SAFE HANDS & IIT-ian's PACE

MONTHLY MAJOR TEST-02 (NB-16 NEET) ANS KEY Dt. 01-11-2023

PHYSICS		CHEMISTRY		BOTANY		ZOOLOGY	
Q. NO.	[ANS]	Q. NO.	[ANS]	Q. NO.	[ANS]	Q. NO.	[ANS]
1	D	51	D	101	D	151	B
2	A	52	A	102	B	152	A
3	A	53	D	103	D	153	C
4	A	54	B	104	C	154	B
5	C	55	A	105	A	155	C
6	D	56	D	106	D	156	A
7	B	57	B	107	A	157	D
8	D	58	A	108	B	158	C
9	A	59	A	109	D	159	C
10	C	60	A	110	D	160	B
11	B	61	B	111	B	161	B
12	B	62	A	112	A	162	B
13	A	63	C	113	C	163	A
14	A	64	C	114	C	164	A
15	C	65	B	115	B	165	C
16	B	66	A	116	D	166	A
17	C	67	A	117	B	167	C
18	B	68	C	118	C	168	C
19	A	69	C	119	B	169	D
20	B	70	B	120	A	170	D
21	D	71	C	121	A	171	B
22	A	72	C	122	D	172	D
23	D	73	B	123	A	173	B
24	B	74	A	124	A	174	D
25	C	75	A	125	B	175	D
26	A	76	C	126	D	176	A
27	B	77	B	127	A	177	C
28	A	78	D	128	C	178	C
29	C	79	A	129	C	179	D
30	D	80	B	130	B	180	D
31	A	81	B	131	D	181	D
32	C	82	D	132	D	182	B
33	B	83	D	133	B	183	D
34	C	84	C	134	B	184	B
35	C	85	D	135	B	185	C
36	C	86	C	136	D	186	D
37	A	87	D	137	C	187	D
38	A	88	D	138	B	188	A
39	A	89	D	139	D	189	D
40	C	90	C	140	D	190	A
41	A	91	B	141	C	191	A
42	C	92	C	142	C	192	A
43	B	93	B	143	D	193	C
44	D	94	B	144	C	194	A
45	B	95	D	145	B	195	B
46	A	96	B	146	C	196	D
47	B	97	C	147	C	197	B
48	A	98	B	148	B	198	D
49	B	99	A	149	C	199	B
50	B	100	D	150	A	200	C

SAFE HANDS & PACE

MAJOR TEST 2 (NEET) ANS KEY & SOLUTIONS Dt. 01-11-2023

: ANSWER KEY :

1)	**d**	**2)**	**a**	**3)**	**a**	**4)**	**a**	**33)**	**b**	**34)**	**c**	**35)**	**c**		
5)	**c**	**6)**	**d**	**7)**	**b**	**8)**	**d**	**36)**	**c**						
9)	**a**	**10)**	**c**	**11)**	**b**	**12)**	**b**	**37)**	**a**	**38)**	**a**	**39)**	**a**	**40)**	**c**
13)	**a**	**14)**	**a**	**15)**	**c**	**16)**	**b**	**41)**	**a**	**42)**	**c**	**43)**	**b**	**44)**	**d**
17)	**c**	**18)**	**b**	**19)**	**a**	**20)**	**b**	**45)**	**b**	**46)**	**a**	**47)**	**b**	**48)**	**a**
21)	**d**	**22)**	**a**	**23)**	**d**	**24)**	**b**	**49)**	**b**	**50)**	**b**				
25)	**c**	**26)**	**a**	**27)**	**b**	**28)**	**a**								
29)	**c**	**30)**	**d**	**31)**	**a**	**32)**	**c**								

: HINTS AND SOLUTIONS :

Single Correct Answer Type

1 **(d)**

The nature of the path is decided by the direction of velocity, and the direction of acceleration. The trajectory can be a straight line, circle or a parabola depending on these factors

2 **(a)**

Velocity required by body in 10 sec

$v = 0 + 2 \times 10 = 20\ m/s$

And distance travelled by it in 10 sec

$S_1 = \frac{1}{2} \times 2 \times (10)^2 = 100\ m$

Then it moves with constant velocity (20 m/s) for 30 sec

$S_2 = 20 \times 30 = 600\ m$

After that due to retardation (4 m/s^2) it stops

$S_3 = \frac{v^2}{2a} = \frac{(20)^2}{2 \times 4} = 50m$

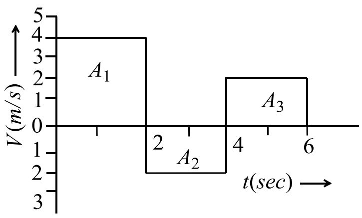
Total distance travelled $S_1 + S_2 + S_3 = 750m$

