# WEEKLY TEST TYJ TEST - 11 RAJPUR ROAD
# SOLUTION Date 30-06-2019

## [PHYSICS]

1. $\text{Average speed} = \dfrac{\text{total distance covered}}{\text{total time taken}}$

$$v_{av.} = \frac{\frac{x}{2} + \frac{x}{2}}{\frac{x/2}{40} + \frac{x/2}{60}} = \frac{x}{\left(\frac{x}{80} + \frac{x}{120}\right)}$$

$$= \frac{80 \times 120}{(120 + 80)} = 48 \text{ km/h}$$

2. $200 = u \times 2 - (1/2)\, a(2)^2$ or $u - a = 100$ ....(i)
$200 + 220 = u(2 + 4) - (1/2)\,(2 + 4)^2 a$
or $u - 3a = 70$ .....(ii)
Solving eqns. (i) and (ii), we get; $a = 15$ cm/s$^2$ and $u = 115$ cm/s.
Further, $v = u - at = 115 - 15 \times 7 = 10$ cm/sec.

3. When a body slides on an inclined plane, component of weight along the plane produces an acceleration

$$a = \frac{mg\sin\theta}{m} = g\sin\theta = \text{constt.}$$

If s be the length of the inclined plane, then

$$s = 0 + \frac{1}{2}at^2 = \frac{1}{2}g\sin\theta \times t^2$$

$$\therefore \quad \frac{s'}{s} = \frac{t'^2}{t^2} \text{ or } \frac{s}{s'} = \frac{t^2}{t'^2}$$

Given t = 4 sec and $s' = \dfrac{s}{4}$

$$\therefore \quad t' = t\sqrt{\frac{s'}{s}} = 4\sqrt{\frac{s}{4s}} = \frac{4}{2} = 2\text{sec}$$

4. Given that; $a = 3t + 4$ or $\dfrac{dv}{dt} = 3t + 4$

$$\therefore \quad \int_0^v dv = \int_0^t (3t + 4)dt \text{ or } v = \frac{3}{2}t^2 + 4t$$

$$v = \frac{3}{2}(2)^2 + 4(2) = 14 \text{ ms}^{-1}$$

5. **For first body** :

$\frac{1}{2}gt^2 = 176.4$ or $t = \sqrt{\frac{176.4 \times 2}{10}}$

or t = 5.9 s

**For second body** : t = 3.9 s

$$u(3.9) + \frac{1}{2}g(3.9)^2 = 176.4$$

$$3.9u + \frac{10}{2}(3.9)^2 = 176.4$$

or u = 24.5 m/s

6. The resultant velocity of the boat and river is 1.0 km/0.25 h = 4 km/h.

Velocity of the rive $= \sqrt{5^2 - 4^2} = 3\text{ km/h}$

7. Let he be the height of the tower.
Using $v^2 - u^2 = 2as$, we get;
Here, u = u, a = – g, s = – h and v = – 3u (upward direction + ve)
$\therefore$ $9u^2 - u^2 = 2gh$ or $h = 4u^2/g$

8. $t = \sqrt{\frac{2h}{g}}$

$$s = 10 \times \frac{t}{2} - \frac{1}{2}g \times \frac{t^2}{4} = 5\sqrt{\frac{2h}{g}} - \frac{g}{8}\frac{2h}{g}$$

$v^2 - u^2 = 2gh$ or $100 = 2gh$ or $10 = \sqrt{2gh}$

$$s = \sqrt{\frac{2gh \times 2h}{4 \times g}} - \frac{h}{4} = h - \frac{h}{4} = \frac{3h}{4}$$

9. $t = \frac{1}{u+v} = \frac{1}{\frac{l}{t_1} + \frac{l}{t_2}}$

or $\frac{1}{t} + \frac{1}{t_1} + \frac{1}{t_2}$ or $t = \frac{t_1 t_2}{(t_1 + t_2)}$

10. **For first body** :
$v^2 = u^2 + 2gh$ or $(3)^2 = 0 + 2 \times 9.8 \times h$

or $h = \frac{(3)^2}{2 \times 9.8} = 0.46$ m

**For second body** :
$v^2 = (4)^2 + 2 \times 9.8 \times 0.46$

$\therefore$ $v = \sqrt{(4)^2 + (2 \times 9.8 \times 0.46)} = 5$ m/s

11. Given y = 0
Distance travelled in 10 s,

$$S_1 = \frac{1}{2}a \times 10^2 = 50a$$

Distance travelled in 20 s,

$$S_2 = \frac{1}{2}a \times 20^2 = 200a$$

$\therefore$ $S_2 = 4S_1$

12. During the first 5 seconds of the motion, the acceleration is – ve and during the next 5 seconds it becomes positive. (Example : a stone thrown upwards, coming to momentary rest at the highest point). The distance covered remains same during the two intervals of time.

