Toughest Questions Ever Asked in AIPMT with Solutions

Biology>>

Q1 (AIPMT 2012): Monascus purpureus is a yeast used commercially in the production of:

Option A	Option B	Option C	Option D
Ethanol	Streptokinase for removing clots from the blood vessels	Citric acid	Blood cholesterol lowering statins

Correct Answer: Option D

Monascus purpureus is a yeast used in the production of statins which are blood cholesterol lowering agent.

Q2 (AIPMT 2011): The purplish red pigment rhodopsin contained in the rods type of photoreceptor cells of the human eye, is a derivative of:

Option A	Option B	Option C	Option D
Vitamin A	Vitamin B1	Vitamin C	Vitamin D

Correct Answer: Option A

Vitamin A is the precursor of the purplish red pigment rhodopsin contained in the rods (photoreceptor) cells of human eye.

Q3 (AIPMT 2010): Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme?

Option A	Option B	Option C	Option D
5′ ------ CGTTCG ------ 3′ 3′ ------ ATGGTA ------ 5′	5′ ------ GATATG ------ 3′ 3′ ------ CTACTA ------ 5′	5′ ------ GAATTC ------ 3′ 3′ ------ CTTAAG ------ 5′	5′ ------ CACGTA ------ 3′ 3′ ------ CTCAGT ------ 5′

Correct Answer: Option C

Because the palindrome in DNA is a sequence of base pairs that reads same on the two strands when orientation of reading is kept same.

Q4 (AIPMT 2009): Oxygenic photosynthesis occurs in:

Option A	Option B	Option C	Option D
Oscillatoria	Rhodospirillum	Chlorobium	Chromatium

Correct Answer: Option A

Cyanobacteria are the only monerans capable of oxygenic photosynthesis and *Oscillatoria* is a cyanobacterium.

Q5 (AIPMT 2014): Which of the following is a hormone releasing Intra Uterine Device (IUD)?

Option A	Option B	Option C	Option D
Multiload 375	LNG – 20	Cervical cap	Vault

Correct Answer: Option B

LNG-20 is a Long Term Reversible Contraceptive Device (LTRC) that helps in contraception without requiring any user action. It is a type of IUD that releases progesterone.

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Chemistry>>

Q1 (AIPMT 2014): The weight of silver (at. wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of O2 at STP will be:

Option A: 5.4 g
Option B: 10.8 g
Option C: 54.0 g
Option D: 108.0 g

Correct Answer: Option D
At STP condition, 1 mole of any gas occupies 22.4 L of volume.

Mass of 1 mole of oxygen gas = 32 g
⇒ 22400 mL of oxygen gas weigh = 32 g

Mass of 5600 mL of oxygen gas = $\frac{32}{22400} \times 5600$
= 8 g

Now, According to the Faraday's second law of electrolysis, when same amount of electricity is passed through different electrolyte, the mass of substance produced at electrodes are directly proportional to their equivalent weight.

Hence, it can be written :

$$\frac{\text{Mass of Ag displaced}}{\text{Mass of Oxgen displaced}} = \frac{\text{Equivalent weight of Ag}}{\text{Equivalent weight of Oxygen}} \quad ...(i)$$

Mass of oxygen displaced = 8 g
Equivalent weight of Ag = 108
Equivalent weight of oxygen gas = 8
On substituting the above values in equation (i), we get

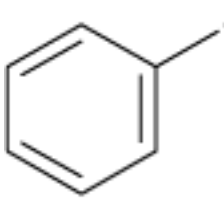
$$\frac{\text{Mass of Ag displaced}}{8} = \frac{108}{8}$$

⇒ mass of Ag displaced = 108 g

Hence, the correct option is (D).

