FIITJEE

IOQJS MOCK TEST – I

PART – II

MODEL SOLUTIONS

1. **A**

Sol. The maximum distance covered by the vehicle before coming to rest = $\frac{v^2}{2a} = \frac{(15)^2}{2(0.3)} = 375$ m

The corresponding time = t = $\frac{v}{a} = \frac{15}{0.3} = 50s$. Therefore after 50 seconds, the distance covered by the vehicle = 375 m from the instant of beginning of braking.

$\Rightarrow$ The distance of the vehicle from the traffic after one minute
= (400 – 375) m = 25 m.

$\therefore$ (A)

2. C

Sol. In element A, the resistance remains constant upto the potential drop of 10 V. Further increase in the voltage does not increase this current (which is constant at 1A). This means that the ratio V/R_A = constant and this resistance R_A increases linearly with voltage.

In element B, the resistance decreases gradually upto 15 V and afterwards the resistance R_B increases linearly with voltage.

When both A and B are in series, the current in the circuit will increase nonlinearly upto 1 A when the total voltage drop across A and B becomes 10 + 15 = 25 V.

Further increase in this voltage does not bring about any change in the current as shown in solution (C). The voltage drop across A will go on increasing while that across B remain fixed at 15 V.

Hence (C) is correct.

3. **C**

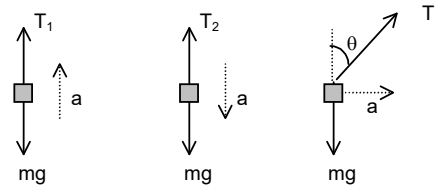
Sol. Referring to the free body diagrams of the bob we obtain,

$T_1 - mg = ma$

$\Rightarrow$ $T_1 = m(g+a)$ …(1)

$mg - T_2 = ma$

$\Rightarrow$ $T_2 = m(g-a)$ …(2)



When the cage moves horizontally with an acceleration a, let the tension be T.

From the free body diagram, $T\sin\theta = ma$

And $T\cos\theta - mg = 0$

$\Rightarrow$ $(T\sin\theta)^2 + (T\cos\theta)^2 = (ma)^2 + (mg)^2$

$\Rightarrow$ $T^2 = m^2(g^2+a^2)$ …(3)

From (1) and (2)

$$\left(\frac{T_1}{m}\right)^2 + \left(\frac{T_2}{m}\right)^2 = (g+a)^2 + (g-a)^2$$

$\Rightarrow$ $\frac{T_1^2 + T_2^2}{2} = (g^2 + a^2)\,m^2$ …(4)

Equations (3) and (4), we obtain

$$T^2 = \frac{1}{2}(T_1^2 + T_2^2) \quad \Rightarrow \quad T = \sqrt{\frac{T_1^2 + T_2^2}{2}}$$

Therefore (C).

4 **A**

Sol. Power = F.v, where F = force imparted by the machine , v = velocity of the liquid

P = p.A.v, Where p = pressure & A = effective area

$= p\frac{dV}{dt} = \left(\frac{3}{2}\times 10^5\right)(60\times 10^{-6})$ ($\because$ 1 atm $\approx 10^5$ N/m^2)

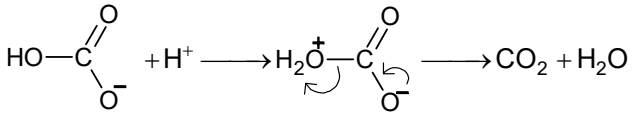
= 9 watts.

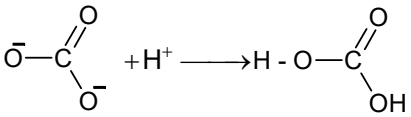
5. B

Sol. $NaHCO_3 + H^+ \longrightarrow Na^+ + CO_2 + H_2O$

$Na_2CO_2 + H^+ \longrightarrow Na^+ + CO_2 + H_2O$

HCO_3^- easily forms CO_2 than CO_3^{2-} ion in presence of acid.





6. C

Sol. Electronegative depends on oxidation state of nitrogen. Higher the positive oxidation state, higher is the electronegativity.

$N_2O \rightarrow$ neutral oxide $\therefore$ pH of its solution = 7

$N_2O_3 + H_2O \longrightarrow 2HNO_2$ (weak acid, high pH)

$N_2O_5 + H_2O \longrightarrow 2HNO_3$ (strong acid, lower pH)

7. B

Sol. Micelles cannot remove dirty substances as the polar end is blocked by H^+.