3 **(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 $= 16\ m$

4 **(a)**

Average speed for other half of distance

$= \frac{4.5 + 7.5}{2} \text{ms}^{-1} = 6\text{ms}^{-1}$

Average speed during whole motion

$= \frac{2 \times 3 \times 6}{3 + 6} \text{ms}^{-1} = 4\text{ms}^{-1}$

5 **(c)**

We know that gravity is a universal force with which all bodies are attracted towards the earth. Hence, g is same for both the balls. Also, if t is the time taken by the balls to reach the ground, then from equation of motion.

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

$$\Rightarrow \quad t = \sqrt{\frac{2(s - ut)}{g}}$$

Since s, u and g are same for both, hence time taken by both the balls is same.

6 **(d)**

Slope of line $= -\frac{2}{3}$

Equation of line is $(v - 20) = -\frac{2}{3}(s - 0)$

$\Rightarrow\ v = 20 - \frac{2}{3}s \qquad$ ...(i)

Velocity at $s = 15m\ ie,$

$v = \frac{ds}{dt}\Big|_{s=15\text{m}} = 20 - \frac{2}{3}(15) = 10\text{ms}^{-1}$

Differentiate Eq. (i) with respect to time,

acceleration $= \frac{dv}{dt} = \frac{2}{3}\frac{ds}{dt}$

$\therefore\ \frac{dv}{dt}\Big|_{s=15\text{m}} = -\frac{2}{3}\frac{ds}{dt}\Big|_{s=15\text{m}} = -\frac{20}{3}\text{ms}^{-2}$

7 **(b)**

Velocity of graph = Area of a-t graph

$= (4 \times 1.5) - (2 \times 1) = 4m/s$

8 **(d)**

Second's hand of a watch completes its one rotation in 1 min. So, its time period is 1 min.

9 **(a)**

Balancing the force, we get

$Mg - N = M\frac{v^2}{R}$

For weightlessness, $N = 0$

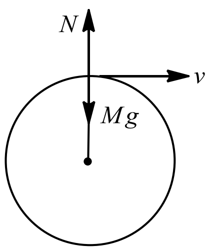
$\therefore\ \frac{Mv^2}{R} = Mg$

or $v = \sqrt{Rg}$

Putting the values, $R = 20$ m, $g = 10.0$ ms^{-2}

So, $\quad v = \sqrt{20 \times 10.0} = 14.14$ ms^{-1}

Thus, the speed of the car at the top of the hill is between 14 ms^{-1} and 10 ms^{-1}



10 **(c)**

$\vec{A}+\vec{B}=\vec{C}$ (given)

So, it is given that $\vec{C}$ is the resultant of $\vec{A}$ and $\vec{B}$

$\therefore \quad C^2 = A^2 + B^2 + 2AB\cos\theta$

$3^2 = 3 + 3 + 2 \times 3 \times \cos\theta$

$3 = 6\cos\theta$ or $\cos\theta = \frac{1}{2} \quad \Rightarrow \theta\ 60°$

11 **(b)**

Since $\vec{F} = 4\hat{i} - 3\hat{j}$ is lying in $X - Y$ plane, hence the vector perpendicular to $\vec{F}$ must be lying perpendicular to $X - Y$ plane *ie*, along Z-axis.

12 **(b)**

$h = 145 - 22.5 = 122.5$ m

Now, $40 = v\sqrt{\frac{2\times122.5}{9.8}}$

or $40 = v \times 5$ or $v = 8\ \text{ms}^{-1}$

13 **(a)**

Here, $v = 900$ km h^{-1}

$= \frac{900 \times 1000}{60 \times 60}\text{ms}^{-1} = 250\ \text{ms}^{-1}$

Minimum force is at the bottom of the vertical circle

$F_{\text{max}} = \frac{mv^2}{r} + mg = 5\ mg$

$\therefore\ v^2 = 4\ gr$

or $r = \frac{v^2}{4g} = \frac{250\times250}{4\times980} = 1594$ m

14 **(a)**

Centripetal velocity at highest point $= \sqrt{gR} = \sqrt{10 \times 1.6} = 4m/s$