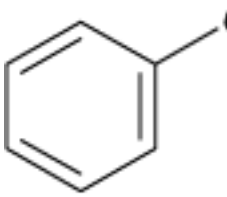
Q2 (AIPMT 2013): Reaction by which Benzaldehyde cannot be prepared:

Option A



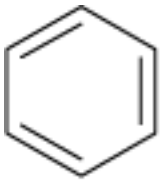
+ CrO_2Cl_2 in CS_2 followed by H_3O^+

Option B



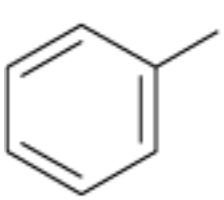
+ H_2 in presence of Pd-$BaSO_4$

Option C



+ CO + HCl in presence of anhydrous $AlCl_3$

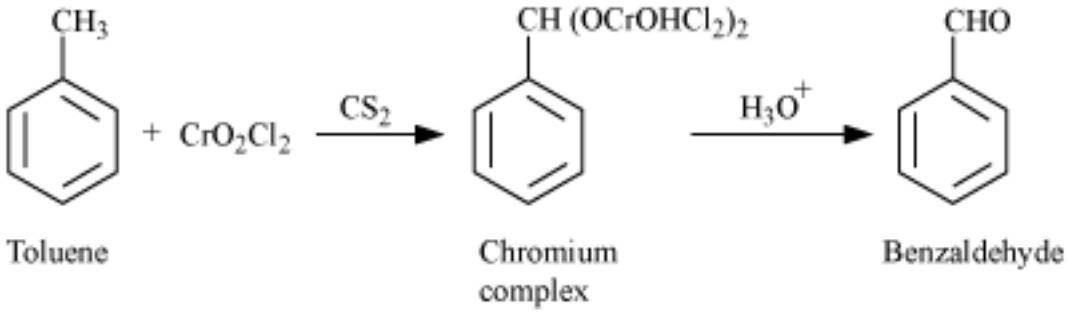
Option D



+ Zn/Hg and conc. HCl

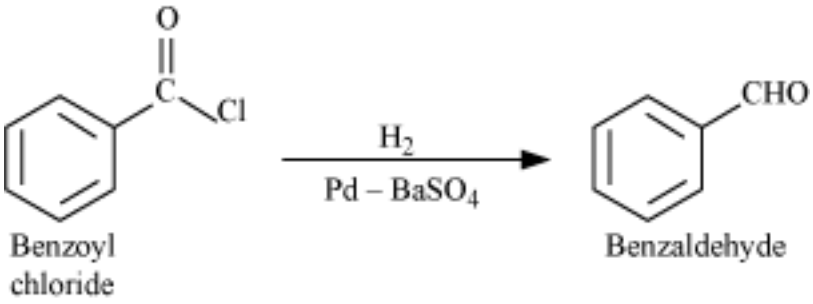
Correct Answer: Option D

Chromyl chloride (CrO_2Cl_2) oxidises methyl group of toluene to a chromium complex, which on hydrolysis gives benzaldehyde.



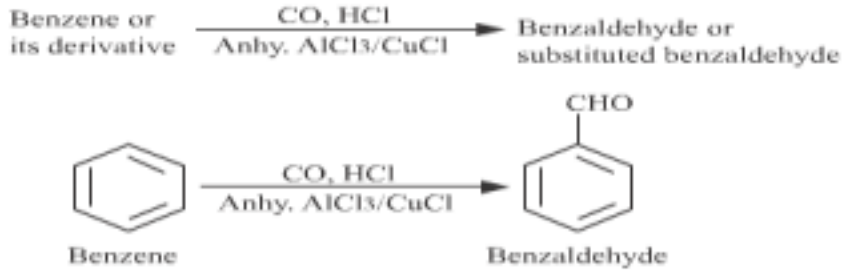
This reaction is called **Etard reaction.**

Benzoyl chloride on reduction over catalyst palladium on barium sulphate gives benzaldehyde.



