^{m+n-2}}{16^m \times 5^{2m+n} \times 9^{m-1}} = \frac{2^{2n} \times 2^{2m-2} \times 5^{m-1} \times 2^{2m-2n} \times 3^{m-n} \times 3^{m+n-2} \times 5^{m+n-2}}{2^{4m} \times 5^{2m+n} \times 3^{2m-2}}$$

$$= 2^{2n+2m-2+2m-2n-4m} \times 3^{m-n+m+n-2-2m+2} \times 5^{m-1+m+n-2-2m-n}$$

$$= 2^{-2} \times 3^0 \times 5^{-3} = \frac{1}{4} \times \frac{1}{125} = \frac{1}{500}$$

14.

Sol. $(s-a)^2 + (s-b)^2 + (s-c)^2 + s^2 - a^2 - b^2 - c^2 = s^2 + a^2 - 2as + s^2 + b^2 - 2bs + s^2 + c^2 - 2cs + s^2 - a^2 - b^2 - c^2 = 4s^2 + (a^2 + b^2 + c^2) - 2s(a+b+c) - (a^2 + b^2 + c^2)$

$= 4s^2 - 2s(a+b+c) = 4s^2 - 4s^2 = 0$ $\quad [\because 2s = (a+b+c)]$

15.

Sol. $x^4 + \frac{1}{x^4} = \left(x^2 + \frac{1}{x^2}\right)^2 - 2$ $\quad \therefore 34 = \left(x^2 + \frac{1}{x^2}\right)^2 - 2 \Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 = 36 \Rightarrow x^2 + \frac{1}{x^2} = 6$

Again $\left(x - \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} - 2 \Rightarrow \left(x - \frac{1}{x}\right)^2 = 6 - 2 = 4$

$\Rightarrow \left(x - \frac{1}{x}\right) = 2$

Alternatively : Go through options.

16.

Sol. $AC^2 = AB^2 + BC^2 = 6^2 + 8^2 = 100 \Rightarrow AC = \sqrt{100} = 10$ cm

Area $= \frac{1}{2} \times$ base $\times$ length

$\frac{1}{2} \times AB \times BC = \frac{1}{2} AB \times OZ + \frac{1}{2} \times BC \times OX + \frac{1}{2} \times AC \times OY$

$\frac{1}{2} \times 6 \times 8 = \frac{1}{2} \times 6 \times r + \frac{1}{2} \times 8 \times r + \frac{1}{2} \times 10 \times r$

$24 = 3r + 4r + 5r \Rightarrow 12r = 24 \Rightarrow r = 2$ cm

17.

Sol. AFO, ΔBFO, ΔAEO, ΔCEO, ΔBDO, ΔCDO are all right angled triangles.

$AE^2 = OA^2 - OE^2$ ----------- (1)

$CD^2 = OC^2 - OD^2$ ----------- (2)

$BF^2 = OB^2 - OF^2$ ----------- (3)

Add (1), (2) and (3)

$AE^2 + CD^2 + BF^2 = OA^2 + OC^2 + OB^2 - OE^2 - OD^2 - OF^2$ -------------- (I)

$AF^2 = OA^2 - OF^2$ ----------- (4)

$BD^2 = OB^2 - OD^2$ ----------- (5)

$CE^2 = OC^2 - OE^2$ ----------- (6)

Add (4), (5) and (6)

$AF^2 + BD^2 + CE^2 = OA^2 + OB^2 + OC^2 - OF^2 - OD^2 - OE^2$ -------------- (II)

From (I) and (II), $AF^2 + BD^2 + CE^2 = AE^2 + CD^2 + BF^2$

18.

Sol. $\sin^4\theta + \cos^4\theta = \frac{1}{2}$

$(\sin^2\theta)^2 + (\cos^2\theta)^2 = \frac{1}{2}$

$(\sin^2\theta + \cos^2)^2 - 2\sin^2\theta\cos^2\theta = \frac{1}{2}$

$-2\sin^2\theta\cos^2\theta = \frac{1}{2} - 1$

$-\sin^2\theta\cos^2\theta = \frac{-1}{4}$

$\sin\theta\cos\theta = \pm\frac{1}{2}$

19.

