

New Light Institute

SINCE 1984

PHYSICS TOPIC TEST : 2021-22

Test ID : 000

Paper ID : PTT-02



TEST DATE : 08-10-2021

SOLUTION

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PHYSICS

SECTION-A

1. (3) [NCERT-42]

$$S_n^{\text{th}} = \frac{a}{2}(2n-1) \quad S(n) = \frac{1}{2}an^2$$

$$\frac{S_n^{\text{th}}}{S(n)} = \frac{2}{n} - \frac{1}{n^2}$$

2. (2) [NCERT-40]

For a car in motion, if we described this event w.r.t a frame of reference attached to the person sitting inside the car, the car will appear to be at rest as the person inside the car (observer) is also moving with same velocity and in the same direction as car.

3. (2) [NCERT-48]

$$v = u - gt$$

$$0 = 20 - 10t$$

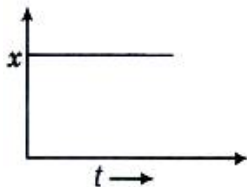
$$t = 2 \text{ sec}$$

So total time of flight = 2t

$$= 2 \times 2 = 4 \text{ sec.}$$

4. (1) [NCERT-41]

For an object at rest, position coordinate must not change.



5. (4) [NCERT-48]

$$s = ut + \frac{1}{2}at^2$$

$$s = 0 + \frac{1}{2}at^2$$

$$t = \sqrt{\frac{2S}{a}} \quad \Rightarrow \quad t \propto \sqrt{S}$$

6. (1) [NCERT-41]

Given, at t = 0 s, position of an object is (-1, 0, 3) and at t = 5 s, its coordinates are (-1, 0, 4). So, there is no change in x and y-coordinates, while z-coordinate changes from 3 to 4. So, the object is in motion along Z-axis.

SECTION-A

1. (3) [NCERT-42]

$$S_n^{\text{th}} = \frac{a}{2}(2n-1) \quad S(n) = \frac{1}{2}an^2$$

$$\frac{S_n^{\text{th}}}{S(n)} = \frac{2}{n} - \frac{1}{n^2}$$

2. (2) [NCERT-40]

कार में बैठे हुए व्यक्ति से संलग्न निर्देश तंत्र के सापेक्ष कार विरामावस्था में होगी जबकि कार के बाहर स्थित व्यक्ति से संलग्न निर्देश तंत्र के सापेक्ष कार की गति की अवस्था में है।

3. (2) [NCERT-48]

$$v = u - gt$$

$$0 = 20 - 10t$$

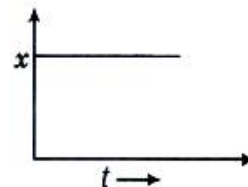
$$t = 2 \text{ sec}$$

आने जाने में लगा समय = 2t

$$= 2 \times 2 = 4 \text{ sec.}$$

4. (1) [NCERT-41]

कार के विरामावस्था के लिए स्थिति (x) नियत होगी इसलिए ग्राफ x-अक्ष के समान्तर होगा।



5. (4) [NCERT-48]

$$s = ut + \frac{1}{2}at^2$$

$$s = 0 + \frac{1}{2}at^2$$

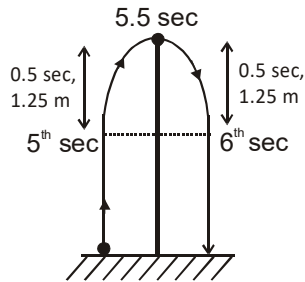
$$t = \sqrt{\frac{2S}{a}} \quad \Rightarrow \quad t \propto \sqrt{S}$$

6. (1) [NCERT-41]

केवल z निर्देशांक में परिवर्तन हो रहा है इसलिए z-अक्ष पर गति करेगी।

7. (3) [NCERT-46]
If an object moving along the straight line covers equal distances in equal intervals of time, it is said to be in uniform motion along a straight line.

8. (1) [NCERT -48]



In this question we have to find distance covered in 6th second it means last 1 sec. Hence total distance covered in last second

$$(6^{\text{th}} \text{ sec}) = 2 \times \frac{1}{2} \times 10 \times (0.5)^2 = 2.5 \text{ m}$$

9. (2) [NCERT -48]

Total time of flight = 10 sec

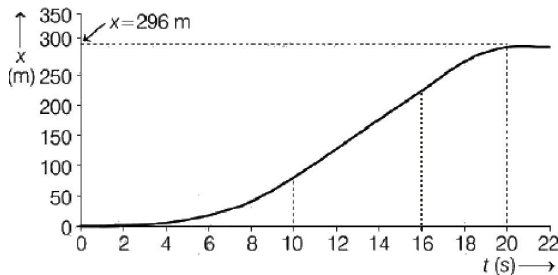
$$\text{so time to reach maximum height} = \frac{10}{2} = 5 \text{ sec}$$

$$\text{Hence total height will be } H = \frac{1}{2} \times g \times (t)^2$$

$$= \frac{1}{2} \times 10 \times (5)^2 = 125 \text{ m}$$

10. (1) [NCERT-41]

According to given situation, we observe that the car is speeding up from origin to $t = 10 \text{ s}$, so $x-t$ graph has a curve with increasing slope. It is in uniform motion only between $t = 10 \text{ s}$ and $t = 16 \text{ s}$. So, for $t = 10 \text{ s}$ and $t = 16 \text{ s}$, the graph must be a straight line inc lined to time axis as shown below

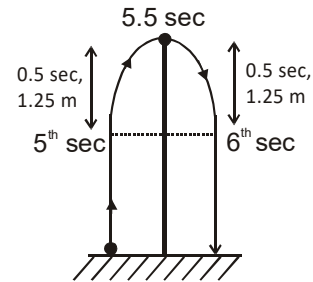


From $t = 16 \text{ s}$ to $t = 20 \text{ s}$, the car slows down by applying brakes. So, the curve has decreasing slope between this interval.