This reaction is called **Rosenmund reduction.**

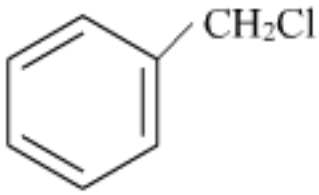
Benzene with Co and HCl in presence of anhydrous $AlCl_3$ results benzaldehyde.



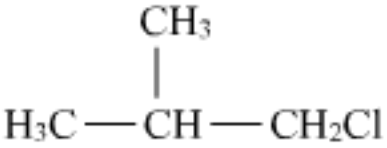
This reaction is called **Gatterman-Koch reaction**

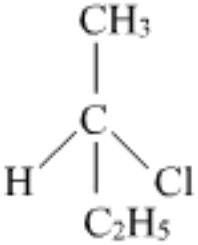
The reagents Zn/Hg and conc. HCl are the specific reagents of **Clemmensen reduction** which reduces carbonyl group of aldehydes and ketones only into CH_2. But this reagent does not reduces carbonyl group of carboxylic acid. Therefore, benzoic acid is not reduced into benzaldeyde in presence of Zn/Hg and conc. HCl.

Q3 (AIPMT 2014): Which of the following compounds will undergo racemisation when solution of KOH hydrolyses?

(i) 

(ii) $CH_3CH_2CH_2Cl$

(iii) 

(iv) 

Option A: (i) and (ii)
Option B: (ii) and (iv)
Option C: (iii) and (iv)
Option D: (i) and (iv)

Correct Answer: None Are Correct

In nucleophilic substitution reaction, racemisation generally occurs in SN1 reaction, whereas, in the case of SN2 reaction, inversion of the configuration occurs.
In SN1 reaction, the rate of reaction depends upon the stability of carbocation.

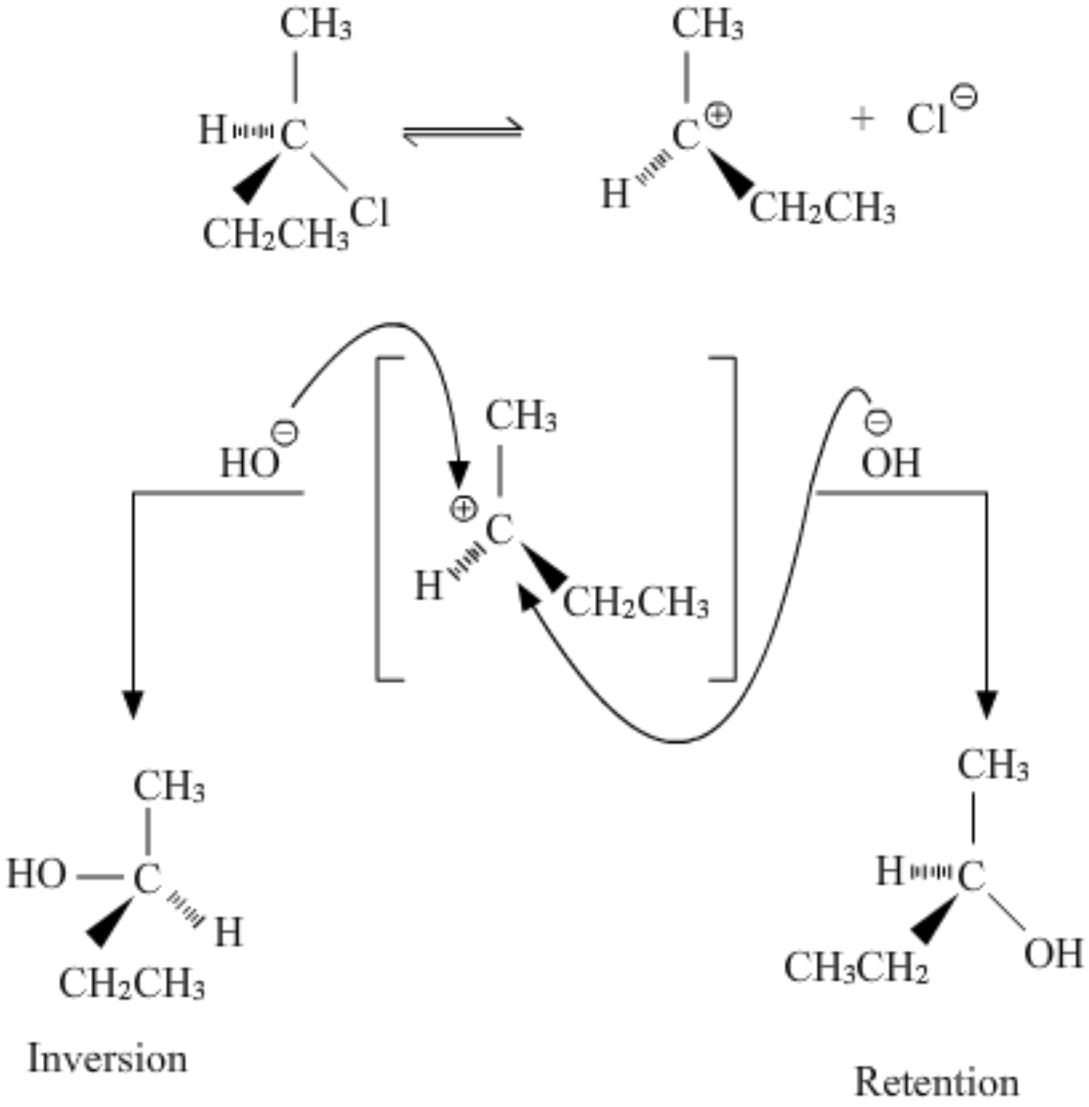
1. Benzyl chloride undergoes SN1 reaction due to the formation of stable benzyl carbocation. However, benzyl group does not show racemisation because of the absence of a chiral centre.

