# Sri Chaitanya IIT Academy, India

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A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

**Sec: Sr.IPLCO** | **Dt: 02-08-15**

**Time: 09:00 AM to 12:00 Noon** | **RPTA-1** | **Max.Marks: 180**

## PAPER-1

## KEY & SOLUTIONS

**PHYSICS**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **D** | 2 | **BD** | 3 | **ABC** | 4 | **ABCD** | 5 | **A** | 6 | **BCD** |
| 7 | **ABCD** | 8 | **ABD** | 9 | **ABCD** | 10 | **AD** | 11 | **3** | 12 | **3** |
| 13 | **1** | 14 | **5** | 15 | **5** | 16 | **2** | 17 | **6** | 18 | **2** |
| 19 | **9** | 20 | **5** | | | | | | | | |

**CHEMISTRY**

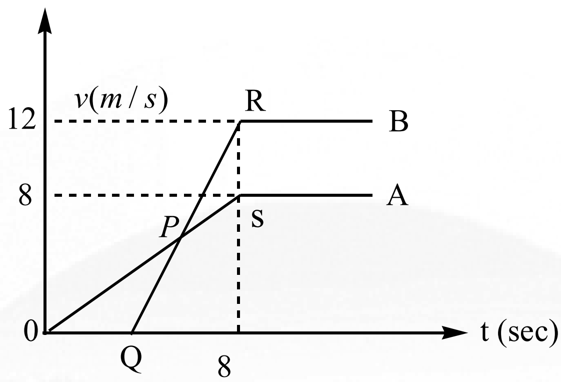
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | **ABCD** | 22 | **ABC** | 23 | **AB** | 24 | **BCD** | 25 | **ABCD** | 26 | **ABCD** |
| 27 | **ABC** | 28 | **BCD** | 29 | **ABC** | 30 | **CD** | 31 | **5** | 32 | **3** |
| 33 | **4** | 34 | **9** | 35 | **2** | 36 | **5** | 37 | **5** | 38 | **5** |
| 39 | **5** | 40 | **4** | | | | | | | | |

**MATHS**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | **AC** | 42 | **ABCD** | 43 | **BD** | 44 | **BCD** | 45 | **ABC** | 46 | **C** |
| 47 | **ABCD** | 48 | **ABC** | 49 | **ABD** | 50 | **AD** | 51 | **5** | 52 | **9** |
| 53 | **5** | 54 | **3** | 55 | **3** | 56 | **5** | 57 | **6** | 58 | **1** |
| 59 | **5** | 60 | **4** | | | | | | | | |

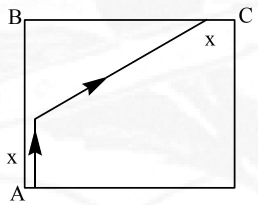
## SOLUTIONS
## PHYSICS

1. The equation $x = 4.91t^2$ is a homogenous equation in which 4.91 is a physical quantity and a numerical constant.
2. velocity time graph of car 'A' and 'B' is shown in fig.




Area of $\Delta OPQ$ is maximum lead of A on B = 12m.
Now upto 8 sec lead of car 'A' on 'B' is =
Area of $\Delta OPQ$ - area of $\Delta PRS$
= 12-4=8m
Car 'B' will over take 'A' at t=10sec.

4. $\dfrac{2x}{\sqrt{2}v} + \dfrac{(a-x)\sqrt{2}}{v} = t$




$t = \dfrac{\sqrt{2}a}{v}$; independent of 'x'
We can select any value of 'x'

6. Sum of the time instant at which height is same is the time of flight = 1+7 or 3+5 = 8sec.
Projection speed =40m/s.

$$h_1 = 40 \times 1 - \frac{1}{2}g(1)^2$$

$$h_2 = 40 \times 3 - \frac{1}{2}g(3)^2$$

$$h_2 - h_1 = 40 \times 2 - \frac{1}{2}10(8)$$

$$h_2 - h_1 = 40m$$

8. $f = \dfrac{uv}{u+v}$

$$\Rightarrow \frac{\Delta f}{f} = \frac{\Delta u}{u} + \frac{\Delta v}{v} + \frac{\Delta(u+v)}{u+v}$$

$$=\frac{\Delta u}{u}+\frac{\Delta u}{v}+\frac{\Delta u}{u+v}+\frac{\Delta v}{u+v}$$

9. $v'=\left(\frac{\alpha^2}{\beta}\right)v \Rightarrow l'\left(\frac{\alpha^3}{\beta^3}\right)l$

$$F'=\left(\frac{1}{\alpha\beta}\right)F \Rightarrow m'=\left(\frac{1}{\alpha^2 m^2}\right)m$$

$$a'=(\alpha\beta)a \Rightarrow t'=\left(\frac{\alpha}{\beta^2}\right)t$$

$$p'=m'v' \Rightarrow p'=\left(\frac{1}{\beta^3}\right)p$$

10. $v_{av}=\frac{s}{t}=\frac{ut+\frac{1}{2}at^2}{t}$

11. $\vec{v}=a\hat{i}+bt\hat{j}$

$\vec{a}=b\hat{j}$

$$a_T=a\cos\theta=\frac{\vec{v}.\vec{a}}{|\vec{v}|}=\frac{b^2t}{\sqrt{a^2+(bt)^2}}$$