7. (3) [NCERT-46]

एक समान गति के लिए समान दूरी समान समय में तय होगी
अतः ग्राफ सरल रेखा एक नियत प्रवणता पर होगी।

8. (1) [NCERT -48]



अन्तिम समय में चली गयी दूरी

$$(6^{\text{th}} \text{ sec}) = 2 \times \frac{1}{2} \times 10 \times (0.5)^2 = 2.5 \text{ m}$$

9. (2) [NCERT -72]

कुल समय = 10 sec

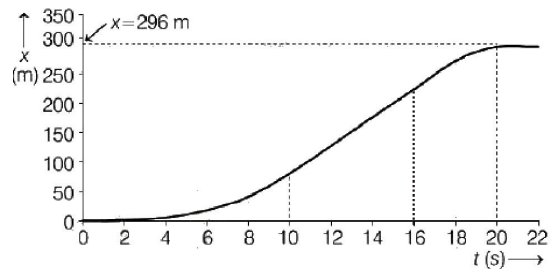
$$\text{महत्तम ऊँचाई तक पहुंचने में लगा समय} = \frac{10}{2} = 5 \text{ sec}$$

$$\text{कुल ऊँचाई } H = \frac{1}{2} \times g \times (t)^2$$

$$= \frac{1}{2} \times 10 \times (5)^2 = 125 \text{ m}$$

10. (1) [NCERT-41]

दी गई स्थिति में कार पहले अपना वेग बढ़ाती है तो ग्राफ की प्रवणता बढ़ेगी $t = 10 \text{ s}$ तक तत्पश्चात् $t = 10 \text{ s}$ से $t = 16 \text{ s}$ तक कार समान वेग से चलती तो ग्राफ की प्रवणता नियत होगी और ग्राफ सरल रेखा में होगा।



$t = 16 \text{ s}$ से $t = 10 \text{ s}$ तक कार को ब्रेक लगा कर रोका गया है तो ग्राफ की प्रवणता घटेगी और $t = 20 \text{ s}$ से केण्ड पर प्रवणता शून्य हो जायेगी

11. (3)

[NCERT -48]

8h/9 metres from the ground

$$h = ut + \frac{1}{2} gt^2$$

$$h = 0 + \frac{1}{2} gT^2$$

$$h = \frac{1}{2} gT^2$$

Again,

$$h = ut + \frac{1}{2} gt^2$$

$$h = 0 + \frac{1}{2} g \left(\frac{T}{3} \right)^2$$

$$h = \frac{1}{2} g \left(\frac{T^2}{9} \right)$$

$$= \frac{g}{18} T^2 = \frac{g}{18} \times \frac{2h}{g} = \frac{h}{9}$$

so from the ground its position = $h - \frac{h}{9} = \frac{8h}{9}$

12. (3)

[NCERT-48]

$$v = At + Bt^2$$

$$\frac{dS}{dt} = At + Bt^2$$

$$\int_0^S dS = A \int_1^2 t dt + B \int_1^2 t^2 dt$$

$$= A \left[\frac{t^2}{2} \right]_1^2 + B \left[\frac{t^3}{3} \right]_1^2$$

$$= A \left[\frac{4}{2} - \frac{1}{2} \right] + \frac{B}{3} [8 - 1]$$

$$S = \frac{3A}{2} + \frac{7B}{3}$$

11. (3)

[NCERT -48]

मैदान से दूरी 8h/9

$$h = ut + \frac{1}{2} gt^2$$

$$h = 0 + \frac{1}{2} gT^2$$

$$h = \frac{1}{2} gT^2$$

Again,

$$h = ut + \frac{1}{2} gt^2$$

$$h = 0 + \frac{1}{2} g \left(\frac{T}{3} \right)^2$$

$$h = \frac{1}{2} g \left(\frac{T^2}{9} \right)$$

$$= \frac{g}{18} T^2 = \frac{g}{18} \times \frac{2h}{g} = \frac{h}{9}$$

मैदान से गेंद की स्थिति = $h - \frac{h}{9} = \frac{8h}{9}$

12. (3)

[NCERT-48]

$$v = At + Bt^2$$

$$\frac{dS}{dt} = At + Bt^2$$

$$\int_0^S dS = A \int_1^2 t dt + B \int_1^2 t^2 dt$$

$$= A \left[\frac{t^2}{2} \right]_1^2 + B \left[\frac{t^3}{3} \right]_1^2$$

$$= A \left[\frac{4}{2} - \frac{1}{2} \right] + \frac{B}{3} [8 - 1]$$

$$S = \frac{3A}{2} + \frac{7B}{3}$$

13. (1)

[NCERT-49]

Given, $x(t) = (t-2)^2$ (i)

Velocity of a particle at any time t , $u = \frac{dx}{dt}$

$\Rightarrow v(t) = 2(t-2)$ (ii)

Let us find the time at which velocity is zero.

i.e, $v = 0 \Rightarrow 2(t-2) = 0 \Rightarrow t = 2s$

So, before 4s is completed, the particle's velocity becomes zero and it takes a turn.

