# ANSWERKEY

| Q. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A.** | **2** | **2** | **2** | **1** | **1** | **2** | **1** | **3** | **4** | **2** | **1** | **4** | **3** | **4** | **1** | **4** | **3** | **1** | **1** | **3** |
| **Q.** | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| **A.** | **2** | **2** | **4** | **3** | **4** | **1** | **4** | **4** | **4** | **4** | **1** | **1** | **3** | **2** | **1** | **3** | **2** | **4** | **1** | **2** |
| **Q.** | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| **A.** | **4** | **1** | **4** | **4** | **4** | **2** | **2** | **3** | **4** | **2** | **1** | **2** | **1** | **2** | **1** | **2** | **3** | **4** | **2** | **4** |
| **Q.** | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| **A.** | **3** | **4** | **3** | **4** | **3** | **4** | **3** | **2** | **1** | **4** | **3** | **3** | **3** | **4** | **4** | **2** | **3** | **3** | **4** | **1** |
| **Q.** | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | | | | | | | | | | |
| **A.** | **3** | **4** | **4** | **4** | **2** | **1** | **4** | **1** | **3** | **4** | | | | | | | | | | |

# SOLUTION

**2.** NCERT XIII Part 1 Page 72.

**3.** In *f*cc unit cell 4r = $\sqrt{2}$ a

[r = radius of Cu atom, a = edge length]

So, r = $\dfrac{\sqrt{2}a}{4}$

$$r = \frac{\sqrt{2}\times 361}{4} = 127 \text{ pm}$$

**4.** $Sb_2S_3 \rightarrow 2\underset{2x}{Sb^{+2}} + 3\underset{3x}{S^{--}}; K_{sp} = (2x)^2.(3x)^3$

$K_{sp} = 108x^5$; $K_{sp} = 108 \times (1 \times 10^{-5})^5 = 108 \times 10^{-25}$

**5.** It is buffer solution so,

$$pH = pK_a + \log \frac{\text{Salt}}{\text{Acid}}$$

$$pH = pK_a - \log \frac{\text{Acid}}{\text{Salt}} \quad \left(\text{Given} \frac{[\text{Acid}]}{[\text{Salt}]} = 10:1\right)$$

$pH = pK_a - \log 10$

$pH = pK_a - 1$

**6.** NCERT-XII, Part-I, Page-48(formula-2.26).

**7.** $P_B = p^{\circ}_B X_B; \quad \therefore P_B = \dfrac{\frac{78}{78}}{\frac{78}{78}+\frac{46}{92}} \times 75; \therefore P_B = 50 \text{ torr}$

**8.** NCERT XI[th] Part-I Page No. 142.

Let the mass of methane and oxygen is w

$$\text{mole fraction of oxygen} = \frac{\frac{w}{32}}{\frac{w}{32}+\frac{w}{16}}$$

$$= \frac{\frac{1}{32}}{\frac{1}{32}+\frac{1}{16}} = \frac{\frac{1}{32}}{\frac{3}{32}} = \frac{1}{3}$$ Let the total pressure be P

The pressure exerted by oxygen (partial pressure)

$= X_{O_2} \times P_{total} \Rightarrow P \times \dfrac{1}{3}$. Hence (3) is correct.

**9.** NCERT XI Part 1 Page # 196

| | | | | |
|---|---|---|---|---|
| A | + | B | $\rightarrow$ | 2C |
| (3–0.75) | | (1–0.75) | 1.5 | |

$$K = \frac{[C]^2}{[A][B]} = \frac{(1.5)^2}{2.25\times 0.25} = \frac{2.25}{2.25\times 0.25} = 4.0$$

**23.** $NCl_5$, $PH_5$, $CuI_2$ exist नहीं करते हैं।

**24.** $PCl_3$ is $sp^3$ hybridised and pyramidal in shape.

$PCl_3$ $sp^3$ संकरण का होता है यह पिरामीडीय होता है।

**26.** [X] is $MnO_4^{2-}$

x + 4 (–2) = –2

x = + 6

**28.** $SO_2$ , $Cl_2O_7$ , $N_2O_5 \longrightarrow$ Acidic nature oxides
$N_2O \longrightarrow$ Neutral oxide.

**29.** $ClO_4^{\ominus}$ does not disproportionate because in this oxoanion chlorine is present in its highest oxidation state.

