# WEEKLY TEST TYJ-02 TEST -8 RAJPUR ROAD
# SOLUTION Date 15-09-2019

## [PHYSICS]

1.

Because the body is revolving in a circle with constant speed, hence acceleration acting on it is exactly perpendicular to direction of its motion, *i.e.*, the body possesses normal acceleration.

2.

Because the particle moving in a circle describes equal angles in equal times, hence both $\omega$ and $r$ are constant. Thus, magnitude of velocity vector remains constant but the direction changes from point to point.

3.

Angular speed of the particle, *i.e.*, rate of change of angular displacement of the particle remains constant.

4.

As, $T_1 = T_2$

Hence, $\frac{2\pi r_1}{v_1} = \frac{2\pi r_2}{v_2}$ or $\frac{v_1}{v_2} = \frac{r_1}{r_2}$

$$\frac{F_1}{F_2} = \frac{mv_1^2}{r_1} \times \frac{r_2}{mv_2^2} = \left(\frac{v_1}{v_2}\right)^2 \times \frac{r_2}{r_1} = \left(\frac{r_1}{r_2}\right)^2 \times \frac{r_2}{r_1} = \frac{r_1}{r_2}$$

5.

Since, water does not fall down, therefore, the velocity of revolution should be just sufficient to

provide centripetal acceleration at the top of vertical circle. So,

$$v = \sqrt{gr} = \sqrt{10 \times 1.6} = 4 \text{ m/s}$$

6.

Because the particle is moving in a circle with uniform speed, hence kinetic energy $\left(= \frac{1}{2} mv^2\right)$ will

remain constant. Acceleration, velocity and displacement will change from point to point due to change in direction.

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$$v = \sqrt{5gr} = \sqrt{5 \times 9.8 \times 4} = \sqrt{196} = 14 \text{ m/s.}$$

8.

Velocity at the top is $\sqrt{gr}$ and that at the bottom is $\sqrt{5gr}$. Hence, required difference in kinetic energy

$$= \frac{1}{2} M[5gr - gr] = 2Mgr$$

$$= 2 \times 10 \times 1 \times 1 = 20 \text{ J}.$$

9.

Centripetal force = force of friction

$$\frac{Mv^2}{r} = \mu \times \text{reactional force}$$

or $$\frac{Mv^2}{r} = \mu Mg \quad \text{or} \quad v = \sqrt{\mu rg}.$$

10.

To cross the bridge without leaving the ground, at the highest point of the bridge,

$$\frac{Mv^2}{R} = Mg \quad \text{or} \quad v = \sqrt{Rg}.$$

11.

Length of the path,

$$314 = \frac{2\pi r}{4} \quad \text{or} \quad r = 200 \text{ m}$$

$$\therefore \quad F = \frac{mv^2}{r} = \frac{1500 \times (20)^2}{200} = 3000 \text{ N}.$$

12.

Given that masses and time periods of two bodies are same,

$$F = m\omega^2 R = m\left(\frac{2\pi}{T}\right)^2 R$$

As $m$ and $T$ are same for two bodies, hence

$$\frac{F_1}{F_2} = \frac{R_1}{R_2}.$$

13.

$$v_{max.} = \sqrt{\mu rg} = \sqrt{0.3 \times 10 \times 300}$$

$$= 30 \text{ m/sec} = 30 \times \frac{18}{5} = 108 \text{ km/hr}$$

14.

$$v = 4.9 \text{ m/sec}, r = 4 \text{ m}, \mu = \frac{v^2}{rg} = \frac{(4.9)^2}{4 \times 9.8} = 0.61.$$

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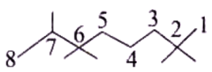
## [CHEMISTRY]

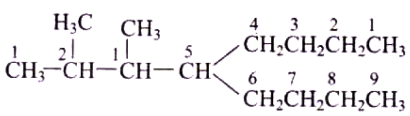
16.



2, 2, 6, 6, 7-Pentamethyloctane

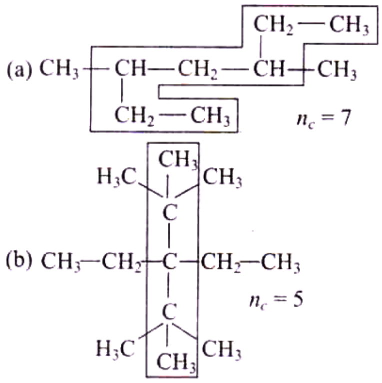
Set or locants = 2, 2, 6, 6, 7

17.



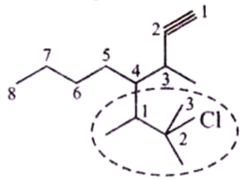
5-(1, 2-Dimethylpropyl) nonane

18.



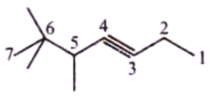

19.

The longest chain including triple bond becomes the parent chain. Hence, here we have 8 carbon parent chain as:




20.

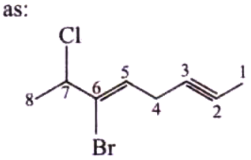
21.



5, 6, 6-Trimethylhept-3-yne

22.

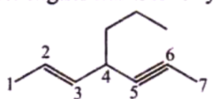
Triple bond is closer to terminal than double bond, numbering starts from right terminal as:




6-Bromo-7-chlorooct-5-en-2yne

23.

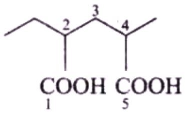
Longest chain with both double and triple bond becomes the parent chain. In the given compound, all the locants, double bond and triple bond are equidistant from terminals. In such circumstance, numbering is done in alphabetical order, here lower number is being given to 'ene' locant and higher number to 'yne' locant.