$$a_T=\frac{b^2\frac{\sqrt{3}a}{b}}{\sqrt{a^2+b^2\frac{3a^2}{b^2}}}=\frac{b\sqrt{3}a}{2a}=\frac{\sqrt{3}b}{2}$$

$$a_N=\sqrt{b^2-a_T^2}=b/2$$

$$a_T/a_N=\sqrt{3}.$$

12. $vv^1=\frac{\int v^2dt}{\int dt}=\frac{\int_0^3(2t+1)^2dt}{\int_0^3 dt}=19$

13. $E=mL^2T^{-2}$

$V=LT^{-1}$

$T=T$

S.Tension $=\frac{MLT^{-2}}{L}=MT-2=EV^{-2}T^{-2}$

So $x-y+z=1+2-2=1$

14. $R=\frac{u^2}{g(1+\sin\alpha)}$; maximum Range up the plane

$R'=\frac{u^2}{g(1-\sin\alpha)}$; maximum Range down the plane.

$$\frac{RR'}{R+R'}=\frac{u^2}{2g}=5$$

15. $R_1 = v\rho g$

$R_2 = v(\rho-\rho_\ell)g$

Relative density '$\rho$' = $\frac{R_1}{R_1-R_2}$

$$\frac{d\rho}{\rho}=\frac{dR_1}{R_1}-\frac{d(R_1-R_2)}{(R_1-R_2)}$$

$$=\left[\frac{dR_1}{R_1}-\frac{dR_1}{(R_1-R_2)}\right]\pm\frac{dR_2}{(R_1-R_2)}$$

$$=\frac{dR_1(R_2)}{R_1(R_1-R_2)}+\frac{dR_2}{(R_1-R_2)}$$

$$=\frac{0.02}{3}\left[\frac{R_2}{R_1}+1\right]$$

$$=\frac{0.02}{3}\left(\frac{1}{4}+1\right)100$$

$$=\frac{0.02}{3}\times\frac{5}{4}\times 100$$

$$=\frac{10}{12}=\frac{5}{6}$$

16. $\frac{dv}{dt}=-\frac{5}{2}v^{+1/2}$

$$\int_{6.25}^{0} V^{-1/2}dv=-\frac{5}{2}\int_0^t dt$$

$$2\left[\sqrt{v}\right]_{6.25}^{o}=-\frac{5}{2}t$$

$$t=\frac{2\times 2}{5}\sqrt{6.25}$$

$$=2\times 2$$

$t = 2\sec$.

17. Initially is moves with acceleration $a=0.2tm/s^2$ and takes 10 sec to attain maximum acceleration $2m/s^2$ in time 10sec. At the end of initial 10 sec speed of train is $V\,m/s$.

$a = 0.2t; t \le 10\sec$

$v = 0.1t^2; t \le 10\sec$

$v_{t=10\sec} = 10m/s$

Now onwards for next 15sec it moves with constant acceleration $2m/s^2$ at the end of $t = 25\sec$. It's speed is maximum 40 $m/s$.

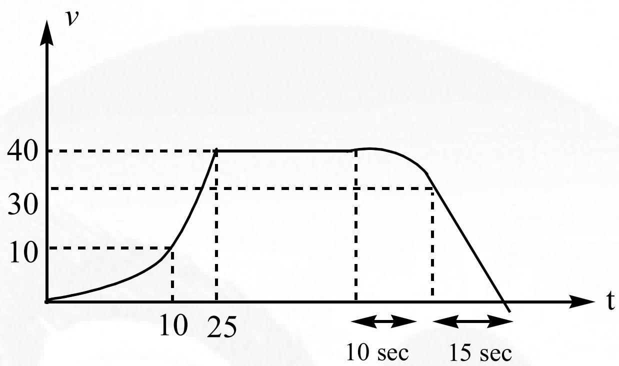
It keeps on moving with 40 for next 't' sec. then driver feels requirement of brake he attains a maximum retardation $2m/s^2$ in 10sec after applying brake the moment it attains maximum retardation it's speed is $v'$

$$\frac{dV'}{dt} = -0.2t; -\int_{40}^{v'} dV' = \int_{0}^{10} 0.2t\,dt$$

$$V' - 40 = \left[-1t^2\right]_0^{10}$$

$$V' = 40 - 10 = 30m/s$$

now onwards speed of train reduces at maximum rate $2m/\lambda^2$ and comes to rest at station 'B' in next 15 sec.




total area under curve $= \frac{100}{3} + \frac{50\times 30}{2} + 40t + \left(400 - \frac{100}{3}\right) + 450 = 2000$

$t = 10\sec$

Total time taken $= 10+15+10+10+15 = 60\sec$

18. Velocity of the projectile is $\sqrt{u_x^2 + u_y^2} = \sqrt{50^2 + 624^2 = 626}$

19. Maximum distance covered in one jump $= \frac{u^2}{g} = 1m$

20. $h = ut_1 + \frac{1}{2}gt_1^2$

$h = -ut_2 + \frac{1}{2}gt_2^2$

$\Rightarrow ht_2 = -4t_1t_2 + \frac{1}{2}gt_1^2t_2$

$ht_1 = ut_1t_2 + \frac{1}{2}gt_2^2t_1$

$h = \frac{1}{2}gt_1t_2$

$\frac{1}{2}gt^2 = \frac{1}{2}gt_1t_2$

$\therefore t = \sqrt{t_1t_2} = \sqrt{7+2\sqrt{6}\times 7-2\sqrt{6}} = 5$