13. Gain in angular KE = loss in PE

If l = length of the pole, moment of inertial of the pole about the edge $= M\left[\frac{l^2}{12}+\frac{l^2}{4}\right] = \frac{Ml^2}{3}$

Loss in potential energy $= \frac{Mgl}{2}$

Gain in angular $KE = \frac{1}{2}I\omega^2 = \frac{1}{2}\times\frac{Ml^2}{3}\times\omega^2$

$\therefore \quad \frac{1}{2}\frac{Ml}{3}\omega^2 = \frac{Mgl}{2}$ or $(l\omega)^2 = 3gl$

or $l\omega = v = \sqrt{3gl}$

$= \sqrt{3\times10\times30} = 30ms^{-1}$

14. Let the velocity of the scooter be v $ms^{-1}$. Then (v – 10)100 = 100 or v = 20 $ms^{-1}$

15. Let x be the distance between the particles after t second. Then

$x = vt - \frac{1}{2}at^2$ .....(i)

For x to be maximum,

$\frac{dx}{dt} = 0$

or v – at = 0

or $t = \frac{v}{a}$

Putting this value in eqn. (i), we get;

$x = v\left(\frac{v}{a}\right) - \frac{1}{2}a\left(\frac{v}{a}\right)^2 = \frac{v^2}{2a}$

## [CHEMISTRY]

16. These are isoelectronic ions and the size decreases with increase in nuclear charge as $S^{2-} > Cl^- > K^+ > Ca^{2+}$ (all have 20 electrons)
17.
18.
19.
20. The configuration corresponds to that of Cl, which has the highest negative electron gain enthalpy.
21. All physical and chemical properties of elements are periodic function of atomic number-Modern Periodic Law.
22. Electronic configuration reveals that the p-orbital of the element is not complete. Therefore, it is a p-block element. Moreover, the atomic number of the element is 33(As). Therefore, it is a metalloid
23. 117 = $[Rn]5f^{14},6d^{10},7s^27p^5$
24. Electronic configuration of Cu is $1s^2, 2s^2, 2p^6, 3s^23p^6, 4s^1, 3d^{10}$ and electronic configuration of $Cu^{2+}$ is $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^9$. Hence, the given configuration represents metallic cation.
25.
26. The given element belongs to third period whose atomic number is = 15. Below this element in the periodic table should belong to 4th period. Fourth period contains 18 elements. Thus atomic number of this element is 15 + 18 = 33.
27. The electronic configuration of M is
$1s^22s^22p^63s^23p^63d^{10}4s^24p^5$
Thus M belongs to halogen family ($ns^2np^5$)

28. Radius of isoelectronic species

$$\propto \frac{1}{\text{oxidation number}}$$

$O^{2-}$, $F^{-}$, $Na^{+}$, $Mg^{2+}$, $\longrightarrow$

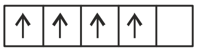
- oxidation order number in increasing
- radius in decreasing order

Thus radius of Ne should be more than $F^-$ but less than $Na^+$ i.e., in between 1.34 and 0.95º

29.

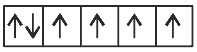
30. All the electron belong to d-Block. For d-block elements electron is removed first from ns than from (n – 1) d-orbitals.

${}_{24}Cr = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 4d^5$
${}_{24}Cr^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$



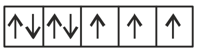
Four unpaired electrons

${}_{26}Fe = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
$Fe^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$



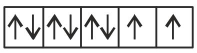
Four unpaired electrons

${}_{27}CO = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$
${}_{27}CO^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^7$



Three unpaired electrons

${}_{28}Ni = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$
${}_{28}Ni^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^8$



Two unpaired electrons