

CLASS XII

DATE : 09-05-2010

ANSWER KEY WITH SOLUTION

PHYSICS

SECTION - A

1. A 2. C 3. D 4. B 5. B 6. A 7. A
8. B 9. A,D 10. A,D 11. A,C,D 12. D 13. A 14. A
15. A

SECTION - C

1. 5 m/s 2. 32 3. 180° 4. 20 cm 5. $x = 30$ cm

MATHEMATICS

SECTION - A

1. D 2. D 3. C 4. A 5. C 6. B 7. C
8. B 9. A,D 10. A,B,C 11. A,D 12. A 13. A 14. D
15. Bonus

SECTION - C

1. 0005 2. 0004 3. 4000 4. 0000 5. 0002

CHEMISTRY

SECTION - A

1. A 2. C 3. D 4. D 5. C 6. D 7. D
8. D 9. ABC 10. ACD 11. ABC 12. A 13. A 14. B
15. C

SECTION - C

1. 0027 2. 0040 3. 0009 4. 0005 5. 0052

SOLUTIONS

PHYSICS

SECTION - A

1. **A**
For verticle oscillation

$$T_1 = 2\pi\sqrt{\frac{m}{k}}$$
 For Torsional $T_2 = 2\pi\sqrt{\frac{I}{C}}$

$$\Rightarrow I = \frac{mR^2}{2} \Rightarrow T_2 = 2\pi\sqrt{\frac{mR^2}{2C}}$$

$$T_1 = T_2$$

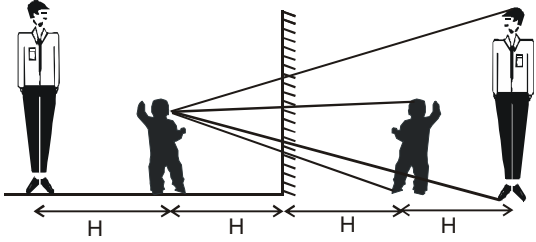
$$\Rightarrow \frac{m}{k} = \frac{mR^2}{2C} \Rightarrow R = \sqrt{\frac{2C}{k}}$$
2. **C**

$$v_i \text{ (at } x = \frac{A}{2}) = \omega\sqrt{A^2 - \frac{A^2}{4}} = \frac{\sqrt{3}A\omega}{2}$$

$$v_i \text{ (at } x = 0) = \omega A$$

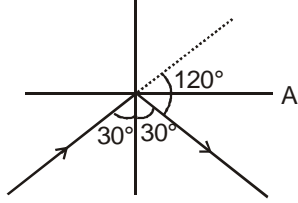
$$\Rightarrow \text{Time to reach at } x = \frac{A}{2} \text{ from m.p.}$$

$$= \frac{\pi}{6\omega} = \frac{\pi}{6} \times \frac{T}{2\pi} = \frac{T}{12}$$

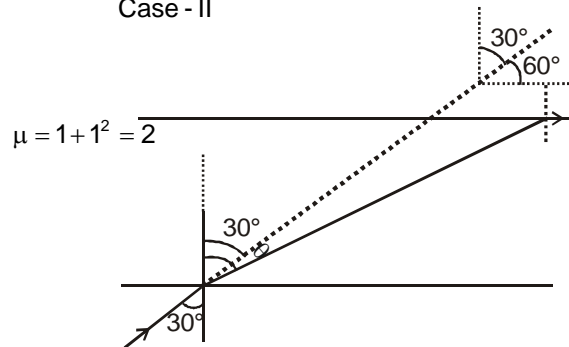
$$\Rightarrow a_{\text{avg}} = \left| \frac{v_f - v_i}{T/12} \right| = \frac{12A(2 - \sqrt{3})\pi}{T^2}$$
3. **D**
If $\theta >$ critical angle T.I.R. takes place & if $\theta <$ critical angle it reflects towards the base. So, ray 1 is not possible.
4. **B**
All reflected rays converge at image but number of rays decreases.
5. **B**
- 
- by using similar triangle the shaded length = $5H/6$
6. **A**

$$\frac{\sin i}{\sin r} = 2 \Rightarrow \sin r = \frac{1}{2} \Rightarrow r = 30^\circ$$
 unit vector = $\cos 30^\circ \hat{i} + \sin 30^\circ \hat{j}$