Acceleration of particle = $\frac{dv}{dt} = 2ms^{-2}$ (iii)

Using $x(t) = v_0t + 1/2 at^2$

\therefore At $t = 0$, $v(0) = v_0 = -4 ms^{-1}$ [put $t = 0$ in eq. (ii)]

Also, $a = + 2ms^{-2}$ [from eq. (iii)]

$x_1(t) = -4 \times 2 + 1/2 \times 2 \times (2)^2 = -8 + 4 = -4$

Distance during this interval = $|x(t)| = 4 m$

For next 2s, $v_0 = v(2) = 0 ms^{-1} \Rightarrow a = 2ms^{-2}$

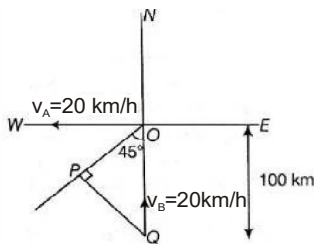
$x_2(t) = 0 + 1/2 \times 2 \times (2)^2 = 4$

\therefore Total distance = $4 + 4 = 8m$.

14. (1)

[NCERT-52]

It is clear from the diagram that the shortest distance between ship A and B is PQ.



Here, $\sin 45^\circ = \frac{PQ}{OQ}$

$\Rightarrow PQ = 100 \times \frac{1}{\sqrt{2}} = 50\sqrt{2}m$

Also, $v_{AB} = \sqrt{v_A^2 + v_B^2} = \sqrt{20^2 + 20^2}$

$= 20\sqrt{2} km/h$

So, time taken for them to reach shortest path

$t = \frac{PQ}{v_{AB}} = \frac{50\sqrt{2}}{20\sqrt{2}} = 2.5h$

13. (1)

[NCERT-49]

दिया है $x(t) = (t-2)^2$ (i)

समय t पर वेग, $u = \frac{dx}{dt}$

$\Rightarrow v(t) = 2(t-2)$ (ii)

वेग के शून्य होने पर समय

$v = 0 \Rightarrow 2(t-2) = 0 \Rightarrow t = 2s$

4s के पहले कण का वेग शून्य हो रहा इसलिए वह वापस मुड़ जायेगा

कण का त्वरण = $\frac{dv}{dt} = 2ms^{-2}$ (iii)

$x(t) = v_0t + 1/2 at^2$

\therefore $t = 0$, $v(0) = v_0 = -4 ms^{-1}$ [$t = 0$ समी0 (ii)]

$a = + 2ms^{-2}$ [(iii) समी0 से]

$x_1(t) = -4 \times 2 + 1/2 \times 2 \times (2)^2 = -8 + 4 = -4$

इस समय दूरी का मान = $|x(t)| = 4 m$

2s, $v_0 = v(2) = 0 ms^{-1} \Rightarrow a = 2ms^{-2}$

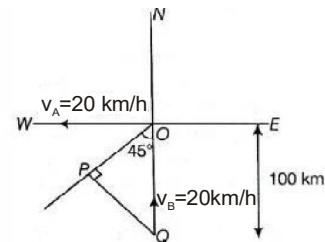
$x_2(t) = 0 + 1/2 \times 2 \times (2)^2 = 4$

\therefore कुल दूरी = $4 + 4 = 8m$.

14. (1)

[NCERT-52]

चित्रानुसार न्यूनतम दूरी PQ होगी.



$\sin 45^\circ = \frac{PQ}{OQ}$

$\Rightarrow PQ = 100 \times \frac{1}{\sqrt{2}} = 50\sqrt{2}m$

$v_{AB} = \sqrt{v_A^2 + v_B^2} = \sqrt{20^2 + 20^2}$

$= 20\sqrt{2} km/h$

$t = \frac{PQ}{v_{AB}} = \frac{50\sqrt{2}}{20\sqrt{2}} = 2.5h$

15. (2) [NCERT -49]

Using $v^2 = u^2 - 2as$ with final velocity = 0

$$\therefore s \propto u^2$$

$$\frac{8}{s_2} = \left(\frac{30}{60}\right)^2$$

$$\therefore s_2 = 32 \text{ m}$$

16. (3) [NCERT-48]

$$S_1 = S_{10} = \frac{1}{2} \times a \times 10^2 - \frac{1}{2}(10)^2$$

$$\text{So } S_2 = 3S_1$$

17. (2) [NCERT-43]

Here, $x_2 = 30 \text{ m}$, $x_1 = 10 \text{ m}$, $t_2 = 7\text{s}$, $t_1 = 5$

Average velocity between 5s and 7s

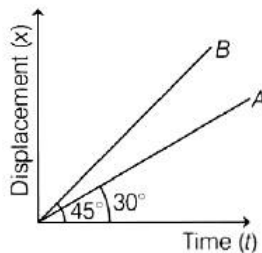
$$\text{i.e., } v = \frac{x_2 - x_1}{t_2 - t_1} = \frac{30.0 - 10.0}{7 - 5}$$

$$= \frac{20.0}{2} = 10 \text{ ms}^{-1}$$

18. (1) [NCERT-42]

In case $x - t$ graph is a straight line, the slope of this line gives velocity of the particle.

As slope = $\tan \theta$, where θ is the angle which the tangent to the curve makes with the horizontal in anti-clockwise direction. So, in the given case.