8. C

Sol. Metallic character increases on moving down the group and decreases along period from left to right. Size decrease from L to R along a period and increases on moving down a group.

9. D

Sol. Sexual reproduction favours Genetic diversity.

10. C

Sol. Zygote is diploid.

11. C

Sol. If a cell forms identical cells then we can say that it undergoes mitosis and numbers of chromosomes are also the same 46.

12. B

Sol. Blood flow to the muscles increased.

13. AB

Sol. (a) When the body is projected vertically up, at the highest point its speed becomes zero whereas it is accelerating downwards with g = 9.8 m/s^2.

(b) When a body is projected up, the velocity during ascent reverses its direction during its descent, whereas the acceleration of the body remains constant, that is $\vec{g}$.

(c) Acceleration means, increasing speed (magnitude of velocity). Therefore, the speed of a particle increases with an acceleration. When the acceleration is decreased the speed of the particle goes on decreasing till the acceleration reduces to zero.

$\therefore$ (A) and (B)

14. ABCD

Sol. Height above the ground $= 30 + \frac{u^2}{2g}$

15. CD

Sol. Q = C_2H_5OH, R = C_2H_4, S = CH_3COONa, T = H_2, U = C_2H_6

16. ABC

Sol. pH of NaCl = pH of H_2O = 7

NaCl is a neutral salt

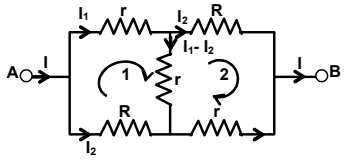
Colour of turmeric change in basic medium

17.

	Biological chemical			
	RNA	**Starch**	**Protein**	**Lipid**
Used for growth and repair			✓	
Contains nitrogen	✓		✓	
Contains carbon, oxygen and hydrogen	✓	✓	✓	✓
Made from amino acids			✓	
Reacts with iodine to form a blue black complex		✓		
Insoluble in water				✓
Contains uracil	✓			

18. (a) C,D
(b) B
(c) A
(d) G,F
(e) Nitrobactor, Nitrosomonas

19. As power is distributed uniformly in a hemisphere, intensity at a distance of 5 m from the source will be



$$I = \frac{P}{S} = \frac{P}{(1/2)4\pi r^2} = \frac{10^{-3}}{2\times\pi\times5^2} = 6.37\ \mu W/m^2$$

Thus loudness level is

$$L = 10 \log \frac{I}{I0} = 10 \log \frac{6.37\times10^{-6}}{(10^{-12})}$$

or $L = 10[\log 6.37 + 6 \log 10] = 10[0.80 + 6]]$

or $L = 68$ dB

If there are 5 dogs barking at the same time and same level $I_2 = 5I_1$. So

$$L_2 - L_1 = 10 \log (I_2/I_1) = 10 \log \frac{5I_1}{I_1}$$

or $L_2 = L_1 + 10 \log 5$

or $L_2 = 68 + 10 \times 0.7 = 75$ dB

20. The current flow is as indicated by symmetry

$$R_{AB} = \frac{V_{AB}}{I} = \frac{V_{AB}}{I_1 + I_2} = \frac{I_1 r + I_2 R}{I_1 + I_2}$$

In loop 1 apply Kirchoff's Low

$I_1 r + (I_1 + I_2) r - I_2 R = 0$

$$\Rightarrow\ I_1 (r+r) = I_2 (R+r) \Rightarrow I_1 r = \frac{I_2}{2}(R+r) \Rightarrow \frac{I_2}{I_1} = \frac{2r}{R+r}$$

$$R_{AB} = \frac{r + \frac{I_2}{I_1}R}{I + \frac{I_2}{I_1}} = \frac{r + 2rR/(r+R)}{I + \frac{2r}{r+R}} = \frac{r^2 + 3rR}{R + 3r} = \frac{r(r+3R)}{(3r+R)}$$

21.

(i) Below 200 K decomposition does not start. As the colour is due to NO_2 gas, colour is observed form 200 to 400°C, beyond 400°C, NO_2 decomposes to NO and O_2 which are colourless gases.

(ii) Pure H_2 and Cl_2 gas are observed in electrolysis because the gases liberate at anode(Cl_2) and cathode(H_2) do not get a chance of mixing.

(iii) $MgCO_3(s) \longrightarrow MgO(s) + CO_2(g)$

A high temperature decomposition process takes place because of adsorption of CO_2 on MgO. Increase in temperature decrease the rate of adsorption.