Sol. Let $P(x) = x^4 - 9x^3 + 27x^2 - 29x + 6$

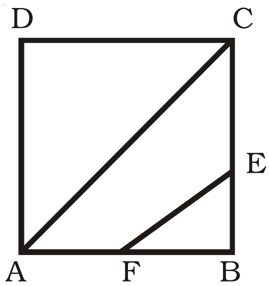
$P(-x) = x^4 + 9x^3 + 27x^2 + 29x + 6$

Sum of +ve number never be negative

$\therefore$ There are no negative real roots.

20.

Sol. ABCD is a square. F is the midpoint of AB.



BE = $\frac{1}{3}$BC. If the area of ΔFBE is 108 sq.cm

AF = BF, BE = $\frac{1}{3}$BC, ΔFBE area = 108 cm^2

Let AB = x cm, BF = $\frac{x}{2}$, BE = $\frac{x}{3}$

$\frac{1}{2} \times BF \times BE = 108 \Rightarrow \frac{1}{2}\times\frac{x}{2}\times\frac{x}{3} = 108 \Rightarrow x^2 = 108 \times 12 \Rightarrow x^2 = 1296$

$\Rightarrow x = \sqrt{1296} \Rightarrow x = 36$ cm

ΔABC, $AC^2 = AB^2 + BC^2 = 36^2 + 36^2 = 2 \times 36^2 \Rightarrow AC = 36\sqrt{2}$

21.

Sol. $AB^2 + BD^2 = AD^2$

$BC^2 + BE^2 = CE^2$

$AB^2 + BC^2 + BD^2 + BE^2 = AD^2 + CE^2$

$AC^2 + DE^2 = AD^2 + CE^2$

$5^2 + (2.5)^2 = \left(\frac{3\sqrt{5}}{2}\right)^2 + CE^2$

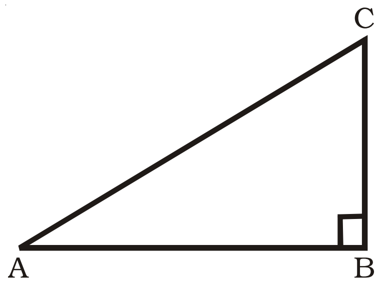
$25 + 6.25 = \frac{9 \times 5}{4} + CE^2$ $\Rightarrow$ **$(31.25)\,4 = 45 + CE^2 \times 4$**

$125 - 45 = CE^2 \times 4$ $\Rightarrow$ **$CE^2 = \frac{80}{4} = 20$** $\Rightarrow$ **$CE = \sqrt{20}$** $\Rightarrow$ **$CE = 2\sqrt{5}$ cm**

22.

Sol. **Let shortest side BC = x**

Perimeter = 5x



Area of triangle = 15 x

$\frac{1}{2} \times AB \times BC = 15x \Rightarrow \frac{1}{2} \times AB \times x = 15x \Rightarrow AB = 30$ cm

$AB + BC + AC = 5x \Rightarrow 30 + x + CA = 5x \Rightarrow CA = 4x - 30$

$AC^2 = AB^2 + BC^2 \Rightarrow (4x - 30)^2 = 30^2 + x^2 \Rightarrow 15x^2 - 240x = 0$

$\Rightarrow 15x(x - 16) = 0$

$\Rightarrow x = 0, x = 16$ cm

BC = x = 16 cm, AB = 30 cm

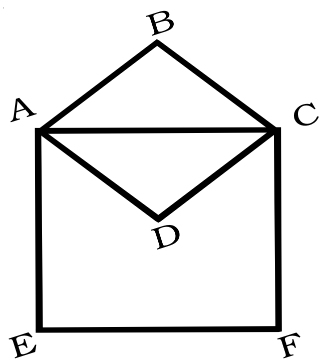
AC = 4x – 30 = 4 × 16 – 30 = 34 cm

$\therefore$ **30 cm, 34 cm, 16 cm are the three sides of the triangle.**

23.