The velocities of two particles A and B are

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

$$v_B = \tan 45^\circ = 1$$

$$\text{The ratio of velocities, } v_A : v_B = \frac{1}{\sqrt{3}} : 1 = 1 : \sqrt{3}$$

19. (1) [NCERT-46]

A particle thrown upward is an example of motion under gravity.

Throughout the motion of the particle,

$$a = -g = \text{constant}$$

Since, acceleration is negative, slope of $v-t$ graph must be negative.

15. (2) [NCERT -49]

$$v^2 = u^2 - 2as \text{ अन्तिम वेग} = 0$$

$$\therefore s \propto u^2$$

$$\frac{8}{s_2} = \left(\frac{30}{60}\right)^2$$

$$\therefore s_2 = 32 \text{ m}$$

16. (3) [NCERT -48]

$$S_1 = S_{10} = \frac{1}{2} \times a \times 10^2 - \frac{1}{2}(10)^2$$

$$\text{So } S_2 = 3S_1$$

17. (2) [NCERT-43]

यहाँ, $x_2 = 30 \text{ m}$, $x_1 = 10 \text{ m}$, $t_2 = 7\text{s}$, $t_1 = 5$

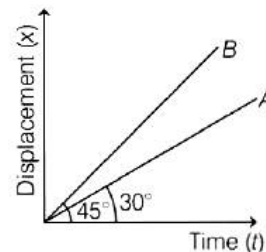
5s और 7s के बीच औसत वेग

$$\text{i.e., } v = \frac{x_2 - x_1}{t_2 - t_1} = \frac{30.0 - 10.0}{7 - 5}$$

$$= \frac{20.0}{2} = 10 \text{ ms}^{-1}$$

18. (1) [NCERT-42]

$$x - t \text{ ग्राफ की प्रवणता} = \frac{dx}{dt} = \text{वेग}$$



कणों A और B के वेग

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

$$v_B = \tan 45^\circ = 1$$

$$\text{वेगों का अनुपात, } v_A : v_B = \frac{1}{\sqrt{3}} : 1 = 1 : \sqrt{3}$$

19. (1) [NCERT-46]

जब कण को ऊपर की ओर फेंका जायेगा तो उसका त्वरण

$$a = -g = \text{नियत होगा।}$$

इसलिए ग्राफ की प्रवणता ऋणात्मक होगा।

20. (2) [NCERT-42]

Here, x-t graph for motion of an object with positive velocity is as follows.

The slope of the (x-t) graph must be positive for positive velocity. So, slope of line = $\tan \theta = +ve$, where θ is an acute angle.

21. (2) [NCERT-42]

Geometrically

Average velocity = Slope of line joining initial and final position in (x-t) graph

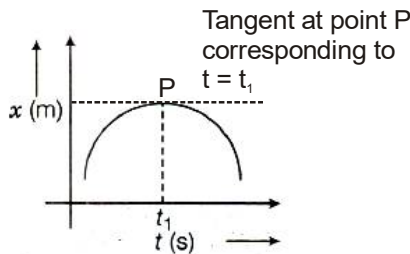
In this case, slope = $\tan 60^\circ = \sqrt{3} \text{ ms}^{-1}$

22. (1) [NCERT-48]

$$\bar{v} = \frac{v_1 \left(\frac{t}{2}\right) + v_2 \left(\frac{t}{2}\right)}{t}$$

$$\bar{v} = \frac{v_1 + v_2}{2}$$

23. (1) [NCERT-41]



The instantaneous velocity is the slope of the tangent to the (x-t) graph at that instant of time. At $t = t_1$, the tangent is parallel to time axis and hence, its slope is zero. Thus, instantaneous velocity at $t = t_1$ is zero.

24. (2) [NCERT -48]

Let each half distance = x

Total distance = $x + x = 2x$

$$\text{Total time} = \frac{x}{40} + \frac{x}{60}$$

$$\text{Average speed} = \frac{2x}{\frac{x}{40} + \frac{x}{60}} = 48 \text{ km/h}$$

25. (2) [NCERT-48]

Given, $v(x) = \beta x^{-2n}$

$$a = \frac{dv(x)}{dt} = \frac{dx}{dt} \cdot \frac{dv}{dx}$$

$$\Rightarrow a = v \frac{dv}{dx} = (\beta x^{-2n}) (-2n\beta x^{-2n-1})$$

$$\Rightarrow -2n\beta^2 x^{-4n-1}$$

20. (2) [NCERT-42]

धनात्मक वेग के लिए ग्राफ को प्रवणता धनात्मक होगी।

21. (2) [NCERT-42]

$$\text{ग्राफ की प्रवणता} = \frac{dx}{dt} = \tan \theta$$

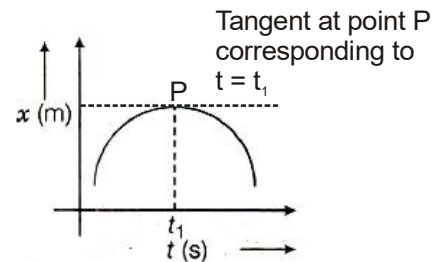
$$v = \tan \theta = \tan 60^\circ = \sqrt{3} \text{ ms}^{-1}$$

22. (1) [NCERT-48]

$$\bar{v} = \frac{v_1 \left(\frac{t}{2}\right) + v_2 \left(\frac{t}{2}\right)}{t}$$

$$\bar{v} = \frac{v_1 + v_2}{2}$$

23. (1) [NCERT-41]