**30.** $CCl_4 + H_2O \xrightarrow{\text{R.T.}}$ No reaction

**31.** Difference of roots

$\alpha - \beta = (\alpha + h) - (\beta + h)$

$$\frac{\sqrt{D_1}}{a} = \frac{\sqrt{D_2}}{p} \qquad \frac{D_1}{D_2} = \frac{a^2}{p^2}$$

**32.** $a(p + x)^2 + 2bpx + c = 0$

roots are q, r

product of roots $= qr = p^2 + \frac{c}{a}$

**34.** $a(bc - 1) - 1(c - 1) + (1 - 6) > 0$

$abc - a - b - c + 2 > 0 \qquad ...(1)$

$A > G$

$$\frac{a+b+c}{3} > (abc)^{1/3} \Rightarrow (a + b + c) - 3(abc)^{1/3} > 0 \quad ..(2)$$

on adding $eq^n$ (1) and (2)

$abc - 3(abc)^{1/3} + 2 > 0$

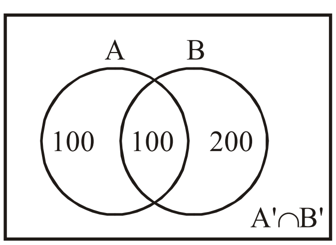
$x^3 - 3x + 2 > 0$

$(x - 1)^2 (x + 2) > 0$

$x > -2$

$(abc)^{1/3} > -2 = abc > -8$

**36.**




$n(A' \cap B') = 700 - 400 = 300$

**38.** Since a, b, c are the roots of the equation $x^3 - 3x^2 + x + \lambda = 0$

$\Rightarrow \; a + b + c = 3 \qquad \Rightarrow \; a + b = 3 - c$

Now area of the triangle will be

$$A = \frac{1}{2} \times \frac{1}{a+b} \times 1 = \frac{1}{2(a+b)} = \frac{1}{2(3-c)}$$

$$\Rightarrow \quad \frac{dA}{dc} = \frac{1}{2(3-c)^2} > 0$$

As A is an increasing function & $c \in [1,2]$

$\therefore \quad A_{max} = \frac{1}{2}$ sq. units.

**39.** $\vec{\alpha}.\vec{\beta} = |\vec{\alpha}||\vec{\beta}|\cos\frac{\pi}{4}$

$$\sqrt{2}a + 3\sqrt{2}b + 4c = I.6.\frac{1}{\sqrt{2}}$$

$a + b + 2\sqrt{2}\,C = I.3$

$\Rightarrow$ LHS is integer if c = 0

then $\vec{\alpha} = a\hat{i} + b\hat{j}$ which lies in xy plane

**40.** Let P(h, k) be the point from which two tangents are drawn to $y^2 = 4x$. Any tangent to the parabola $y^2 = 4x$ is

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

If it passes through P(h, k), then

$$k = mh + \frac{1}{m} \Rightarrow m^2 h - mk + 1 = 0$$

Let $m_1$, $m_2$ be the roots of this equation. Then,

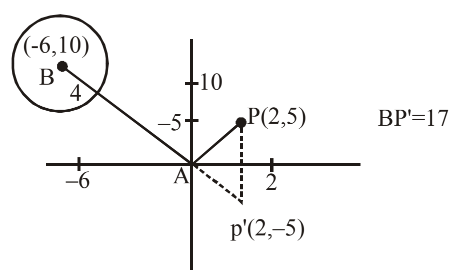
$$m_1 + m_2 = \frac{k}{h} \text{ and } m_1 m_2 = \frac{1}{h}$$

$$\Rightarrow 3m_2 = \frac{k}{h} \text{ and } 2m_2^2 = \frac{1}{h} \; [\because m_1 = 2m_2 \text{(given)}]$$