Sol. **Area of ABCD = 108 m^2, length = 12 m.**

$\therefore$ **$l \times b = 108$** $\Rightarrow$ **breadth (b) = 9 m**



$\therefore$ **$AC = \sqrt{AD^2 + DC^2} = \sqrt{81 + 144} = 15$ m**

$\therefore$ **Side of the square AEFC = 15 m**

$\therefore$ **Area of the square AEFC = 15 × 15 = 225 sq.m**

24.

Sol. Given. AB and CD are two parallel chords of a circle, which are on opposite sides of the centre. AB = 10 cm, CD = 24 cm.

Distance between AB and CD = 17 cm

To find. Radius = ?

Construction. Draw OP $\perp$ AB and

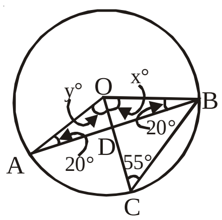
OQ ⊥ CD. Join OB and OD.
Procedure. Since, AB || CD and OP ⊥ AB, OQ ⊥ CD
∴ Points P, O and Q are collinear
Let OP = x cm Then, OQ = (17 – x)cm

PB $= \frac{10}{2} = 5\text{cm}$

(∴ ⊥ from the centre bisects the chord) QD = $\frac{24}{2} = 12\text{cm}$

(∴ ⊥ from the centre bisects the chord)
In rt. ΔOPB, $r^2 = x^2 + 5^2$ ....(1)
(By pythagoras theorem)
In rt.ΔOQD, $r^2 = (17 - x)^2 + 12^2$ ....(2)
From (1) and (2), we have
$x^2 + 25 = (17 - x)^2 + 12^2$
⇒ $x^2 + 25 = 289 + x^2 - 34x + 144$
⇒ $x^2 - x^2 + 34x = 289 + 144 - 25$
⇒ $34x = 408 \Rightarrow x = 12$ cm
Using the value of x in (1), we get.
$r^2 = 12^2 + 5^2 = 144 + 25 = 169$
∴ Radius r = 13 cm (∴ radius can't be – ve).

25.
Sol. Given. ∠OAB = 20°, ∠OCB = ∠55°
To find. ∠BOC = ? and ∠AOC = ?
Procedure. Let ∠AOC = y° and ∠BOC = x°
∠OBA = ∠OAB [As OA = OB = radius]
∴ ∠OBA = 20°
OD = OD ...[Common]



∴ ΔOAD ≅ ΔOBD (SAS theorem of congruence)
⇒ x° = y° ...(C.P.C.T)
Also, ∠ODA = ∠ODB ...(C.P.C.T)
∠ODA + ∠ODB = 180° ...[Linear pair]
2∠ODA = 180° ⇒ ∠ODA = 90°
∴ ∠ODB = 90° ...[∵ ∠ODA = 90°]
So in ΔODA,
∠AOD + ∠OAD + ∠ODA = 180°
y° + 20° + 90° = 180°
y° = 180° – 110° = 70°
∴ x° = y° = 70°.

26.

Sol. In ΔPQS, we have $PQ + QS > PS$ ... (i)

[$\because$ Sum of the two sides of a Δ is greater than the third side]

Similarly, in ΔPRS, we have

$RP + RS > PS$ .... (ii)

Adding (i) and (ii), we get

$(PQ + QS) + (RP + RS) > PS + PS$

$\Rightarrow$ $PQ + (QS + RS) + RP > 2\ PS$

$\Rightarrow$ $PQ + QR + RP > 2\ PS$ [$\because$ $QS + RS = QR$]

27.

Sol. Since the sum of any two sides of a triangle is greater than the third side.

Therefore, in ΔPQR, we have

$PQ + QR > PR$ .... (i)

In Δ RSP, we have

$RS + SP > PR$ .... (ii)

In ΔPQS, we have

$PQ + SP > QS$ .... (iii)

In ΔQRS, we have

$QR + RS > QS$ .... (iv)

Adding (i), (ii), (iii) and (iv), we get

$2\ (PQ + QR + RS + SP) > 2\ (PR + QS)$

$\Rightarrow$ $PQ + QR + RS + SP > PR + QS$.

This proves (i).