4-Propylhept-2-en-5-yne

24.

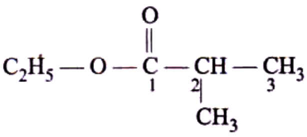
Compound has two carbon containing principal functional group, that become terminals of parent chain irrespective of chain length. Also, the two alkyl locants are equidistant from terminals, numbering is done in alphabetical order as:



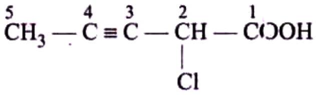
25.

Lower number to carbon bearing –OH.

26.

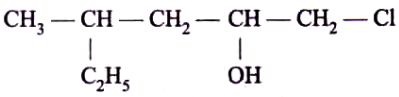


27.



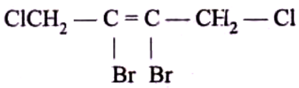
(X) 2-Methyl-hex-3-enoic acid (wrong)
2-Chloro-pent-3-yn-1-oic acid (correct)

28.



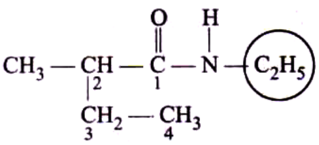
1-Chloro-4-methyl hexanol-2

29.



2, 3- Dibromo-1,4-dichloro but-2-ene.

30.



## [MATHEMATICS]

31. (c) $\frac{(3+2i\sin\theta)(1+2i\sin\theta)}{(1-2i\sin\theta)(1+2i\sin\theta)} = \left(\frac{3-4\sin^2\theta}{1+4\sin^2\theta}\right) + i\left(\frac{8\sin\theta}{1+4\sin^2\theta}\right)$

Now, since it is real, therefore Im $(z) = 0$

$\Rightarrow \frac{8\sin\theta}{1+4\sin^2\theta} = 0 \Rightarrow \sin\theta = 0$, $\therefore \theta = n\pi$

where $n = 0, 1, 2, 3, ......$

**Trick :** Check for (a), if $n = 0, \theta = 0$ the given number is absolutely real but (c) also satisfies this condition and in (a) and (c), (c) is most general value of $\theta$.

32. (b) $(x+iy)^{1/3} = a - ib$

$x + iy = (a-ib)^3 = (a^3 - 3ab^2) + i(b^3 - 3a^2b)$

$\Rightarrow \quad x = a^3 - 3ab^2, y = b^3 - 3a^2b$

$\Rightarrow \quad \frac{x}{a} = a^2 - 3b^2, \frac{y}{b} = b^2 - 3a^2$

$\therefore \quad \frac{x}{a} - \frac{y}{b} = a^2 - 3b^2 - b^2 + 3a^2$

$\frac{x}{a} - \frac{y}{b} = 4(a^2 - b^2) = k(a^2 - b^2)$

$\therefore \quad k = 4$.

33. (c) $\left|(1+i)\frac{(2+i)}{(3+i)}\right| = |1+i|\left|\frac{2+i}{3+i}\right| = \frac{|1+i||2+i|}{|3+i|}$

$= \frac{\sqrt{1+1}.\sqrt{4+1}}{\sqrt{9+1}} = \frac{\sqrt{2}\times\sqrt{5}}{\sqrt{10}} = 1$.

34. (d) $\frac{1+i}{1-i} = \frac{1+i}{1-i}\times\frac{1+i}{1+i} = \frac{(1+i)^2}{2}$

Now $1+i = r(\cos\theta + i\sin\theta) \Rightarrow r\cos\theta = 1, r\sin\theta = 1$

$\Rightarrow \quad r = \sqrt{2}, \theta = \pi/4$

$\therefore \quad 1 + i = \sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$

$\Rightarrow \quad \frac{1}{2}(1+i)^2 = \frac{1}{2}.2\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)^2$

By De Moivre's Theorem, $\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)$

Hence the amplitude is $\frac{\pi}{2}$ and modulus is 1.

**Trick :** $arg\left(\frac{1+i}{1-i}\right) = arg(1+i) - arg(1-i)$

$= 45^\circ - (-45^\circ) = 90^\circ$

$\left|\frac{1+i}{1-i}\right| = \frac{|1+i|}{|1-i|} = \frac{\sqrt{2}}{\sqrt{2}} = 1$.

35. (d) Given $z_1 = 1 + 2i$, $z_2 = 3 + 5i$ and $\bar{z}_2 = 3 - 5i$

$\frac{\bar{z}_2 z_1}{z_2} = \frac{(3-5i)(1+2i)}{(3+5i)} = \frac{13+i}{3+5i}$

$= \frac{13+i}{3+5i}\times\frac{3-5i}{3-5i} = \frac{44-62i}{34}$

Then, $\text{Re}\left(\frac{\bar{z}_2 z_1}{z_2}\right) = \frac{44}{34} = \frac{22}{17}$.

36. (a) $amp\left(\frac{1+\sqrt{3}\,i}{\sqrt{3}+i}\right) = amp(1+\sqrt{3}\,i) - amp(\sqrt{3}+i)$

$= \frac{\pi}{3} - \frac{\pi}{6} = \frac{\pi}{6}$.

37. (b) Given that $\sqrt{-8-6i} = x + iy = z$

$\Rightarrow -8-6i = (x+iy)^2 \Rightarrow x^2 - y^2 + 2ixy = -8-6i$

$\therefore x^2 - y^2 = -8$ .....(i) and $2xy = -6$ ....(ii)

Now $x^2 + y^2 = \sqrt{64+36} = \pm 10$ .....(iii)

From (i) and (iii), we get $x = \pm 1$ and $y = \pm 3$

Hence $z = \pm(1-3i)$

**Trick :** Since $\{\pm(1-3i)\}^2 = -8-6i$.