$$\Rightarrow 2\left(\frac{k}{3h}\right)^2 = \frac{1}{h} \Rightarrow 2k^2 = 9h$$

Hence, P(h, k) lies on $2y^2 = 9x$

**42.**




**44.** $$\left.\frac{dy}{dx}\right|_{(x_1 y_1)} = \frac{4x_1}{y_1} = 4 \Rightarrow y_1 = x_1$$

$(x_1, y_1)$ lies on $4x^2 - y^2 = 12$

$\Rightarrow x_1 = y_1 = \pm 2$

$\therefore$ Equation of tangent lines with slope 4 are

$y = 4x + 6$ & $y = 4x - 6$

$\Rightarrow |c_1 - c_2| = 12$

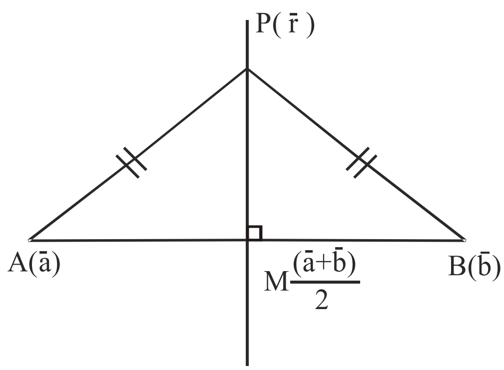
**46.** Eq of plane O Q R is

$$\begin{vmatrix} x & y & z \\ 1 & 3 & 4 \\ 2 & 1 & -2 \end{vmatrix} = 0$$

$\Rightarrow 2x - 2y + z = 0$

distance of P from plane $= \left|\dfrac{6+4-1}{\sqrt{4+4+1}}\right| = 3$

**47.**




$\overline{MP} \perp \overline{AB}$

$\Rightarrow \overline{MP}\,.\,\overline{AB} = O$

$$\Rightarrow \left(\bar{r} - \frac{\bar{a}+\bar{b}}{2}\right).\left(\bar{b}-\bar{a}\right) = 0$$

$$\Rightarrow \quad \left[\bar{r} - \frac{1}{2}\left(\bar{a}+\bar{b}\right)\right]\left(\bar{a}-\bar{b}\right) = 0$$

**49.** Statement-2 is clearly true.

Since $\overrightarrow{OM} = \lambda\overrightarrow{OD} = \lambda\vec{d}$

Now points A, B, C and M are coplanar

$$\Rightarrow \quad [\vec{a}\ \vec{b}\ \vec{c}] = [\vec{m}\ \vec{a}\ \vec{b}] + [\vec{m}\ \vec{b}\ \vec{c}] + [\vec{m}\ \vec{c}\ \vec{a}]$$

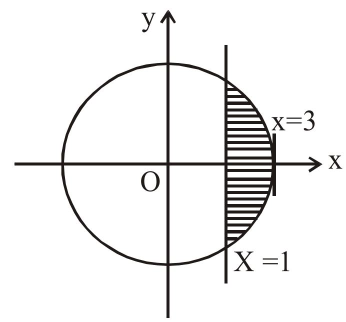
$$= [\lambda\vec{d}\ \vec{a}\ \vec{b}] + [\lambda\vec{d}\ \vec{b}\ \vec{c}] + [\lambda\vec{d}\ \vec{c}\ \vec{a}]$$

$$\Rightarrow \quad \lambda = \frac{[\vec{a}\ \vec{b}\ \vec{c}]}{[\vec{d}\ \vec{a}\ \vec{b}] + [\vec{d}\ \vec{b}\ \vec{c}] + [\vec{d}\ \vec{c}\ \vec{a}]}$$

and therefore Statement-1 is also true.