दिये गये बिंदु P पर ग्राफ की प्रवणता शून्य है तो वेग शून्य होगा।

24. (2) [NCERT -48]

माना आधी दूरी = x

कुल दूरी = $x + x = 2x$

$$\text{कुल समय} = \frac{x}{40} + \frac{x}{60}$$

$$\text{औसत चाल} = \frac{2x}{\frac{x}{40} + \frac{x}{60}} = 48 \text{ km/h}$$

25. (2) [NCERT-48]

दिया $v(x) = \beta x^{-2n}$

$$a = \frac{dv(x)}{dt} = \frac{dx}{dt} \cdot \frac{dv}{dx}$$

$$\Rightarrow a = v \frac{dv}{dx} = (\beta x^{-2n}) (-2n\beta x^{-2n-1})$$

$$\Rightarrow -2n\beta^2 x^{-4n-1}$$

26. (2) [NCERT -49]

$$\text{Use } S_{th} = u + \frac{a}{2}(2t - 1)$$

$$150 = 0 + \frac{a}{2}(2 \times 8 - 1)$$

$$\frac{a}{2} = \frac{150}{15} = 10$$

$$a = 20 \text{ m/s}^2.$$

27. (1) [NCERT-42]

Must be zero

28. (4) [NCERT-42]

$$\text{Given, } x = 8 + 12t - t^3$$

$$\text{we know } v = \frac{dx}{dt}$$

$$\text{and acceleration } a = \frac{dv}{dt}$$

$$\text{So, } v = 12 - 3t^2 \text{ and } a = -6t$$

$$\text{At } t = 2s$$

$$v = 0 \text{ and } a = -6 \times 2$$

$$a = 12 \text{ ms}^{-2}.$$

$$\text{So, retardation of the particle} = 12 \text{ ms}^{-2}.$$

29. (4) [NCERT -43]

Since car returns

hence displacement = 0

$$\therefore \text{ average velocity} = 0$$

30. (3) [NCERT-47]

According to 3rd equation of motion

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

$$\text{Now, } v = 3u \text{ and } u = v.$$

$$\therefore a = \frac{(3v)^2 - (v)^2}{2x} \quad \text{As } a = g; \therefore x = \frac{4v^2}{g}$$

31. (3) [NCERT-43]

$$\text{Here, } v = 15 \text{ ms}^{-1}, v_0 = 30 \text{ ms}^{-1} \text{ and } t = 2s$$

$$\text{Using relation, } v = v_0 + at \Rightarrow 15 = 30 + a \times 2$$

or Acceleration of the car

$$a = \frac{(15 - 30)\text{ms}^{-1}}{2s} = -\frac{15}{2}\text{ms}^{-2}$$

$$= -7.5 \text{ ms}^{-2}.$$

26. (2) [NCERT -49]

$$S_{th} = u + \frac{a}{2}(2t - 1)$$

$$150 = 0 + \frac{a}{2}(2 \times 8 - 1)$$

$$\frac{a}{2} = \frac{150}{15} = 10$$

$$a = 20 \text{ m/s}^2.$$

27. (1) [NCERT-42]

अवश्य शून्य होगा

28. (4) [NCERT-42]

$$\text{दिया } x = 8 + 12t - t^3$$

$$\text{हम जानते है } v = \frac{dx}{dt}$$

$$\text{तथा त्वरण } a = \frac{dv}{dt}$$

$$v = 12 - 3t^2 \text{ तथा } a = -6t$$

$$\text{At } t = 2s$$

$$v = 0 \text{ तथा } a = -6 \times 2$$

$$a = 12 \text{ ms}^{-2}.$$

$$\text{मंदन} = 12 \text{ ms}^{-2}.$$

29. (4) [NCERT -43]

चूँकि कार वापस अपने स्थान पर आ गयी

इसलिए विस्थापन = 0

$$\therefore \text{ औसत वेग} = 0$$

30. (3) [NCERT-47]

गति के तृतीय समीकरण से

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

$$v = 3u \text{ and } u = v.$$

$$\therefore a = \frac{(3v)^2 - (v)^2}{2x} \quad \text{As } a = g; \therefore x = \frac{4v^2}{g}$$

31. (3) [NCERT-43]

$$v = 15 \text{ ms}^{-1}, v_0 = 30 \text{ ms}^{-1} \text{ तथा } t = 2s$$

$$v = v_0 + at \Rightarrow 15 = 30 + a \times 2$$

कार का त्वरण

$$a = \frac{(15 - 30)\text{ms}^{-1}}{2s} = -\frac{15}{2}\text{ms}^{-2}$$

$$= -7.5 \text{ ms}^{-2}.$$

32. (3) [NCERT-50]

$$h_1 = \frac{1}{2} \times 10 \times 4 = 20$$

$$h_2 = ut + \frac{1}{2}gt^2$$

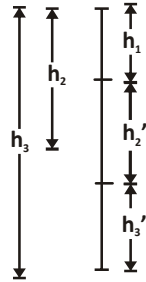
$$= 0 + \frac{1}{2}g \times 4^2 = 80$$

$$h_2' = h_2 - h_1 = 60$$

$$h_3 = \frac{1}{2}g \times 6^2 = 180$$

$$h_3' = 180 - 80 = 100$$

$$h_1 : h_2' : h_3' = 20 : 60 : 100 = 1 : 3 : 5$$



32. (3) [NCERT-50]