7. **A**
In CM frame both the masses execute SHM with

$$\omega = \sqrt{\frac{k}{\mu}} = \sqrt{\frac{2k}{m}}$$
 Initially particles are at extreme
 distance = $L_0 + (L - L_0) \cos \sqrt{\frac{2k}{m}} t$
8. **B**
Mirror in convex in nature and produces diminished image at closer distance but due to small size, it appears distant.
9. **A,D**
- 
- For T.I.R. at A
 $4 \sin 30^\circ = \mu_2 \sin 90^\circ$
 $\mu_2 = 2$
 Case - I
 If $\mu_2 < 2$, then always T.I.R. takes place & in this situation angle of deviations is 120°

Case - II



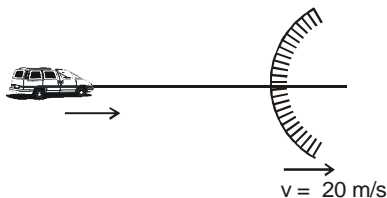
- $\mu_2 > 2$, then for the given angle of incidence no. T.I.R. takes places at A, so light strikes on interface B for T.I.R.
 $\mu_2 \sin \alpha = 2 \sin 90^\circ$
 or $\mu_2 = \frac{2}{\sin \alpha}$
 $\sin \alpha < 1$
 $\mu_2 > 2$
10. **A,D**
 11. **A,C,D**
 TIR takes place when ray of light travels from denser to rarer medium.
 Further $\sin \theta_{12} = \frac{\mu_2}{\mu_1}$ and $\sin \theta_{13} = \frac{\mu_3}{\mu_1}$
 Since, $\frac{\mu_2}{\mu_1} > \frac{\mu_3}{\mu_1}$
 $\theta_{12} > \theta_{13}$
 Smaller the value of critical angle, more are the chances of TIR.

12. **D**
13. **A**

$$-\frac{v}{u} = +\frac{1}{10}$$

$$\Rightarrow -\frac{10}{u} + \frac{1}{u} = \frac{1}{10}$$

$$-\frac{9}{u} = \frac{1}{10} \Rightarrow u = -90 \text{ m}$$



The distance between mirror and jeep = 90 m

14. **A**

$$\frac{dv}{dt} = -\left(\frac{v}{u}\right)^2 \frac{du}{dt} \Rightarrow V_{im} = -\left(\frac{v^2}{u^2}\right) V_{om}$$

$$\Rightarrow -1 \times 10^{-2} = -\left(\frac{1}{100}\right) V_{om} \Rightarrow V_{om} = 1 \text{ m/s}$$

$$V_0 = 1 + V_m = 1 + 20 = 21 \text{ m/s}$$

15. **A**

$$\Rightarrow v = \frac{fu}{u-f}$$

$$m = -\frac{v}{u} = \frac{f}{f-u} \Rightarrow \frac{dm}{dt} = \frac{f}{(f-u)^2} \frac{du}{dt}$$

$$\frac{du}{dt} = V_{om} = 1 \text{ m/s}, u = -90, f = +10$$

$$\Rightarrow \frac{dm}{dt} = \frac{1}{(100)^2} \times 1 \Rightarrow \frac{dm}{dt} = 10^{-3}$$

SECTION - C

1. **5 m/s**

with respect to box time

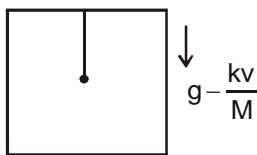
$$\text{period of box } T' = 2\pi \sqrt{\frac{l}{a}}$$

$$a = g - \left(g - \frac{kv}{M}\right) = \frac{kv}{M}$$

$$T' = 2\pi \sqrt{\frac{lM}{kv}}$$

According to problem : $T' = 2T$

$$2\pi \sqrt{\frac{lM}{kv}} = 2 \left[2\pi \sqrt{\frac{l}{g}} \right] \Rightarrow \frac{lM}{kv} = \frac{4l}{g} \Rightarrow v = \frac{Mg}{4k}$$



2. **32**

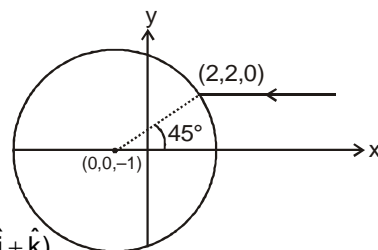
$$\hat{n} = \frac{2\hat{i} + 2\hat{j} + \hat{k}}{3}$$

$$\hat{e} = -\hat{i}$$

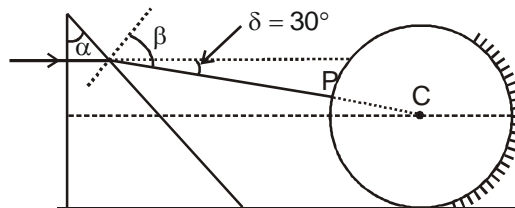
Using, $\hat{r} = \hat{e} - 2(\hat{e} \cdot \hat{n})\hat{n}$

$$\hat{r} = -\hat{i} - \frac{2(-2)(2\hat{i} + 2\hat{j} + \hat{k})}{3}$$

$$= -\hat{i} + \frac{4}{9}(2\hat{i} + 2\hat{j} + \hat{k}) = \frac{-\hat{i} + 8\hat{j} + 4\hat{k}}{9}$$