**51.** Since the area is symmetrical about x-axis, so

area $= 2\displaystyle\int_1^3 \sqrt{9-x^2}\,dx$




$$= \left[x\sqrt{9-x^2} + 9\sin^{-1}x/3\right]_1^3$$

$= 9\pi/2 - \sqrt{8} - 9\sin^{-1}(1/3)$

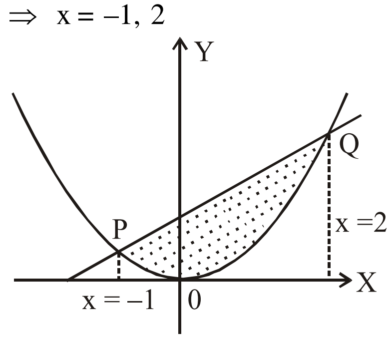
$= 9\,(\pi/2 - \sin^{-1} 1/3) - \sqrt{8} = 9\sec^{-1} 3 - \sqrt{8}$

**52.** Solving the equation of the given curves for x, we get

$x^2 = x + 2$

$\Rightarrow (x-2)(x+1) = 0$

$\Rightarrow x = -1, 2$




So reqd. area $= \displaystyle\int_{-1}^{2}\left[\frac{x+2}{4} - \frac{x^2}{4}\right]dx$

$$= \frac{1}{4}\left[\frac{x^2}{2} + 2x - \frac{x^3}{3}\right]_{-1}^{2}$$

$$= \frac{1}{4}[(2+4-8/3) - (1/2 - 2 + 1/3)] = \frac{9}{8}$$

**53.** Given equation can be written as

$$\left[1 + \left(\frac{d^2y}{dx}\right)^3\right]^4 = \left(\frac{m}{m+1}\right)^5\left(\frac{d^3y}{dx^3}\right)^5$$

This shows that its order = 3, degree = 5

**54.** a = $2\cos\frac{\alpha+\beta}{2}\cos\frac{\alpha-\beta}{2}-2\cos^2\frac{\alpha+\beta}{2}+1$

= $2\cos\frac{\alpha+\beta}{2}\left(\cos\frac{\alpha-\beta}{2}-\cos\frac{\alpha+\beta}{2}\right)+1$

= $2\cos\frac{\alpha+\beta}{2}\cdot 2\sin\frac{\alpha}{2}\sin\frac{\beta}{2}+1=b+1$

$\Rightarrow$ a – b = 1

**55.** $\sin^2 x\cos^2 x\,(1-\sin^2 x)=1$

$\sin^2 x\cos^4 x=1$

No value of x for L.H.S. = R.H.S.

**56.** Given, $\sigma_{10}^2=\frac{99}{12}=\frac{33}{4}$

$\Rightarrow\ \sigma_{10}=\frac{\sqrt{33}}{2}$

SD of required series = $3\sigma_{10}=\frac{3\sqrt{33}}{2}$

**57.** $A\wedge(A\vee B)$ is F when A = F

$A\vee(A\wedge B)$ is F when A = F, B = F

We have

$[A\wedge(A\to B)]\to B$

$\equiv\ [A\wedge(\sim A\vee B)]\to B$

$\equiv\ [(A\wedge(\sim A))\vee(A\wedge B)]\to B$

$\equiv\ A\wedge B\to B$

$\equiv\ \sim(A\wedge B)\vee B$

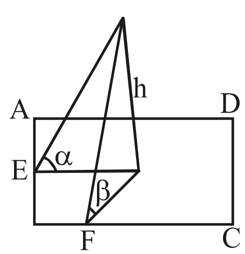
$\equiv\ [(\sim A)\vee(\sim B)]\vee B$

$\equiv\ (\sim A)\vee[(\sim B)\vee B]$

$\equiv\ (\sim A)\vee T\equiv T$

$\therefore\ [A\wedge(A\to B)]\to B$ is a tautology.

**58.**




Statement-2 is True. In statement-1 if the height of the pole is h, then the length of the adjacent sides of the field are 2h cot α and 2h cot β and the area if $4h^2\cot\alpha\cot\beta=4h^2$ as $\alpha+\beta=\pi/2$ $\Rightarrow\cot\alpha\cot\beta=1$.

So $4h^2=2500\Rightarrow h=25$ units.

and the statement-1 is true using statement-2.