Now, in ΔOPQ, we have

$OP + OQ > PQ$ .... (v)

In ΔOQR, we have

$OQ + OR > QR$ .... (vi)

In ΔORS, we have

$OR + OS > RS$ .... (vii)

In ΔOSP, we have

$OS + OP > SP$ .... (viii)

Adding (v), (vi), (vii) and (viii), we get

$2\ (OP + OQ + OR + OS) > PQ + QR + RS + SP$

$\Rightarrow 2\ \{(OP + OR) + (OQ + OS)\}$

$> PQ + QR + RS + SP$

$\Rightarrow 2\ (PQ + QS) > PQ + QR + RS + SP$

$$\begin{bmatrix} \because OP + OR = PR \\ \text{and } OQ + OS = QS \end{bmatrix}$$

$\Rightarrow PQ + QR + RS + SP < 2\ (PR + QS)$

This proves (ii).

28.

Sol. **Let the cost of one chair and one table be Rs. C and Rs. T respectively.**

$4C + 3T = 1800$ .... (1)

$5C + 4T = 2300$ .... (2)

$\{(2) \times 3\} - \{(1) \times 4\}$ we get $C = 300$

Cost of each their = Rs. 300

29.

Sol. **Let the numbers be 3x, 4x and 5x**

$3x + 5x = 24 \Rightarrow$ **$x = 3$**

Sum of all the numbers = $12x = 36$

30.

Sol. **$? \times ? = 111 \times 3996$**

$\therefore ?^2 = 111 \times 111 \times 36 = 111^2 \times 6^2$

$\therefore ? = 111 \times 6 = 666$

PHYSICS & CHEMISTRY

1.

SOL: (a)

An aeroplane flies 400 *m* north and 300 *m* south so the net displacement is 100 *m* towards north.

Then it flies 1200 *m* upward so $r = \sqrt{(100)^2 + (1200)^2}$

$= \mathbf{1200\,m}$

2.

SOL: (c)

If the body starts from rest and moves with constant acceleration then the ratio of distances in consecutive equal time interval $S_1 : S_2 : S_3 = 1 : 3 : 5$

3.

SOL: (c)

Total distance $= \frac{1}{2}gt^2 = \frac{25}{2}g$

Distance moved in 3 *sec* $= \frac{9}{2}g$

Remaining distance $= \frac{16}{2}g$

If *t* is the time taken by the stone to reach the ground for the remaining distance then

$\Rightarrow \frac{16}{2}g = \frac{1}{2}gt^2 \Rightarrow t = 4 \text{ sec}$

4.

SOL: (b) $u = 4\ m/s$, $v = 0, t = 2\sec$

$v = u + at \implies 0 = 4 + 2a \implies a = -2\ m/s^2$

$\therefore$ Retarding force $= ma = 2 \times 2 = 4$ *N*

5.

SOL: (c) Relative density of alloy $= \frac{\text{Density of alloy}}{\text{Density of water}}$

$= \frac{\text{Mass of alloy}}{\text{Volume of alloy} \times \text{density of water}}$

$= \frac{m_1 + m_2}{\left(\frac{m_1}{\rho_1} + \frac{m_2}{\rho_2}\right) \times \rho_w} = \frac{m_1 + m_2}{\frac{m_1}{\rho_1/\rho_w} + \frac{m_2}{\rho_2/\rho_w}} = \frac{m_1 + m_2}{\frac{m_1}{s_1} + \frac{m_2}{s_2}}$

$\left[\textbf{As relative density of substance } = \frac{\textbf{density of substance}}{\textbf{density of water}}\right]$

6.

Sol: (d) Accelaration due to gravity in terms of density and radius of the planet is

$\mathbf{g} = \frac{\mathbf{4}}{\mathbf{3}}\pi\mathbf{G}\rho\mathbf{R}$

$\Rightarrow \mathbf{g}\ \alpha\ \rho\mathbf{R}$

7.

Sol: (b) $g' = g\left(1 - \frac{d}{R}\right) \Rightarrow \frac{g}{n} = g\left(1 - \frac{d}{R}\right) \Rightarrow d = \left(\frac{n-1}{n}\right)R$

8.