2. 1-Chloropropane is a primary alkyl halide and undergoes SN2 reaction. Hence it will not show any racemisation.

3. 1-Chloro-2-methylpropane is also a primary halide and does not posses any chiral centre. Hence, it is unable to form racemic products.

4. 2-Chlorobutane is a secondary alkyl halide and possesses one chiral centre. Therefore, it will undergo racemisation reaction.

The mechanism for racemisation is as follows:



Hence, the options provided are incorrect.

Q4 (AIPMT 2011): In Dumas' method of estimation of nitrogen 0.35 g of an organic compound gave 55 mL of nitrogen collected at 300 K temperature and 715 mm pressure. The percentage composition of nitrogen in the compound would be (Aqueous tension at 300 K = 15 mm)

Option A: 14.45
Option B: 15.45
Option C: 16.45
Option D: 17.45

Correct Answer: Option C
Vapour Pressure of gas = 715 − 15= 700 atm

To calculate the volume of N_2 at STP
V_1 = 55 mL V_2 = 0
P_1 = 300 K T_2 = 273 K

$$V_2 = \frac{P_1 V_1 T_2}{P_2 T_1}$$

$$V_2 = \frac{700 \times 55 \times 273}{760 \times 300}$$

$$= 46.099 \text{ mL}$$

22400 mL of nitrogen at STP weigh = 28 g

46.099 mL of nitrogen at STP weigh = $\frac{28 \times 46.099}{22400}$

= 0.0576 g

$$\% \text{ of N} = \frac{0.0576}{0.35} \times 100 = 16.45\%$$

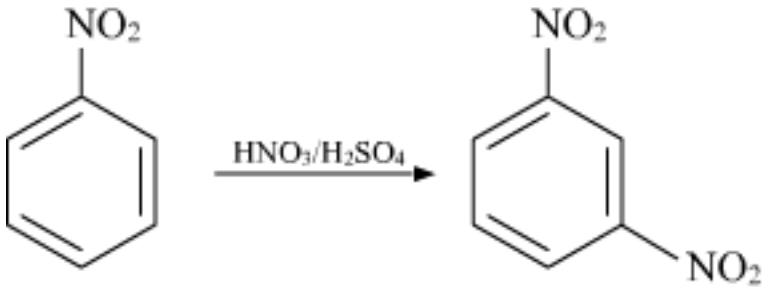
Q5 (AIPMT 2013): Nitrobenzene on reaction with conc. HNO3/H2SO4 at 80 − 100°C forms which one of the following products?