**59.** $f(x)=x^3-x^2+100x+1001$

$f'(x)=3x^2-2x+100>0\ \ \forall\ x\in R$

$\therefore$ f(x) is increasing (strictly)

$\therefore\ f\left(\frac{1}{1999}\right)>f\left(\frac{1}{2000}\right)$

f(x + 1) > f(x – 1)

**60.** Let $f(x)=x^2\,\ell n\,\frac{1}{x}=-x^2\,\ell n\,x$

$\therefore\ f'(x)=-2x\,\ell n\,x-x=0\quad\Rightarrow\ x=e^{-1/2}$

$\lim\limits_{x\to0}f(x)=0,\ \lim\limits_{x\to\infty}f(x)=-\infty$ and $f(e^{-\frac{1}{2}})=\frac{1}{2e}$

$\therefore$ Maximum value of f(x) is $\frac{1}{2e}$

**61.** $X=\frac{A^2B}{C^{1/3}D}$

$\frac{\Delta X}{X}=2\frac{\Delta A}{A}+\frac{\Delta B}{B}-\frac{1}{3}\frac{\Delta C}{C}-\frac{\Delta D}{D}$

$=2\times2\%+2\%-\frac{1}{3}\times4\%-5\%$

$=4\%+2\%-\frac{4}{3}\%-5\%$

The percentage error contributed by C is $\frac{4}{3}$ which is minimum among A, B, C and D.

**62.** (i) $[(a\cos\theta)\hat{i}+(b\sin\theta)\hat{j}].[(b\sin\theta)\hat{i}-(a\cos\theta)\hat{j}]$

= ab sin θ cos θ – ba sin θ cos θ = 0

(ii) $[a(\cos\theta)\hat{i}+(b\sin\theta)\hat{j}].$

$\left[\left(\frac{1}{a}\sin\theta\right)\hat{i}-\left(\frac{1}{a}\cos\theta\right)\hat{j}\right]$

= sin θ cos θ – sin θ cos θ = 0

(iii) $[(a\cos\theta)\hat{i}+(b\sin\theta)\hat{j}].\ 5\hat{k}=0$

Hence, all the three options are correct because the dot product of two perpendicular vectors is zero.

**63.** Using $v^2 = u^2 - 2gh$ (for vertically upward motion under gravity)

$$0 = u^2 - 2 \times 10 \times 5$$

$$u = 10 \text{ ms}^{-1}$$

Also using $u = u - gt$

$$0 = 10 - 10 \times t \qquad t = 1\text{s}$$

which means the each ball is thrown after 1 sec. Therefore the number of balls thrown up per minute is 60.