3. **180°**



$$\mu \sin 30^\circ = \sin \beta$$

$$\sqrt{3} \cdot \frac{1}{2} = \sin \beta \Rightarrow \beta = 60^\circ, \delta = 30^\circ$$

\Rightarrow Ray strikes normal to the spherical surface. It retraces the path.

\therefore Angle of deviation = 180°

4. **20 cm**

use formula

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \quad d = n_{\text{obs}} \left[\frac{t_1}{n_1} + \frac{t_2}{n_2} + \frac{t_3}{n_3} \dots \right]$$

5. **x = 30 cm**

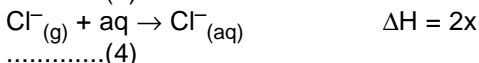
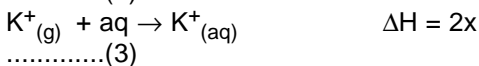
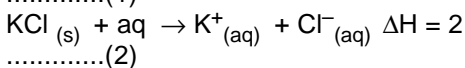
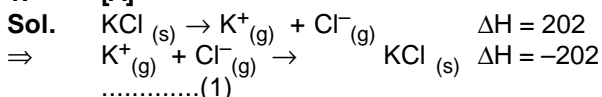
$$\text{Total shift} = 15 \left[1 - \frac{1}{1.5} \right] + 20 \left[1 - \frac{1}{2} \right] = 15 \text{ cm}$$

$$x + 15 + 20 + 10 - 15 = 60 \Rightarrow x = 30 \text{ cm}$$

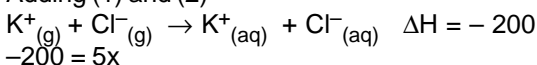
CHEMISTRY

SECTION - A

1. **[A]**



Adding (1) and (2)



$$\Rightarrow x = -40 \Rightarrow 2x = -80$$

2. **[C]**

3. **[D]**

Sol. Let $\sum x - x = x$

$$\sum y - y = 5x$$

Also $\sum x - y = x$

$$xy_{(g)} \rightarrow x_{(g)} + y_{(g)}$$

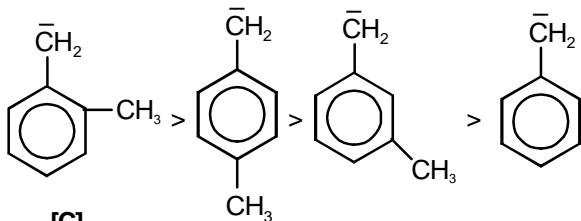
$$\sum x - y = \Delta H^0_f x_{(g)} + \Delta H^0_f y_{(g)} - \Delta H^0_f xy_{(g)}$$

$$x = \frac{x}{2} + \frac{5x}{2} - 200$$

$$x = 100$$

$$\sum x - x = 100 \text{ KJ}$$

4. [D]
Sol. Nucleophilicity
more -ve, more nucleophilicity.
CH₃ show +I and +H
So order of nucleophilicity



5. [C]
Sol. $\text{NH}_{3(g)} \rightarrow \text{N}_{(g)} + 3\text{H}_{(g)}$
 $3 \Delta H_f^\circ \text{N}_{(g)} + 3\Delta H_f^\circ \text{H}_{(g)} - \Delta H_f^\circ \text{NH}_{3(g)}$

$$3x_3 = \frac{x_1}{2} + \frac{3x_2}{2} - \Delta H_f^\circ(\text{NH}_3)$$

$$\Rightarrow \Delta H_f^\circ \text{NH}_{3(g)} = \frac{x_1}{2} + \frac{3x_2}{2} - 3x_3$$

6. [D]
Sol. Reactivity of substance \propto stability of Intermediate
Stability order

Reactivity with AgNO₃
PhCH₂Cl > CH₂=CH-Cl > Ph-Cl > CH≡C-Cl

7. [D]
Sol. +M(OH) > +M(OCH₃)

