## ACE OF PACE (SOLUTION)

1. (4)

A convex mirror always forms a virtual image in the care of a real object.
In care of a virtual object reflected rays may intersect really to make a real image.

2. (3)

$$(\text{magnification})m = \frac{f}{f-u}$$

Focal real image m = –n

$$-n = \frac{-f}{-f-u}$$

$$\Rightarrow u = -\frac{f(n+1)}{u}$$

3. (3)

$$\text{Mirror formula}: \frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

Here object is real so u is negative

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Also (u) = f

$$\frac{1}{v} - \frac{1}{f} = \frac{1}{f} \qquad \therefore v = \frac{f}{2}$$

4. (3)

$$m = \frac{f}{f-u}$$

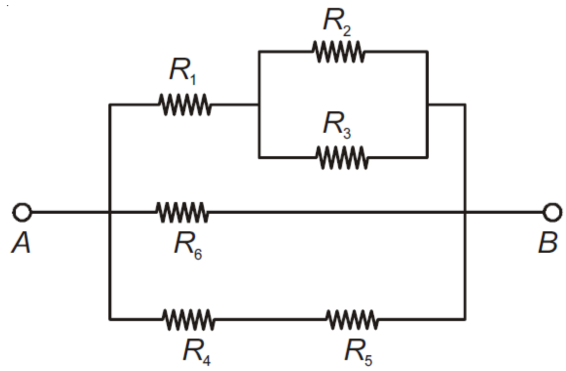
$$f = -0.15\text{m}$$

$$m = +2(\text{virtual image})$$

$$2 = \frac{-0.15}{-0.15-u}$$

$$\Rightarrow = -.075\text{m or } -7.5\text{cm.}$$

5. (3)

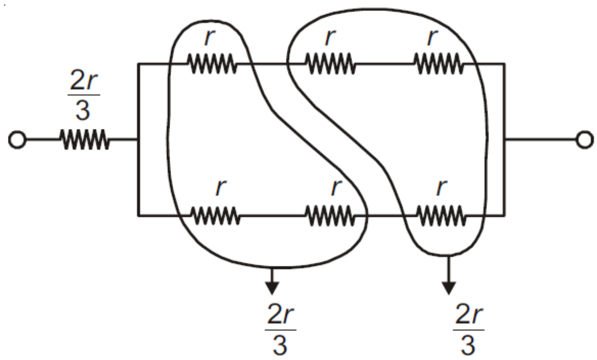



$R_2$ and $R_3 \Rightarrow$ Parallel

6. (3)

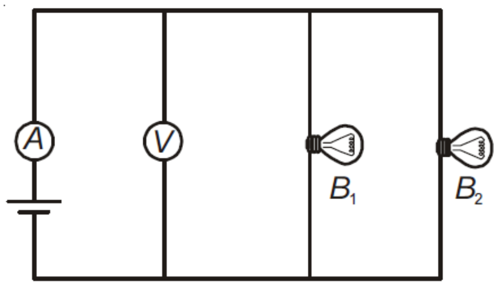
Resistance is the opposition to the flow of current

7. (2)




$R_{net} = 2r$

8. (3)




If $B_2$ gets fused, $R_{net}$ increases, $i$ decreases, but reading of $V$ remains same.

9. (3)

For (L / 2, D), resistance is minimum

10. (1)

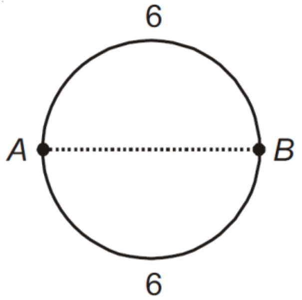
$$x = \frac{\rho l}{A}$$

$$20 = \frac{\rho(2l)}{(A/2)}$$

$$\frac{x}{20} = \frac{1}{4}$$

$$x = 5$$

11. (3)




$R = 3$

12. (4)
Because here earth's magnetic field has vertical component only.

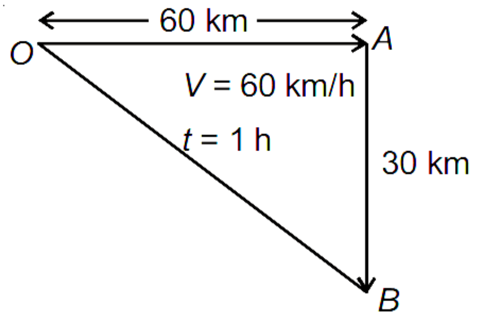
13. (2)
They will move in helical path while trapped in earth's magnetic field and will eventually move towards poles.

14. (2)

15. (2)
Because stationary magnetic field is zero inside soft ring.

