PRACTICE TEST PHYSICS SOLUTION TYJ BALLIWALA 19 JULY 2019

1. (c) $v = r\omega \Rightarrow \omega = \frac{v}{r}$ = constant [As v and r are constant]

2. (c) As time periods are equal therefore ratio of angular speeds will be same. $\omega = \frac{2\pi}{T}$

3. (b) $F = \frac{mv^2}{r} \Rightarrow F \propto v^2$. If v becomes double then F (tendency to overturn) will become four times.

4. (b) Work done by centripetal force is always zero.

5. (c) It is always directed in a direction of tangent to circle.

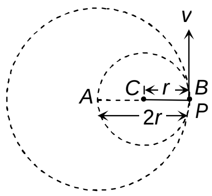
6. (c) Stone flies in the direction of instantaneous velocity due to inertia

7. (c) Centripetal acceleration $= \frac{v^2}{r}$ = constant. Direction keeps changing.

8. (c) Linear velocity, acceleration and force varies in direction.

9. (b) Angular velocity of particle P about point A,

$\omega_A = \frac{v}{r_{AB}} = \frac{v}{2r}$



Angular velocity of particle P about point C,

$\omega_C = \frac{v}{r_{BC}} = \frac{v}{r}$

Ratio $\frac{\omega_A}{\omega_C} = \frac{v/2r}{v/r} = \frac{1}{2}$.

10. (b)

11. (a) $F = \frac{mv^2}{r}$. If m and v are constants then $F \propto \frac{1}{r}$

$\therefore \frac{F_1}{F_2} = \left(\frac{r_2}{r_1}\right)$

12. (a) In uniform circular motion (constant angular velocity) kinetic energy remains constant but due to change in velocity of particle its momentum varies.

13. (c)

14. (a,c) Centripetal force $= \frac{mv^2}{r}$ and is directed always towards the centre of circle. Sense of rotation does not affect magnitude and direction of this centripetal force.

15. (a) When speed is constant in circular motion, it means work done by centripetal force is zero.

16. (d)

17. (a) This horizontal inward component provides required centripetal force.

18. (a) Thrust at the lowest point of concave bridge

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

19. (d)

20. (a) Because the reaction on inner wheel decreases and becomes zero. So it leaves the ground first.

21. (b)

22. (a) $\frac{a_R}{a_r} = \frac{\omega_R^2 \times R}{\omega_r^2 \times r} = \frac{T_r^2}{T_R^2} \times \frac{R}{r} = \frac{R}{r}$ [As $T_r = T_R$]

23. (c) $\omega_{min} = \frac{2\pi}{60}\frac{Rad}{min}$ and $\omega_{hr} = \frac{2\pi}{12 \times 60}\frac{Rad}{min}$

$\therefore \frac{\omega_{min}}{\omega_{hr}} = \frac{2\pi/60}{2\pi/12 \times 60}$

24. (d) The particle performing circular motion flies off tangentially.

25. (a) The angle of banking, $\tan\theta = \frac{v^2}{rg}$

$\Rightarrow \tan 12° = \frac{(150)^2}{r \times 10} \Rightarrow r = 10.6 \times 10^3\, m = 10.6\, km$

26. (c) K.E. $= \frac{1}{2}mv^2$. Which is scalar, so it remains constant.

27. (b) $v = 72\, km/hour = 20\, m/\sec$

$\theta = \tan^{-1}\left(\frac{v^2}{rg}\right) = \tan^{-1}\left(\frac{20 \times 20}{20 \times 10}\right) = \tan^{-1}(2)$

28. (a)

29. (d) $120\, rev/\min = 120 \times \frac{2\pi}{60} rad/\sec = 4\pi\, rad/\sec$

30. (c) In uniform circular motion, acceleration causes due to change in direction and is directed radially towards centre.

31. (b) Reaction on inner wheel $R_1 = \frac{1}{2}M\left[g - \frac{v^2 h}{ra}\right]$

Reaction on outer wheel $R_2 = \frac{1}{2}M\left[g + \frac{v^2 h}{ra}\right]$

where, r = radius of circular path, $2a$ = distance between two wheels and h = height of centre of gravity of car.

32. (d) Maximum tension $= m\omega^2 r = m \times 4\pi^2 \times n^2 \times r$

By substituting the values we get $T_{\max} = 87.64\, N$

33. (d) $\frac{v^2}{rg} = \frac{h}{l} \Rightarrow v = \sqrt{\frac{rgh}{l}} = \sqrt{\frac{50 \times 1.5 \times 9.8}{10}} = 8.57\, m/s$

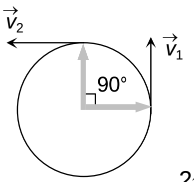
34. (b) $a = \omega^2 r = 4\pi^2 n^2 r = 4\pi^2 \times 1^2 \times 20 \times 10^3$

$\therefore$ a $= 8 \times 10^5\, m/\sec^2$

35. (c)

36. (d) In 15 second's hand rotate through 90°.

Change in velocity $|\overrightarrow{\Delta v}| = 2v\sin(\theta/2)$



$= 2(r\omega)\sin(90°/2) = 2 \times 1 \times \frac{2\pi}{T} \times \frac{1}{\sqrt{2}}$

$= \frac{4\pi}{60\sqrt{2}} = \frac{\pi\sqrt{2}}{30} \frac{cm}{\sec}$ [As T = 60 sec]

37. (c) Since $n = 2$, $\omega = 2\pi \times 2 = 4\pi\, rad/s^2$

So acceleration $= \omega^2 r = (4\pi)^2 \times \frac{25}{100} m/s^2 = 4\pi^2$

38. (b) $\omega^2 r = 4\pi^2 n^2 r = 4\pi^2 \left(\frac{1200}{60}\right)^3 \times 30 = 4740\, m/s^2$

39. (a)

40. (c) Particles of cream are lighter so they get deposited near the centre of circular path.

41. (d) Radial force $= \frac{mv^2}{r} = \frac{m}{r}\left(\frac{p}{m}\right)^2 = \frac{p^2}{mr}$ [As $p = mv$]

42. (b) $\frac{mv^2}{r} \propto \frac{K}{r} \Rightarrow v \propto r^{\circ}$