**64.** Velocity of the stone relative to the ground

$$= 10 + 5 = 15 \text{ m/s (upwards)}$$

Velocity of the stone after 2s, relative to the ground

$$v = 15 - 10 \times 2 \quad (\text{using, } v = u - gt)$$

$$v = -5 \text{ ms}^{-1}$$

or $$|v| = +5 \text{ ms}^{-1}$$

**65.** Given $x = ct + bt^2 - ct^3$

velocity $v = \frac{dx}{dt} = a + 2bt - 3ct^2$

and acceleration $f = \frac{dv}{dt} = 2b - 6ct$

Acceleration is zero at time

$2b - 6ct = 0 \qquad t = \frac{b}{3c}$

Putting this value of t in eq. (i), we get

$$v = a + 2b\left(\frac{b}{3c}\right) - 3c\left(\frac{b}{3c}\right)^2$$

or $$v = a + \frac{2b^2}{3c} - \frac{b^2}{3c} = a + \frac{b^2}{3c}$$

**66.** Given, $R = 4\sqrt{3}H$

$$\frac{u^2 \sin 2\theta}{g} = \frac{4\sqrt{3}u^2 \sin^2\theta}{2g}$$

or $$2 \sin\theta \cos\theta = 2\sqrt{3} \sin^2\theta$$

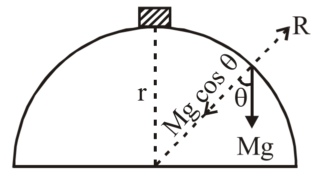
or $$\cos\theta = \sqrt{3} \sin\theta$$

$$\tan\theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30^\circ$$

**67.** $Mg\cos\theta - R = \frac{Mv^2}{r}$

when the body leaves the surface, R = 0

$$Mg\cos\theta = \frac{Mv^2}{r}$$




$$\cos\theta = \frac{v^2}{rg} = \frac{(5)^2}{5 \times 10} = \frac{1}{2}$$

$$\theta = 60^\circ$$

**68.** Time taken to reach the bag on the ground

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 490}{9.8}} = 10\text{s}$$

$\therefore \qquad R = 150 \times 10 = 1500\text{m}$

**69.** $$H_{max} = \frac{u^2 \sin^2\theta}{2g} = 4$$

$$R = \frac{u^2 \sin^2 2\theta}{g} = 12$$

Dividing both the equations, we get

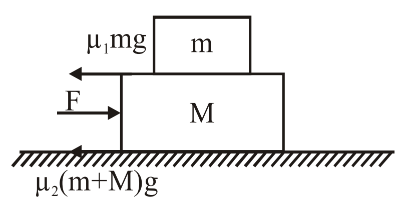
$$\tan\theta = \frac{4}{3} \text{ or } \sin\theta = \frac{4}{5}$$

Putting the value of sin θ in eqn. (i), we get,

$$u^2 = \frac{8g}{16/25}$$

or $$u = 5\sqrt{g/2}$$

**70.** $F = \mu_2 (m + M) g + (M + m)a \qquad ....(i)$




Now, since the friction force between m and M is $\mu_1$ mg, the acceleration.

$$a = \frac{\text{Force}}{\text{mass}} = \frac{\mu_1 mg}{m} = \mu_1 g$$

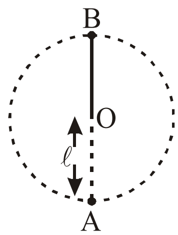
Putting the value of a in eqn. (i), we get

$$F = \mu_2(m + M)g + \mu_1(m + M)g$$

$$= (\mu_1 + \mu_2)(m + M)g$$

$$= (0.5 + 0.7)(3 + 5) \times 10 = 96 \text{ N}$$

**71.** $\frac{1}{2}mv_A^2 + 0 = \frac{1}{2}mv_B^2 + mg(2\ell)$




If $v_B = v$ then $v_A = 2v$ (given)

$\therefore \qquad \frac{1}{2}m(2v)^2 = \frac{1}{2}mv^2 + 2mg\ell$

$$\frac{1}{2}mv^2 \times 3 = 2mg\ell$$

$$v = 2\sqrt{\frac{g\ell}{3}}$$

**72.** $$F = \frac{d(mv)}{dt} = v\frac{dm}{dt}$$

$= 0.2 \times 2 = 0.4$ kg-m/s

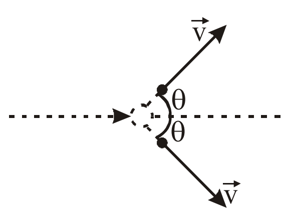
$$\text{Power (P)} = \frac{\text{Work}}{\text{Time}}$$

$$= \frac{\text{Force} \times \text{Displacement}}{\text{Time}} = \text{Force} \times \text{velocity}$$

$= 0.4 \times 0.2 = 0.08$ J/s or watt

**73.** Initial horizontal momentum = Final horizontal momentum

2kg×4/m/s = 1kg×v cos θ m/s+1 kg×v cosθm/s




$8 = 2v \cos\theta$

$v \cos\theta = 4$ m/s .....(i)

The initial kinetic energy of the shell

$$= \frac{1}{2} \times 2\text{kg} \times (4\text{m/s})^2$$

= 16 J

An amount of 48 J is imparted by explosion. Thus, the total energy of the fragments is 64 J, i.e. each fragment has 32 J kinetic energy.