15 **(c)**

Resistance, $R = \frac{V}{i} = \frac{W}{qi}$

$$= \frac{[\text{ML}^2\text{T}^{-2}]}{[\text{A}^2\text{T}]}$$

$$R = [\text{ML}^2\text{T}^{-3}\text{A}^{-2}]$$

$$\left[\frac{h}{e^2}\right] = \frac{[\text{ML}^2\text{T}^{-1}]}{[\text{AT}]^2}$$

$$= [\text{ML}^2\text{T}^{-3}\text{A}^{-2}]$$

16 **(b)**

We know that

Specific heat $= \frac{Q}{m\,\Delta t}$

Unit of specific heat

$$= \frac{\text{unit of heat}}{\text{unit of mass} \times \text{unit of temperature}}$$

$\therefore$ Unit of specific heat $= \frac{\text{J}}{\text{kg°C}} = \text{Jkg}^{-1}\text{°C}^{-1}$

17 **(c)**

$[X] = [F] \times [\rho] = [MLT^{-2}] \times \left[\frac{M}{L^3}\right] = [M^2L^{-2}T^{-2}]$

18 **(b)**

$X = \text{M}^a\text{L}^b\text{T}^{-c}$

$\therefore \quad \frac{\Delta X}{X} = \pm\left[\alpha\frac{\Delta M}{M} + b\frac{\Delta L}{L} + c\frac{\Delta T}{T}\right]$

$= \pm[a\alpha + \beta b + \gamma c]\%$

19 **(a)**

Percentage error in radius is $\frac{0.1}{4.3} \times 100$. again, $V \propto R^3$

21 **(d)**

$[\eta] = [\text{ML}^{-1}\text{T}^{-2}]$or $\quad [T] = \left[\frac{\text{M}}{\text{L}\eta}\right]^{1/2}$

Time period $= 2\pi\sqrt{\frac{M}{L\eta}}$

22 **(a)**

$T = M \times a = M \times \left(\frac{F}{m+M}\right)$

23 **(d)**

Given that, $u = 10\ \text{ms}^{-1}, \frac{dm}{dt} = 2\ \text{kgs}^{-1}$

Total mass of the truck, $M = (100 + 100)$ kg $= 200$ kg

We know that,

$F = \frac{u\ dm}{dt}$

or $F = 10 \times 2 = 20$ N

or $Ma = 20$ N

or $200a = 20$ N

or $a = \frac{20}{200}ms^{-2} = \frac{1}{10}ms^{-2}$

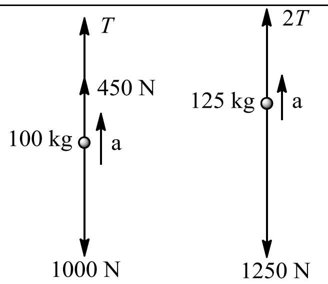
now, we know that,

$a = \frac{v-u}{t} \quad (u = 10ms^{-2}, t = 50s)$

$\Rightarrow \quad \frac{1}{10} = \frac{v-10}{50} \Rightarrow v = 15\ \text{ms}^{-1}$

24 **(b)**

Refer to the free body diagram of painter



$T + 540 - 1000 = 100a$

or $T - 550 = 100a$ ...(i)

Refer to the free body diagram of the system

$2T - 1250 = 125a$ ....(ii)

From Eqs. (ii) and (i),

$2(550+100a)-1250 = 125a$

or $75a = 1250 - 1100 = 150$

or $a = \frac{150}{75}\text{ms}^{-2} = 2\text{ ms}^{-2}$

25 **(c)**

Momentum of one piece $= \frac{M}{4} \times 3$

Momentum of the other piece $= \frac{M}{4} \times 4$

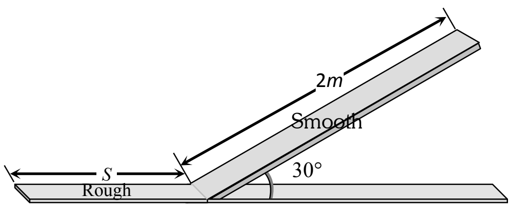
$\therefore$ Resultant momentum $= \sqrt{\frac{9M^2}{16} + M^2} = \frac{5M}{4}$