$$h_1 = \frac{1}{2} \times 10 \times 4 = 20$$

$$h_2 = ut + \frac{1}{2}gt^2$$

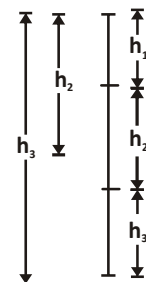
$$= 0 + \frac{1}{2}g \times 4^2 = 80$$

$$h_2' = h_2 - h_1 = 60$$

$$h_3 = \frac{1}{2}g \times 6^2 = 180$$

$$h_3' = 180 - 80 = 100$$

$$h_1 : h_2' : h_3' = 20 : 60 : 100 = 1 : 3 : 5$$



33. (1) [NCERT-18]

Initial velocity = $2v_0$

Final velocity, $v = 4v_0$

For constant acceleration,

\therefore Average distance covered,

$$x = \frac{v + v_0}{2}t = \left(\frac{4v_0 + 2v_0}{2}\right)t = 3v_0t$$

Using relation is $x = 3v_0t$.

34. (1) [NCERT-48]

Given, $v_0 = 0$

Using relation, $v^2 = v_0^2 + 2ax$

$$v^2 = 2ax$$

$$\therefore v = \sqrt{2ax}$$

33. (1) [NCERT-18]

प्रारम्भिक वेग = $2v_0$

अन्तिम वेग $v = 4v_0$

नियत त्वरण के लिए औसत दूरी

$$x = \frac{v + v_0}{2}t = \left(\frac{4v_0 + 2v_0}{2}\right)t = 3v_0t$$

$$x = 3v_0t.$$

34. (1) [NCERT-48]

दिया है $v_0 = 0$

$$v^2 = v_0^2 + 2ax$$

$$v^2 = 2ax$$

$$\therefore v = \sqrt{2ax}$$

35. (1) [NCERT-47]

Time taken by body A, $t_1 = 5$ sec.

Acceleration of body A = a_1

Time taken by body B, $t_2 = 5 - 2 = 3$ sec.

Acceleration of body B = a_2

Distance covered by first body in 5th second after start.

$$s_5 = u + \frac{a_1}{2}(2t_1 - 1) \Rightarrow 0 + \frac{a_1}{2}(2 \times 5 - 1) = \frac{9a_1}{2}$$

Distance covered by the second body in the 3rd second after its start,

$$s_3 = u + \frac{a_2}{2}(2t_2 - 1) \Rightarrow 0 + \frac{a_2}{2}(2 \times 3 - 1) = \frac{5a_2}{2}$$

Since, $s_5 = s_3$

$$\therefore \frac{9a_1}{2} = \frac{5a_2}{2} \text{ or } a_1 : a_2 = 5 : 9.$$

35. (1) [NCERT-47]

A का समय, $t_1 = 5$ sec.

A का त्वरण = a_1

B का समय, $t_2 = 5 - 2 = 3$ sec.

B का त्वरण = a_2

प्रारम्भ से पहली वस्तु द्वारा 5th में चली गयी दूरी

$$s_5 = u + \frac{a_1}{2}(2t_1 - 1) \Rightarrow 0 + \frac{a_1}{2}(2 \times 5 - 1) = \frac{9a_1}{2}$$

प्रारम्भ से पहली वस्तु द्वारा 3rd में चली गयी दूरी

$$s_3 = u + \frac{a_2}{2}(2t_2 - 1) \Rightarrow 0 + \frac{a_2}{2}(2 \times 3 - 1) = \frac{5a_2}{2}$$

$s_5 = s_3$

$$\therefore \frac{9a_1}{2} = \frac{5a_2}{2} \text{ or } a_1 : a_2 = 5 : 9.$$

SECTION-B
SECTION-B
36. (1) [NCERT-48]

$$\text{Here, } v(x) = 3x^2 - 4x$$

$$a = v \frac{dv}{dx} = (3x^2 - 4x) \times \frac{dv}{dx}$$

$$= (3x^2 - 4x) \times (6x - 4)$$

37. (1) [NCERT-47]

$$h = -ut + \frac{1}{2}gt^2$$

$$= -29 \times 10 + \frac{1}{2} \times 10 \times 100 = 210 \text{ m}$$

38. (2) [NCERT-60]

For the second stone, time required to reach the ground is given by

$$y = ut - \frac{1}{2}gt^2$$

$$-240 = 40t - \frac{1}{2} \times 10 \times t^3 \Rightarrow t = 12\text{s}$$

For the first stone,

$$-240 = 10t - \frac{1}{2} \times 10 \times t^3$$

Solving we get, $t = 8\text{s}$

During first 8 sec both the stones are in the air,

$$\therefore y_2 - y_1 = (v_2 - v_1)t = 30t$$

\therefore Graph of $(y_2 - y_1)$ against t is a straight line before 8 sec,

$$y_2 = u_2t - \frac{1}{2}gt^2 - 240$$

After 8 s stone two has acceleration with respect to stone one.

Graph is curve line

Hence, graph (2) is the correct description.