$$= \frac{1}{2} \times 1\text{kg} \times v^2 = 32\text{J}$$

$v^2 = 64$

$v = 8$ m/s

and $\qquad v \cos\theta = 4$

$$\cos\theta = \frac{1}{2} \Rightarrow \theta = 60^\circ$$

**74.** $s = 6t^3 - t^2 - 1$

$$v = \frac{ds}{dt} = 18t^2 - 2t$$

At $\qquad t = 0;\ v = 0$

At $\qquad t = 3s;\ v = 18 \times 9 - 2 \times 3 = 156$ m/s

Also $\qquad W = \frac{1}{2}m(v_2^2 - v_1^2)$

$$= \frac{1}{2} \times 3(156^2 - 0)$$

= 36504 J

**75.** Let the spring constant of spring Q is k and that of P is 2k. The extensions produced by applying equal forces on them are $x_p$ and $x_Q$, respectively. Since F = kx (numerically)

or $\qquad x = \frac{F}{k}$

and $\qquad U = \frac{1}{2}kx^2$

or $\qquad U = \frac{1}{2}k\left(\frac{F}{k}\right)^2 = \frac{F^2}{2k}$

or $\qquad U \propto \frac{1}{k}$

Thus, $\qquad \frac{U_Q}{U_P} = \frac{k_P}{k_Q} = \frac{2k}{k} = 2$

or $\qquad U_Q = 2U_P = 2E$

**76.** $e = \dfrac{\text{Relative velocity after collision}}{\text{Relative velocity before collision}}$

For the collision between the blocks A and B

$$e = \frac{v_B - v_A}{v_A - v_B} = \frac{v_B - v_A}{10 - 0} = 0.5$$

($\because$ $u_B = 0$ and $u_A = 10$ m/s)

or $\quad v_B - v_A = 5 \quad$ .....(i)

Also from the principle of conservation of linear momentum,

$$mu_A + mu_B = mv_A + mv_B$$

or $\quad 10 + 0 = v_A + v_B$

or $\quad v_B + v_A = 10 \quad$ ....(ii)

From eqs. (i) and (ii)

$$v_B = 7.5 \text{ m/s and } v_A = 2.5 \text{ m/s}$$

Now for the collision between the blocks B and C.

$$e = \frac{v_C - v_B}{u_B - u_C} = \frac{v_C - v_B}{7.5 - 0} = 0.5$$

or $v_C - v_B = 7.5 \times 0.5 = 3.75 \quad$ ...(iii)

and also from momentum conservation principle,

$$mu_B + mu_C = mv_B + mv_C$$

$$7.5 + 0 = v_B + v_C$$

or $\quad v_C + v_B = 7.5 \quad$ ...(iv)

From eqs. (iii) and (iv), we get

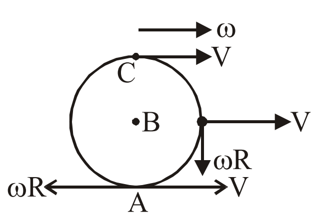
$$v_C = 5.6 \text{ m/s}$$

**77.** $\vec{V}_A = V\hat{i} + \omega R(-\hat{i}); \vec{V}_B = V\hat{i}; \vec{V}_C = V\hat{i} + \omega R\hat{i}$

$\vec{V}_C - \vec{V}_A = 2\omega R\hat{i}$

$2[\vec{V}_A - \vec{V}_C] = 2[V(i) - V(i) - \omega R(i)] = -2\omega R(i)$

Hence $\vec{V}_C - \vec{V}_A = -2(\vec{V}_B - \vec{V}_C)$




**78.** Angular momentum of a body of mass m moving with velocity v in circular orbit of radius r about the centre of the orbit is = mvr

From the angular momentum conservation principle, if v' is the linear velocity of the coment when it is farthest distance r' from the sun, then

$$mv'\,r' = mvr$$

$$v' = \frac{vr}{r'} = \frac{6 \times 10^4 \times 8 \times 10^{10}}{1.6 \times 10^{12}} = 3 \times 10^3 \text{ m/s}$$

**79.** $\tau = F.\, r_\perp$

$= F.\, R$

$\tau = I\alpha$

where $\quad I = \dfrac{1}{2}MR^2$

(Moment of inertia of the disc about axis passing through its centre and $\perp$ to its plane face)

$\therefore \quad I\alpha = F.\, R$

$$\alpha = \frac{FR}{I} = \frac{F.R}{\frac{1}{2}MR^2} = \frac{2F}{MR}$$

Thus, $\quad \alpha \propto \dfrac{1}{R}$