The third piece should also have the same momentum

Let its velocity be v, then

$\frac{5M}{4} = \frac{M}{2} \times v \Rightarrow v = \frac{5}{2} = 2.5\ m/sec$

26 **(a)**



$v^2 = u^2 + 2as = 0 + 2 \times g \sin 30 \times 2 \Rightarrow v = \sqrt{20}$

Let it travel distance 'S' before coming to rest

$S = \frac{v^2}{2\mu g} = \frac{20}{2 \times 0.25 \times 10} = 4m$

27 **(b)**

$A + B = 18$ ...(i)

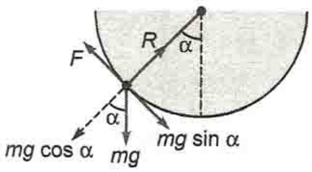
$12 = \sqrt{A^2 + B^2 + 2AB\cos\theta}$ ...(ii)

$\tan\alpha = \frac{B\sin\theta}{A+B\cos\theta} = \tan 90° \Rightarrow \cos\theta = -\frac{A}{B}$ ...(iii)

By solving (i), (ii) and (iii), $A = 13\ N$ and $B = 5N$

28 **(a)**

As is clear from figure



$F = mg\sin\alpha$

$R = mg\cos\alpha$

$\frac{F}{R} = \tan\alpha$

$ie\ \ \mu = \tan\alpha = \frac{1}{3}$

$\therefore\ \cot a = 3$

29 **(c)**

Force produced by the engine $F = \frac{P}{v} = \frac{30\times10^3}{30} = 10^3 N$

Acceleration $= \frac{\text{Forward force by engine} - \text{resistive force}}{\text{mas of car}}$

$= \frac{1000 - 750}{1250} = \frac{250}{1250} = \frac{1}{5}\ m/s^2$

30 **(d)**

The tension in the string at any position is

$T = \frac{mv^2}{r} + mg\cos\theta$

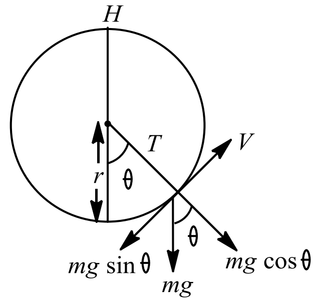
For critical position

$\theta = 180°$

$v = v_c$

T=0

Hence $v_c\sqrt{rg}$



31 **(a)**

Percentage of energy loss

$=\frac{mg(2-1.5)}{mgh} \times 100$

$= \frac{mg(0.5)}{mg \times 2} \times 100$

=25%

32 **(c)**

Kinetic energy $= \frac{1}{2}mv^2$

$\therefore$ K. E. $\propto v^2$

If velocity is doubled then kinetic energy will become four times

33 **(b)**

According to the graph the acceleration a varies linearly with the coordinate x. We may write $a = \alpha x$, where α is the slope of the graph.

From the graph

$\alpha = \frac{20}{8} mg_0 = 2.5\ \text{s}^{-2}$

The force on the brick is in the positive x-direction and according to Newton's second law, its magnitude is given by

$F = \frac{a}{m} = \frac{\alpha}{m}x$

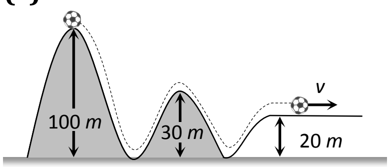
If x_f is the final coordinate, the work done by the force is

$W = \int_0^{x_f} F\,dx = \frac{a}{m}\int_0^{x_f} x\,dx$

$= \frac{\alpha}{2m}x_f^2 = \frac{2.5}{2 \times 10} \times (8)^2$

$= 8$ J

34 **(c)**



Ball starts from the top of a hill which is 100 m high and finally rolls down to a horizontal base which is 20 m above the ground so from the conservation of energy $mg(h_1 - h_2) = \frac{1}{2}mv^2$

$\Rightarrow v = \sqrt{2g(h_1 - h_2)} = \sqrt{2 \times 10 \times (100 - 20)}$

$= \sqrt{1600} = 40\ m/s$

35 **(c)**

Initially potential energy $= \frac{1}{2}kx^2$

$\Rightarrow \quad U = \frac{1}{2}kx^2$

or $2U = kx^2 \Rightarrow k = \frac{2U}{x^2}$

When it is stretched to nx cm, then

PE $= \frac{1}{2}kx_1^2 = \frac{1}{2} \times \frac{2U}{x^2} \times n^2x^2 = n^2U$