16. (2)

17. (3)
Displacement of car = $\sqrt{60^2 + 30^2} = 30\sqrt{5}$ km




$\left[\begin{array}{l}\text{Distance } OA = \text{Speed} \times \text{Time} \\ \Rightarrow 60 \times 1\text{ h} = 60 \text{ km}\end{array}\right]$

18. (3)

For upstream, Speed $\Rightarrow v - u$ (where $v \to$ man and $u \to$ water)

For downstream, Speed $\Rightarrow v + u$

$$t_{up} = \frac{d}{v-u}$$

$$t_2 = \frac{d}{v-u}$$

$$\Rightarrow \quad d = (v-u)t_2 \qquad ...(i)$$

$$t_{down} = \frac{d}{v+u}$$

$$t_1 = \frac{d}{v+u}$$

$$\Rightarrow \quad d = (v+u)t_1 \qquad ...(ii)$$

$$t_{still} = \frac{d}{v}$$

$$\boxed{t_{still} = \frac{2t_1t_2}{t_1+t_2}}$$

On equating (i) and (ii)

$$(v-u)\,t_2 = (v+u)\,t_1$$

$$\Rightarrow vt_2 - ut_2 = vt_1 + ut_1$$

$$\Rightarrow v(t_2 - t_1) = u(t_1 + t_2)$$

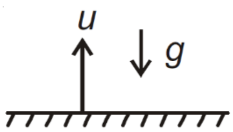
$$\Rightarrow u = \frac{v(t_2-t_1)}{t_2+t_1}$$

So, $d = \left(v - \frac{v(t_2-t_1)}{t_1+t_2}\right)t_2 = vt_2\left(\frac{t_1+t_2-t_2+t_1}{t_1+t_2}\right)$

$\boxed{\frac{d}{v} = \frac{2t_1t_2}{t_1+t_2}}$ $\to$ **Remember as shortcut**

19. (2)

Whether body move upwards or downwards the earth tries to pull it downwards only.
Hence during both the motion g will negative. So, negative, negative




20. (2)

$$d_s = \frac{u^2}{2a} \Rightarrow ds \propto u^2$$

$$u' = 2u$$

$$\frac{d'}{f} = \frac{(2u)^2}{u^2}$$

$$\Rightarrow \frac{d'}{8} = 4$$

$$\Rightarrow d' = 32$$

21. (4)

By newton's second law

$\vec{F} = m\vec{a}$ ....(i)

for (i) Uniform motion means body is moving with constant velocity. By (i) it can be said that only for accelerated motion force is required (2) is true using (i)

(3) Using (i)$\vec{a} = \frac{\vec{F}}{m}$ so this is true

22. (1)

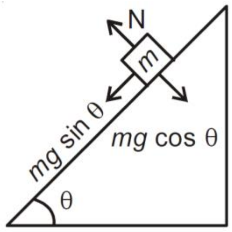
No component of force is in the direction of motion (as $\vec{F} \perp \vec{V}$) so it cannot change the speed of particle. But velocity cannot be constant because force will change the direction of motion.

23. (2)

For constant velocity, no force is required so $\vec{F} = 0$

24. (4)

Force enerted by the plane on the block will be N

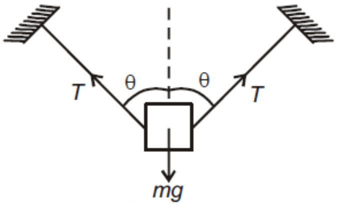



$N = mg\cos\theta$

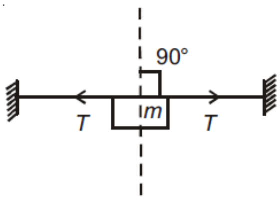
25. (4)

$2T\cos\theta = mg$

$T = \frac{mg}{2\cos\theta}$ ...(i)




To make this string completely straight




$\theta = 90°$

in (i) put $\theta = 90°$

$T = \frac{mg}{2\cos 90°} \approx \infty$

26.

Assume 1000 g (or 1000 mL) of water.

It contains $\frac{1000}{18} = 55.55$ mol of water.

Let the number of moles of A be x.

The mole fraction is 0.2.

$0.2 = \frac{x}{55.55 + x}$

$55.55 + x = 5x$

$55.55 = 4x$

$x = 13.88$ mol.

The molality of the solution is m =

$\frac{\text{Number of moles of solute}}{\text{Mass of solvent in kg}} = \frac{13.88 \text{ g/mol}}{1 \text{ kg}} = 13.88$ m.

27. (3)

98% mass of $H_2SO_4$ means 98g of $H_2SO_4$ in 100g solid ion

Given, density = 1.84 g/cc = 1.84 g/ml (1cc = 1mL)

$\text{Density} = \frac{\text{mass}}{\text{volume}}$

$\therefore \text{Volume} = \frac{100}{1.84} \text{mL} = \frac{100}{1.84 \times 1000} \text{L}$

$\text{Now, Molarity} = \frac{\text{Weight given}}{\text{Molecular } \omega t \times \text{volume}}$

$= \frac{98 \times 1.84 \times 1000}{98 \times 100}$

$= 18.4\text{M}$

28.