Option A: 1, 2−Dinitrobenzene
Option B: 1, 3−Dinitrobenzene

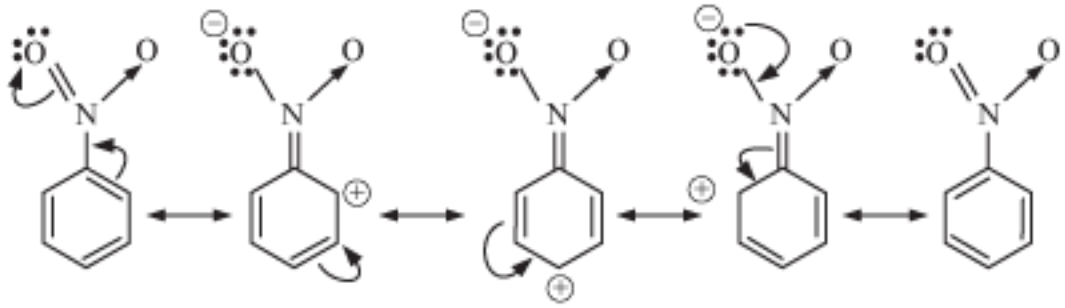
Option C: 1, 4−Dinitrobenzene
Option D:1, 2, 4 − Trinitrobenzene

Correct Answer: Option B

In nitrobenzene, NO_2 group attached to the benzene ring is *meta*-directing for incoming electrophile. Therefore, the product of nitration of nitrobenzene is 1, 3-dinitrobenzene.



1, 3-Dinitrobenzene



Electron density is less on *o*− and *p*− positions as compared to *meta* position. Therefore, electrophile will attack at the *meta* position.

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Physics>>

Q1 (AIPMT 2013): A small object of uniform density rolls up a curved surface with an initial velocity '*v*'. It reaches upto a maximum height of $\frac{3v^2}{4g}$ with respect to the initial position. The object is:

Option A: Ring
Option B: Solid sphere
Option C: Hollow sphere
Option D: Disc

Correct Answer: Option D
We know,

$$v = \sqrt{\frac{2gh}{1+\frac{k^2}{r^2}}}$$

Where, k=radius of gyration
Thus,

$$v^2 = \frac{2g(\frac{3v^2}{4g})}{1+\frac{k^2}{r^2}}$$

$$\text{or}, k^2 = \frac{1}{2}r^2$$

Thus the given curved surface is a disc.
Hence, the correct option is (d).

Q2 (AIPMT 2013): Infinite number of bodies, each of mass 2 kg are situated on *x*-axis at distances 1 m, 2 m, 4 m, 8m, ……, respectively, from the origin. The resulting gravitational potential due to this system at the origin will be: (NEET 2013 Q:11)

Option A: − G

Option B: $-\frac{8}{3}G$

Option C: $-\frac{4}{3}G$

Option D: − 4G

Correct Answer: Option D

Gravitational potential due to the given system at the origin is,

$$V = -2G - \frac{2G}{2} - \frac{2G}{4} - \frac{2G}{8} - ....$$

$$\text{or, } V = -2G\left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} ....\right) = -4G \quad \text{(The given series is geometric series)}$$

Hence, the correct option is (D).