(iv) $T_2 > T_1$

(v) The decomposition temperature of $Fe_2(SO_4)_3$ is higher than $FeSO_4$ due to high lattice energy of ferric sulphate than $FeSO_4$. The high lattice energy is due to stronger attraction between Fe^{3+} and SO_4^{2-} ions as compared to Fe^{2+} and SO_4^{2-} ions in $FeSO_4$.

(vi) Stability: M > M*

Energy of M* is higher than that of M.

(vii) Most of the decomposition reactions are endothermic but a few reaction are exothermic.

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)(\text{endothermic})$$

$$2H_2O(aq) \longrightarrow 2H_2O(aq) + O_2(s)(\text{exothermic})$$

(viii) No it is not a decomposition reaction, because in decomposition reaction the number of products is always greater than that of reactant. In decomposition reaction bond breaking and bond formation takes place. Here no such activity takes place.

(ix) $Mg(OH)_2$ forms MgO and H_2O on heating. The adsorption of H_2O and MgO does not take place. In the decomposition of $MgCO_3$ into MgO and CO_2. CO_2 has a stronger tendency to be adsorbed of MgO due to its acidic nature. So no free surface is left on MgO to interact with polymers during fire.

22.

(i) Due to low melting point it spreads on water. The surface area of it increases. So reactivity increases and becomes violent.

(ii) Strong basic oxides are more ionic and have less lattice energy than weak basic oxides. So the strong basic oxides are more soluble in water than weak basic oxides.

(iii) P = NaOH, Q = $NaHCO_3$, R = Na_2CO_3

(iv) Nitrogen has more electrons on the valence shell than magnesium. So nitrogen can show more number of oxidation sates than magnesium(only +2 oxidation state). So compound formed by nitrogen is higher than that of magnesium.

(v) $3Zn + Cr_2(SO_4)_3 \longrightarrow 3ZnSO_4 + 2Cr$

$\therefore$ Zn decolourises $Cr_2(SO_4)_3$

(vi) $ZnO + C \longrightarrow Zn + CO$

Above reaction takes place at higher temperature. Thermodynamic factors also contribute to the reaction. In aqueous solution more electropositive metal displaces less electropositive metal from its salt solution.

(vii) $Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2 + 2H_2O$

$Cu + HCl \longrightarrow$ No reaction

Cu is present below hydrogen in the activity series. So Cu cannot displace H_2 from acids. So it does not react with HCl. It reacts with H_2SO_4 but does not displace H_2. Since H_2SO_4 is an

oxidizing agent it oxidises Zn to Zn^{2+} ion. HCl is not an oxidizing agent. So it can't react with Cu.

(viii) $Na \xrightarrow{O_2} Na_2O + Na_2O_2 + NaO_2$

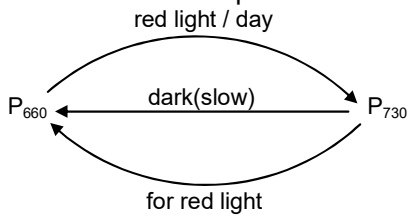
$Ca \xrightarrow{O_2} CaO$

Na^+ and Ca^{2+} attract with O^{2-} ions from the above products. Ca^{2+} strongly attracts O^{2-} ions so O^{2-} ions do not get time to combine with either O_2 to form O_2^{2-} and O_2^- ions.

Na^+ due to less charge can't attract O^{2-} with strong force in short time.

(ix) Zn can displace H_2 from both dilute and Conc. HCl. Conc. HCl is volatile as it forms fumes of HCl. If H_2 is prepared with conc. HCl, it becomes impure due to mixing of HCl fumes.

23. (a) a simple flow chart given the information presented such as:



(b) Short day (1) night must be long enough or no flowering when short night (1) P_{730} has to drop below a critical level (1).

(c)

Causes	Effects
Ozone depletion results from chemical reactions high in the upper atmosphere such as CFCs used in the manufacture of coolants whereas global warming (or the enhanced greenhouse effect) results from excess carbon compound such as methane, carbon dioxide being released in the atmosphere. Largely due to industrialization, combustion of fossil fuel, cattle farming, waste products cause heat to be 're-radiated' back to the earth.	Increase in UV rays which allow increases in mutation / DNA damage / eg. skin cancer whereas global warming results in widespread environmental changes such as polar ice caps melting / sea temperatures / floods / droughts etc.

(d) The mass of the water would stay the same.

24. (i) (a) A (b) D (c) D (d) A

(ii) (a) Active: 24 days, passive 6 days.
(b) Passive after 45 days.
(c) Passive is fast acting compared to active; passive lasts a short time, whereas active lasts longer and is safer for longer or words to that effect.