36. (1) [NCERT-48]

$$\text{Here, } v(x) = 3x^2 - 4x$$

$$a = v \frac{dv}{dx} = (3x^2 - 4x) \times \frac{dv}{dx}$$

$$= (3x^2 - 4x) \times (6x - 4)$$

37. (1) [NCERT-47]

$$h = -ut + \frac{1}{2}gt^2$$

$$= -29 \times 10 + \frac{1}{2} \times 10 \times 100 = 210 \text{ m}$$

38. (2) [NCERT-60]

दूसरे पत्थर के लिए जमीन तक पहुंचने का समय

$$y = ut - \frac{1}{2}gt^2$$

$$-240 = 40t - \frac{1}{2} \times 10 \times t^3 \Rightarrow t = 12\text{s}$$

$$-240 = 10t - \frac{1}{2} \times 10 \times t^3$$

$$t = 8\text{s}$$

8 सेकेण्ड तक दोनों पत्थर हवा होंगे

$$\therefore y_2 - y_1 = (v_2 - v_1)t = 30t$$

\therefore 8 सेकेण्ड के पहले ग्राफ सरल रेखा होगा

$$y_2 = u_2t - \frac{1}{2}gt^2 - 240$$

दूसरे पत्थर का त्वरण पहले पत्थर के सापेक्ष 8 सेकेण्ड के बाद होगा।

इसलिए ग्राफ वक्र रेखा होगी।

39. (4) [NCERT-42]

$$\bar{v} = \frac{s}{\frac{2s}{5v_1} + \frac{3s}{5v_2}} = \frac{5v_1v_2}{3v_1 + 2v_2}$$

40. (3) [NCERT-46]

 Given, $v_0 = 30\text{ms}^{-1}$ for 3 sec

Since, the motion is uniformly the v- t graph must be a straight line parallel to x-axis.

Since, the velocity is increasing in next 2 second, the slope must be positive due to positive acceleration. This is shown in graph (3).

41. (1) [NCERT-47]

$$\frac{h_1}{h_2} = \frac{\frac{1}{2}gt_1^2}{\frac{1}{2}gt_2^2}$$

$$\frac{h}{2h} = \frac{t_1^2}{t_2^2}$$

$$\frac{t_1}{t_2} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$$

42. (4) [NCERT-49]

 For free fall, $v_0 = 0$ and $a = -g = -9.8\text{ms}^{-2}$

The equations of motion are

$$v = -9.8\text{t ms}^{-1} \quad (\text{using } v = v_0 + at)$$

$$y = \frac{1}{2} \times (-9.8) \times t^2\text{m} = -4.9t^2\text{m}$$

$$(\text{using } y = v_0t + 1/2at^2)$$

$$v^2 = 2 \times (-9.8) \times y \quad (\text{using } v^2 = v_0^2 + 2ay)$$

$$= -19.6\text{y m}^2\text{s}^{-2}.$$

43. (3) [NCERT-52]

A and B reach home at the same time

39. (4) [NCERT-42]

$$\bar{v} = \frac{s}{\frac{2s}{5v_1} + \frac{3s}{5v_2}} = \frac{5v_1v_2}{3v_1 + 2v_2}$$

40. (3) [NCERT-46]

 दिया है $v_0 = 30\text{ms}^{-1}$ for 3 sec

पहले 3 s तक ग्राफ x-अक्ष के समान्तर होगा और आगे वेग बढ़ने पर ग्राफ ऊपर उठेगा।

41. (1) [NCERT-47]

$$\frac{h_1}{h_2} = \frac{\frac{1}{2}gt_1^2}{\frac{1}{2}gt_2^2}$$

$$\frac{h}{2h} = \frac{t_1^2}{t_2^2}$$

$$\frac{t_1}{t_2} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$$

42. (4) [NCERT-49]
 $v_0 = 0$ and $a = -g = -9.8\text{ms}^{-2}$

गति के समीकरण

$$v = -9.8\text{t ms}^{-1} \quad (v = v_0 + at)$$

$$y = \frac{1}{2} \times (-9.8) \times t^2\text{m} = -4.9t^2\text{m}$$

$$(y = v_0t + 1/2at^2)$$

$$v^2 = 2 \times (-9.8) \times y \quad (v^2 = v_0^2 + 2ay)$$

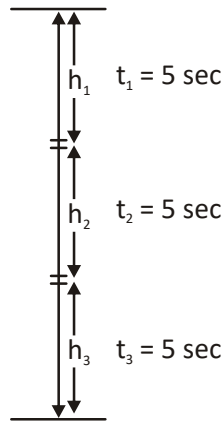
$$= -19.6\text{y m}^2\text{s}^{-2}.$$

43. (3) [NCERT-52]

A और B घर एक साथ पहुँचते हैं।

44. (1)

[NCERT-47]



$$h_1 + h_2 + h_3 = 1/2g (15)^2$$

$$h_1 + 3h_1 + h_3 = \frac{225}{2}g$$

$$4h_1 + h_3 \left(\frac{25}{2}g \right)$$

$$4h_1 + h_3 = gh_1 \Rightarrow h_3 = 5h_1$$

$$h_1 + h_2 = 1/2 g (10)^2 = 50 g$$

$$h_1 = 1/2 g (5)^2$$

$$h_1 = \frac{25}{2}g \Rightarrow h_2 = 3h_1 \Rightarrow h_3 = 5h_1$$

45. (2)

[NCERT-50]

Let the distance travelled by the vehicle before it stop be d_s . Then, using the equation of motion $v^2 = v_0^2 + 2ax$ and noting that $v = 0$ [as the vehicle stops finally],

$$\text{Stopping distance} = x = d_s = \frac{v_0^2}{2a}$$

46. (1)

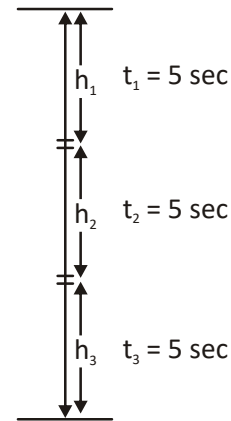
[NCERT-52]

Since, the speed of the particle are positive, the slope of the straight line in (x-t) graph must be positive.