Q3 (AIPMT 2013): When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ toward west. The electric and magnetic fields in the room are:

(a) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ up

(b) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ down

(c) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ up

(d) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ down

Correct Answer: Option B

Acceleration due to the electric field,

$$a_o = \frac{eE}{m}$$

$$\Rightarrow E = \frac{ma_o}{e} \text{ towards west}$$

Under the action of electric field as well as the magnetic field,

$$\frac{ev_oB + eE}{m} = 3a_o$$

$$ev_oB = 3ma_o - eE = 3ma_o - ma_o = 2ma_o$$

$$\Rightarrow B = \frac{2ma_o}{ev_o} \text{ downwards}$$

Hence, the correct option is (B)

Q4 (AIPMT 2014): If n_1, n_2, and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by:

Option A: $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

Option B: $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

Option C: $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

Option D: $n = n_1 + n_2 + n_3$

Correct Answer: Option A

Let the total length of the string be l.
Let the lengths of the three segments be l_1, l_2 and l_3.
Let the tension in the string be T and the mass density of the string be μ.
The fundamental frequency for the string is given by:

$$n = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

The respective fundamental frequencies of the parts of the string are:

$$n_1 = \frac{1}{2l_1}\sqrt{\frac{T}{\mu}}$$

$$n_2 = \frac{1}{2l_2}\sqrt{\frac{T}{\mu}}$$

$$n_3 = \frac{1}{2l_3}\sqrt{\frac{T}{\mu}}$$

$l = l_1 + l_2 + l_3$ ...(i)

$$l = \frac{1}{2n}\sqrt{\frac{T}{\mu}}$$

Similarly, $l_1 = \frac{1}{2n_1}\sqrt{\frac{T}{\mu}}$, $l_2 = \frac{1}{2n_2}\sqrt{\frac{T}{\mu}}$ and $l_3 = \frac{1}{2n_3}\sqrt{\frac{T}{\mu}}$

Substituting the values of l, l_1, l_2 and l_3 in (i), we get:

$$\frac{1}{2n}\sqrt{\frac{T}{\mu}} = \frac{1}{2n_1}\sqrt{\frac{T}{\mu}} + \frac{1}{2n_2}\sqrt{\frac{T}{\mu}} + \frac{1}{2n_3}\sqrt{\frac{T}{\mu}}$$

$$\Rightarrow \frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$$

Hence, the correct option is (A).

Q5 (AIPMT 2014): A balloon with mass '*m*' is descending down with an acceleration '*a'* (where *a* < *g*). How much mass should be removed from it so that it starts moving up with an acceleration '*a*'?

Option A: 2ma/g+a

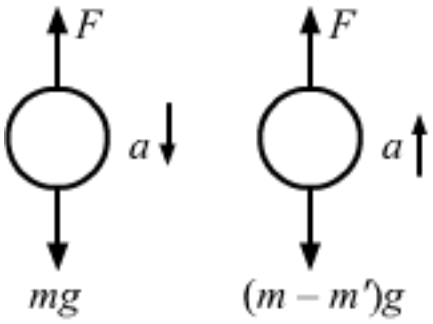
Option B: 2ma/g-a

Option C: ma/g+a

Option D: ma/g-a

Correct Answer: Option A

Let F be the force exerted by the air on the balloon.



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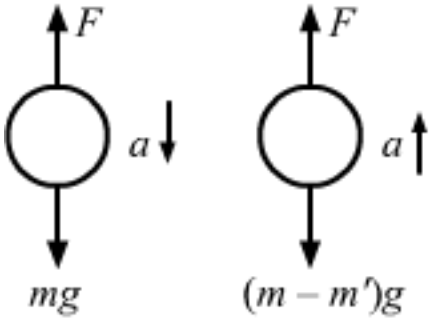

Net force on the balloon = mg − F
According to Newton's second law,
mg − F = ma ...(i)

Let the mass removed be m'.

Now, net force on the balloon = $F - (m - m')g$
$F - (m - m')g = (m - m')a$ ...(ii)

On adding (i) and (ii), we get
$m'g = 2ma - m'a$

Hence, the correct option is (a).

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