8. [D]
Sol. $\Delta H_f^\circ \text{H}_2\text{O}_{(l)} = -68$
 $\Delta H_f^\circ \text{Na}_2\text{O}_{(s)} = -100$
from eqⁿ (1)
 $-88 = 2\Delta H_f^\circ(\text{NaOH}) - 2\Delta H_f^\circ(\text{H}_2\text{O})$
 $-88 = 2\Delta H_f^\circ(\text{NaOH}) + 2 \times 68$
 $\Delta H_f^\circ(\text{NaOH}) = -112$
 $\text{Na}_2\text{O}_{(s)} + \text{H}_2\text{O}_{(l)} \rightarrow 2\text{NaOH}_{(aq)}$
 $x = 2 \times \Delta H_f^\circ(\text{NaOH}) - \Delta H_f^\circ(\text{Na}_2\text{O}) - \Delta H_f^\circ(\text{H}_2\text{O})$
 $x = -224 + 100 + 68 \Rightarrow x = -56 \text{ Kcal}$

9. [A, B, C] 10. [A, C, D]

11. [A, B, C]
Sol. In structure II SIR restricte - M effect of -NO₂

12. [A]

13. [A]

- Sol. $20 \times N_{\text{C}_2\text{O}_4^{2-}} = N_{\text{H}_2\text{O}_2} \times 30$
 $= M_{\text{H}_2\text{O}_2} \times (n_f)_{\text{H}_2\text{O}_2} \times 30$
 $= 0.3 \times 2 \times 30$
 $\therefore \quad \quad \quad = 0.9$
 $\therefore N_{\text{C}_2\text{O}_4^{2-}} = \frac{0.9}{(n_f)_{\text{C}_2\text{O}_4^{2-}}} = \frac{0.9}{2} = 0.45\text{M}$

14. [B]
Sol. $20 \times N_{\text{MnO}_4^-} = 15 \times N_{\text{C}_2\text{O}_4^{2-}}$
 $N_{\text{MnO}_4^-} = \frac{15 \times 0.9}{20} \Rightarrow M_{\text{MnO}_4^-} = \frac{15 \times 0.9}{20 \times 5} = 0.135 \text{ M}$

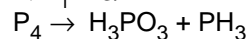
15. [C]
Sol. $25 \times N_{\text{Fe}^{+2}} = 6 \times N_{\text{MnO}_4^-}$
 $N_{\text{Fe}^{+2}} = \frac{6 \times 27}{25 \times 40} = M_{\text{Fe}^{+2}} \quad (n_f = 1)$
 \therefore No. of Fe⁺² ions in 25 ml of solution
 $= \frac{6 \times 27 \times 25}{40 \times 25 \times 1000} \times N_A = 2.44 \times 10^{21}$

SECTION - C

1. 0027
Sol. $\text{Mn} + \text{HNO}_3 \rightarrow \text{Mn}(\text{NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$

$$\text{eq. wt. of HNO}_3 = \frac{M}{1} + \frac{M}{3} = \frac{4M}{3} = \frac{M}{3/4}$$

$$\Rightarrow x_1 = 3/4$$

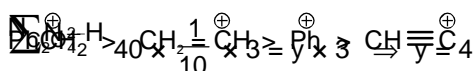


$$\text{eq. wt of P}_4 = \frac{M}{12} + \frac{M}{12} = \frac{M}{6}$$

$$\Rightarrow x_2 = 6 \Rightarrow (x_1 + x_2) \times 4 = 27$$

2. 0040 3. 0009

4. 0005
 $\text{Fe}_2(\text{SO}_4)_3$ FeC_2O_4
x m. moles y m. moles



$$(2x + y) \times 1 = 60 \times \frac{1}{10} \times 1 \Rightarrow x = 1$$

The sum of millimoles of Fe₂(SO₄)₃ and FeC₂O₄
 $= x + y = 1 + 4 = 5$

5. 0052
Sol. m.e. of H₂A = 200 × 0.25 × 2 = 100
m.e. of BOH = 300 × 0.2 = 60

⇒ Since base is limiting
Hence energy will be evolved according to it

$$q = C \times \Delta t$$

$$= 1.5 \times 2 = 3$$

$$60 \times 10^{-3} \text{ g.eq. produces 3KJ}$$

$$1 \text{ gm eq.} \quad \quad \quad 50 \text{ KJ}$$

Hence enthalpy of neutralisation of HNO₃ Vs BOH = 50KJ

Let enthalpy of dissociation of BOH = x

$$-57 + x = -50$$

$$\Rightarrow x = 7$$

Let enthalpy of dissociation of CH₃COOH = y

$$57 - (x + y) = 48$$

$$x + y = 9$$

$$7 + y = 9 \quad \Rightarrow y = 2$$

Therefore the sum of enthalpy of neutralisation of HNO₃ Vs BOH and enthalpy of dissociation of CH₃COOH = 50 + 2 = 52