The correct option is **D** 1019.6 g

Given, molality (m) = 0.2 mol/kg

weight of solvent = 1000 g

Since it is a sulphuric acid ($H_2SO_4$) solution

weight of solute = 0.2 × 98 = 19.6 g

Total weight of solution will be

= 1000 + 19.6 = 1019.6 g

29. (3)

$r_f \rightarrow rn_2$

$r_i \rightarrow rn_1$

$(4)^2 - (3)^2 = 7$

$16 - 9 = 7$

$n_2 = n_f = 4$

$n_1 = n_i = 3$

30. (1)

$V = 2.18 \times 10^8 \frac{2}{h} cm/sec$

for $Li^{+2} = V = \frac{3}{2} \times 2.18 \times 10^8 cm/sec$

$n = 2$

$= 3.27 \times 10^8 cm/sec$

31. (1)

32. (1)

(–) change increases, Nuclear attraction decrease size increases.

33. (3)

Total $e^-$ in CO = 6 + 8 = 14

Bond order = 3

34. (2)

$O_2 \rightarrow 2e^-$ in anti bonding orbital

$He_2^+ \Rightarrow 1e^-$ in anti bonding orbital

35. (1)

$MgCO_3 \rightarrow$ Magnesite

$FeCO_3 \rightarrow$ Siderite

$ZnO \rightarrow$ Zincite

$Ag_2S \rightarrow$ Argentite

36. (3)

37. (1)

38. (1)

In the given structure Ha is present next to C = O,

$H_b$ is in conjugation with C = C and that extends to C = O

$H_c$ has no conjugation
Therefore $H_b$ is most acidic and $H_c$ is least acidic
Therefore the order of acidity is :
$H_b > H_a > H_c$

39. (3)

40. (3)

+I effect of $CH_3$ group increases electron density on N and makes it a stronger base. So, the order of basic strength would be expected to be $3^o > 2^o > 1^o > NH_3$

But in an aqueous medium presence of hydrogen bonding and bulkier groups affects the basicity.

In $(CH_3)_3N$, alkyl groups hinder the attack of the proton on N. Therefore, it becomes less basic and due to the additive effects of steric hindrance and induction, $(CH_3)_2NH$ is the strongest base in the aqueous medium.

Thus, for an aqueous medium order of basicity is $2^o > 1^o > 3^o > NH_3$

Hence the correct option is C.

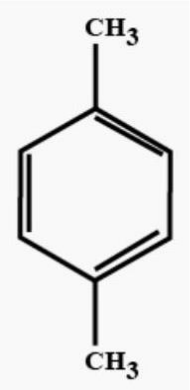
41. (2)
Molar conductance of $NaNO_3$
$= NaCl + AgNO_3 - AgCl$
$= 110.3 + 116.5 - 121.6$
$= 105.2$

42. (4)

$$\Lambda_m = K \times \frac{1000}{M}$$
$$M = K \times \frac{1000}{\Lambda_m}$$
$$M = \frac{3.06 \times 10^{-6} ohm^{-1} cm^{-1} \times 1000}{1.53 ohm^{-1} cm^{-1} mol^{-1}}$$
$$M = 2 \times 10^{-3}$$
$$M = S = 2 \times 10^{-3}$$
$$K_{sp} = \left[Ba^{2+}\right]\left[SO_4^{2-}\right]$$
$$K_{sp} = S \times S = S^2$$
$$K_{sp} = 4 \times 10^{-6}$$

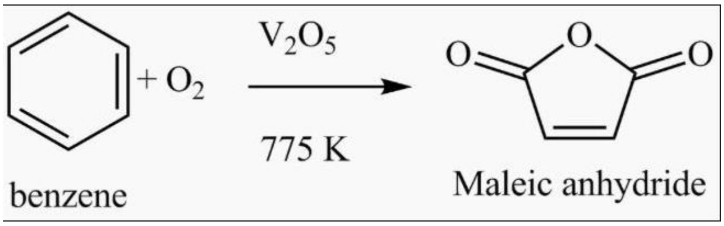
43. (2)

44. (3)
As methyl group is ortho, para directing so this will only ortho product as para is not available.




45. (3)
Since only one product is obtained, all the four aromatic hydrogen atoms are equivalent. This is possible only if the substituents are in para positions

46. (4)
When a mixture of benzene vapour and oxygen is passed over V2O5 catalyst at 775 K, Maleic anhydride is obtained.



47. (3)
Alkaline $KMnO_4$ is a strong oxidizing agent. It oxidizes methyl group attached to benzene can be oxidised to carboxyl group.
Other oxidizing agents that can be used are acidified
$K_2Cr_2O_7$ and dil. $HNO_3$

48. (4)

$NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g) \quad K_P = 64 atm^2$

| | | |
|---|---|---|
| 0 | 0 | 0 |
| a − x | x | x |

$\Rightarrow K_P = x^2 = 64\ atm^2 \quad x = 8atm$

total pressure at Eq $\Rightarrow 8 + 8 = 16atm$

49. (4)

50. (1)

pOH of $H_2O = 7.0$ (at 298K)

According to Le- Chattier's principles:
When temperature increases according to Le Chattier's principle the extra heat would be absorbed that is forward reaction is favoured as it absorbs heat.

$H_2O + H_2O \leftrightharpoons H_3O^+ + OH^-$

$\rightarrow$ the pH falls, as temperature increases.

$\rightarrow$ also the pOH decreases since the value of $pK_w$ itself decreases.