$\therefore$ Potential energy stored in the spring $= n^2U$

Assertion - Reasoning Type

36 **(c)**

$R = \frac{u^2 \sin 2\theta}{g} \ \therefore R_{\max} = \frac{u^2}{g}$ when $\theta = 45° \ \therefore R_{\max} \propto u^2$

Height $H = \frac{u^2 \sin^2\theta}{2g} \Rightarrow H_{\max} = \frac{u^2}{2g}$

When $\theta = 90°$

It is clear that $H_{\max} = \frac{R_{\max}}{2}$

37 **(a)**

Both bodies will take same time to reach the earth because vertical downward component of the velocity for both the bodies will be zero and time of descent $= \sqrt{\frac{2h}{g}}$. Horizontal velocity has no effect on the vertical direction

38 **(a)**

Let t be the time taken by the projectile while going through height h. Taking vertical upward motion of projectile, we have

$y_0 = 0, y = h, u_y = 2\sqrt{gh}\sin 60°$

$= 2\sqrt{gh} \times \sqrt{3}/2 = \sqrt{3gh}$

$a_y = -g, t = ?$

As, $y = y_0 + u_yt + \frac{1}{2}a_yt^2$

$\therefore h = 0 + \sqrt{3gh}\,t + \frac{1}{2}(-g)t^2$

or $gt^2 - 2\sqrt{3gh}\,t + 2h = 0$

On solving, we get two value of time,

$ie, \left(\frac{\sqrt{3gh}+\sqrt{gh}}{g}\right)$

and $\left(\frac{\sqrt{3gh}-\sqrt{gh}}{g}\right)$, Here, the first time is to reach a height h while going up and second time is to come back at height h. Therefore, time of projectile above the height h is

$= \left(\frac{\sqrt{3gh}+\sqrt{gh}}{g}\right) - \left(\frac{\sqrt{3gh}-\sqrt{gh}}{g}\right)$

$= \frac{2\sqrt{gh}}{g} = \sqrt{\frac{4h}{g}}$

39 **(a)**

Avogadro number has the unit per gram mole. So, it is not diamensionless.

40 **(c)**

Nuclear cross-section is measured in unit barn. but in SI system the value of 1 barn$=10^{-28}\ m^2$. Therefore, assertion is true and reason is false.

41 **(a)**

Both assertion and reason are true and the reason is correct explanation of the assertion.

Pressure $= \frac{\text{Force}}{\text{Area}}$

$= \frac{\text{Force} \times \text{distance}}{\text{Area} \times \text{distance}} = \frac{\text{energy}}{\text{volume}} =$ energyh density

42 **(c)**
Assertion is true, but the reason is false. The fan continue to rotate due to inertia of motion

43 **(b)**
According to law of inertia (Newton's first law), when cloth is pulled from a table, the cloth come in state of motion but dishes remains stationary due to inertia. Therefore when we pull the cloth from table the dishes remains stationary

44 **(d)**
For uniform motion apparent weight = Actual weight for downward accelerated motion

45 **(b)**
If two protons are brought near one another, work has to be done against electrostatic force because same charge repel each other. The work done is stored as potential energy in the system

46 **(a)**
When a spring is compressed or stretched, work is to be done against restoring force. This work done is stored in the spring in from of potential energy

48 **(a)**
Here, $u = 0, a = 10\text{ms}^{-2}, s = 40/2 = 20\text{m}$

Using the relation $v^2 = u^2 + 2as = 0 + 2 \times 10 \times 20 = 400$ or $v = 20\text{ms}^{-1}$. Thus both the Assertion and Reason are correct and Reason is the correct explanation of Assertion.

49 **(b)**
Statement 1 is based on visual experience. Statement 2 is formula of relative velocity. But it does not explains Statement 1. The correct explanation of Statement 1 is due to visual perception of motion (due angular velocity). The object appears to be faster when its angular velocity is greater w.r.t. observer

50 **(b)**
When two bodies are moving in opposite direction, relative velocity between them is equal to sum of the velocity of bodies. But if the bodies are moving in same direction their relative velocity is equal to difference in velocity of the bodies