Sol: (c) Let m = mass of boy, M = mass of man

v = velocity of boy, V = velocity of man

$\frac{1}{2}MV^2 = \frac{1}{2}\left[\frac{1}{2}mv^2\right]$ ....(i)

$\frac{1}{2}M(V+1)^2 = 1\left[\frac{1}{2}mv^2\right]$ ....(ii)

Putting $m = \frac{M}{2}$ and solving $V = \frac{1}{\sqrt{2}-1}$

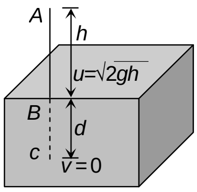
9.

Sol: (c) Let the blade stops at depth d into the wood.

$v^2 = u^2 + 2aS$

$\Rightarrow 0 = (\sqrt{2gh})^2 + 2(g-a)d$

by solving $a = \left(1 + \frac{h}{d}\right)g$



So the resistance offered by the wood $= mg\left(1 + \frac{h}{d}\right)$

10.

SOL:(d) Time lost in covering the distance of 1.98 km by the sound waves $\mathbf{t} = \frac{\mathbf{d}}{\mathbf{v}} = \frac{\mathbf{1980}}{\mathbf{330}} = \mathbf{6.0}\, sec$

11.

Sol: (a)

Distance of person from nearer cliff, (d_1) = $\frac{\mathbf{v \times t}}{\mathbf{2}} \Rightarrow \mathbf{d_1} = \frac{\mathbf{330 \times 3}}{\mathbf{2}} = \mathbf{495m}$

Distance of person from farther cliff,

$$\mathbf{d_2} = \frac{\mathbf{v \times t}}{\mathbf{2}} \Rightarrow \mathbf{d_2} = \frac{\mathbf{330 \times 5}}{\mathbf{2}} = \mathbf{825m}$$

$\therefore$ **Total distance between two cliffs = d_1+d_2 = (495 + 825) = 1320m.**

12.

Sol: (a) Resistor 'R' and galvanometer are in series

13.

Sol: (a)

electric p**o**wer = $\mathbf{I^2R}$

When current is constant

$p \, \alpha \, \mathbf{R_{eq}}$

14.

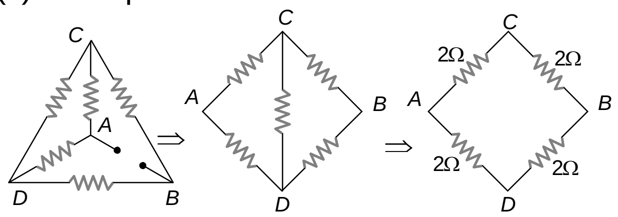
Sol: (c) $R = \rho \frac{l}{A}$

15.

Sol. (c) $R_{AB} = 2 + \frac{1}{3} = 2\frac{1}{3}\Omega$.

16.

SOL: (d) The equivalent circuits are as shown below



Clearly, the circuit is a balanced Wheatstone bridge. So effective resistance between *A* and *B* is 2Ω.

17.

SOL: (c) By Kirchhoff's current law.

BIOLOGY

1. About 50% energy of milk comes from fat.
2. CO_2 prevent the growth of insect and pest.
3. Keeping the plant in dark - boiling the leaf in ethanol - ringing the leaf with not watch adding iodine solution
4. Hydra is acoelomate organism.
5. Nematodes (Round worm) have dual digestive methods.
6. Hypotonic solution have higher concentration at outside the cell, so the fluid will more from outside to inside the cell en it becomes turgid.
7. Its root meristem because the branches like structure are fucing downward growth.
8. Involuntary muscle can perform Autonomic function but Tongue performs action our will.
9. Platelets are smaller than RBC and RBC (Erythrocytes) is smaller than Eosinophils cells
10. The cell will be a fungal cell.
11. Option (d) is correct.
12. Cockroach have exoskeleton but no endoskeleton.
13. Nitrogenous base pair are comes in these sequence
    A always unit with T
    G always unit with G
    So the sequence must be opposite.
14. Liver secretion bile which do not have any enzymes.
15. The pH of blood is 7.4.
16. Fish gills perform all the above function.