Since, $v_A > v_B$, the slope of straight line representing A must be greater than the slope of the straight line representing B.

44. (1)

[NCERT-47]



$$h_1 + h_2 + h_3 = 1/2g (15)^2$$

$$h_1 + 3h_1 + h_3 = \frac{225}{2}g$$

$$4h_1 + h_3 \left(\frac{25}{2}g \right)$$

$$4h_1 + h_3 = gh_1 \Rightarrow h_3 = 5h_1$$

$$h_1 + h_2 = 1/2 g (10)^2 = 50 g$$

$$h_1 = 1/2 g (5)^2$$

$$h_1 = \frac{25}{2}g \Rightarrow h_2 = 3h_1 \Rightarrow h_3 = 5h_1$$

45. (2)

[NCERT-50]

$$\text{रुकने की दूरी} = x = d_s = \frac{v_0^2}{2a}$$

46. (1)

[NCERT-52]

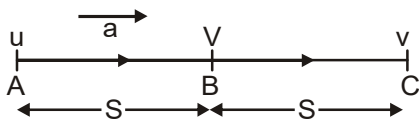
दोनों ग्राफ की प्रवणता धनात्मक होगी

ग्राफ A की प्रवणता अधिक होगी

47. (3)

[NCERT-42]

Suppose velocity at mid point is V



$$V^2 = u^2 + 2as$$

$$v^2 = V^2 + 2as$$

$$V^2 - v^2 = u^2 - V^2$$

$$2V^2 = u^2 + v^2$$

$$V^2 = \frac{u^2 + v^2}{2}$$

$$V = \sqrt{\frac{1}{2}(u^2 + v^2)}$$

48. (3)

[NCERT-48]

Motion from A to B

$$s = ut + \frac{1}{2} at^2$$

$$100 = 4u + \frac{1}{2} a(4)^2 = 4u + 8a$$

$$25 = u + 2a \quad \dots(i)$$

motion from A to C

$$s = ut + \frac{1}{2} at^2$$

$$220 = 6u + \frac{1}{2} a(6)^2 = 6u + 18a$$

$$110 = 3u + 9a \quad \dots(ii)$$

On solving eqn. (i) and (ii)

$$a = \frac{35}{3} \text{ms}^{-2}, u = \frac{5}{3} \text{ms}^{-1}$$

again, $v = u + at$

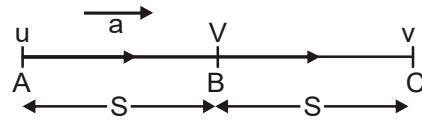
$$= \frac{5}{3} + \frac{35}{3} \times 8$$

$$= \frac{5 + 280}{3} = \frac{285}{3} = 95 \text{ms}^{-1}$$

47. (3)

[NCERT-42]

माना मध्य पथ पर वेग है V



$$V^2 = u^2 + 2as$$

$$v^2 = V^2 + 2as$$

$$V^2 - v^2 = u^2 - V^2$$

$$2V^2 = u^2 + v^2$$

$$V^2 = \frac{u^2 + v^2}{2}$$

$$V = \sqrt{\frac{1}{2}(u^2 + v^2)}$$

48. (3)

[NCERT-48]

A से B तक गति

$$s = ut + \frac{1}{2} at^2$$

$$100 = 4u + \frac{1}{2} a(4)^2 = 4u + 8a$$

$$25 = u + 2a \quad \dots(i)$$

A से C तक गति

$$s = ut + \frac{1}{2} at^2$$

$$220 = 6u + \frac{1}{2} a(6)^2 = 6u + 18a$$

$$110 = 3u + 9a \quad \dots(ii)$$

समी० (i) तथा (ii) को हल करने पर

$$a = \frac{35}{3} \text{ms}^{-2}, u = \frac{5}{3} \text{ms}^{-1}$$

पुनः $v = u + at$

$$= \frac{5}{3} + \frac{35}{3} \times 8$$

$$= \frac{5 + 280}{3} = \frac{285}{3} = 95 \text{ms}^{-1}$$

49. (3) [NCERT -48]

$$S = \frac{u+v}{2} \times t = \frac{20+60}{2} \times 4 = 160 \text{ km}$$

50. (3) [NCERT -48]

$$y = -\frac{2}{3}t^2 + 16t + 2$$

$$\frac{dy}{dt} = v \Rightarrow -(4/3)t + 16$$

$$v = 0$$

$$(4/3)t = 16$$

$$t = 12 \text{ sec}$$

49. (3) [NCERT -48]

$$S = \frac{u+v}{2} \times t = \frac{20+60}{2} \times 4 = 160 \text{ km}$$

50. (3) [NCERT -48]

$$y = -\frac{2}{3}t^2 + 16t + 2$$

$$\frac{dy}{dt} = v \Rightarrow -(4/3)t + 16$$

$$v = 0$$

$$(4/3)t = 16$$

$$t = 12 \text{ sec}$$

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