VITEEE 2021 Solutions
May 28 - Slot 3

Ques- The amino acid residue that favors the occurrence of a turn in the protein structure is:
1.Proline
2.Tryptophan
3.Serine
4.Glutamic acid

Solution.
The amino acid residue that is known to favor the occurrence of a turn in protein structure is:

1. **Proline**

Proline is unique among amino acids because of its rigid cyclic structure, which can introduce a kink or turn in the polypeptide chain. This characteristic makes proline especially prevalent in turns and loops of proteins. So, the correct answer is:

Ques- Honey is more vicious than coconut oil because:
1.The intermolecular attraction between the molecules of coconut oil is weaker than honey.
2.Honey is denser than coconut oil
3. The intermolecular spaces between the molecules in honey are more than coconut oil.
4.The intermolecular attraction between the molecules of coconut oil is stronger than honey.

Solution.

Viscosity is a measure of a fluid's resistance to shear or flow. The primary determinant of viscosity is the type and strength of intermolecular interactions.

Honey is more viscous than coconut oil primarily because of the interactions between its molecules.

The correct reason for honey's higher viscosity compared to coconut oil is:

1. **The intermolecular attraction between the molecules of coconut oil is weaker than honey.**

This stronger intermolecular attraction in honey leads to higher resistance to flow, making honey more viscous. Thus, the answer is:

1. **The intermolecular attraction between the molecules of coconut oil is weaker than honey.**

Ques- A car of mass M is moving with uniform velocity v on a horizontal road. When a person of mass m drops on it from above, the velocity of thecar will be?
1. Mv / M+m
2. mv / M
3. Mv / m
4. Mv / M+m

Solution.
To solve this problem, we can use the principle of conservation of momentum.

Initially, only the car is moving, and the person is at rest. After the person drops onto the car, both are moving together.

Let's find the momentum before and after the person drops on the car:

Before:

Momentum of car = $M \times v$
Momentum of person = 0 (since the person is at rest with respect to the horizontal motion of the car)

Total momentum before = $M \times v$

After:
Let v' be the velocity of both the car and the person after the event.
Total momentum after = $(M + m) \times v'$

By the conservation of momentum, the total momentum before should be equal to the total momentum after:
$$M \times v = (M + m) \times v'$$

Rearranging to solve for v':
$$v' = \frac{M \times v}{M + m}$$

So, the correct answer is:
1. $\frac{Mv}{M+m}$

Ques- One of the following aldehydes undergoes Cannizzaro's reaction and reduces the Schiff's reagent, but does not reduce Fehling's reagent. That is
1.2-OH-PhCHO
2.PhCHO
3.HCHO
4.CH3CHO

Solution.
Cannizzaro's reaction is observed for aldehydes that lack an alpha-hydrogen. This means that the aldehyde cannot form an enolate ion and undergo aldol condensation. Instead, it undergoes disproportionation (Cannizzaro's reaction).

Now, Schiff's reagent is used to test for the presence of aldehydes, and all aldehydes generally reduce Schiff's reagent.

Fehling's reagent specifically tests for the presence of reducing sugars and aliphatic aldehydes but does not respond to aromatic aldehydes.

Given the options:

1. \(2-OH-PhCHO\): This is salicylaldehyde (an aromatic aldehyde with a hydroxyl group).
2. \(PhCHO\): This is benzaldehyde (a simple aromatic aldehyde).
3. \(HCHO\): This is formaldehyde.
4. \(CH_3CHO\): This is acetaldehyde.

Among the options, benzaldehyde (PhCHO) is the one that:
- Undergoes Cannizzaro's reaction because it doesn't have an alpha-hydrogen.
- Reduces Schiff's reagent since it's an aldehyde.
- Does not reduce Fehling's reagent because it's an aromatic aldehyde.

So, the correct answer is:
2. \(PhCHO\) (benzaldehyde)

Ques- A nucleus with atomic number Z and mass numberA undergoes alpha decay. Which of the following is true?
1.Z increases by 2 and A decreases by 4
2.Z decreases by 2 and A decreases by 2
3.Z increases by 1 and A do not change
4.Z decreases by 2 and A decreases

Solution.
When a nucleus undergoes alpha decay, it emits an alpha particle. An alpha particle is composed of 2 protons and 2 neutrons, so it has a charge of +2 (due to the 2 protons) and a mass number of 4.

Given this information:

1. The atomic number \(Z \) will decrease by 2 because 2 protons are lost.

2. The mass number A will decrease by 4 because the total of 2 protons and 2 neutrons are lost.

So, the correct answer is:
4. Z decreases by 2 and A decreases by 4.

Ques- A carbamate contains
1.A carbonate and an amide group
2.A carbonyl and an amide group
3.An amide and an ester group
4.A carbonyl and an ester group

Solution.
A carbamate is a functional group that is derived from carbamic acid. Structurally, it contains both an ester group and an amide group. Specifically, the carbamate structure can be represented as:

$$ {O=C(NR_{1}R_{2})OR_{3}} $$

Where R_{1}, R_{2}, and R_{3} are alkyl or aryl groups.

So, the correct answer is:
3. An amide and an ester group

Ques- A conducting loop in the plane of the paper is halfway into the magnetic field (which points into the page). If the magnetic field begins to increase rapidly in strength, what happens to the loop?
1. The loop is pushed upwards, towards the top of the page.
2. The loop is pushed to the right, out of the page.
3. The loop is pulled to the left towards the magnetic field.
4. The loop is pushed downwards, towards the bottom of the page

Solution.
When the magnetic field (which is pointing into the page) increases in strength, it induces an electromotive force (EMF) and current in the loop according to Faraday's Law of electromagnetic induction.

Using the right-hand rule, the induced current in the loop will circulate counterclockwise to oppose the change in the magnetic field. This means that on the left half of the loop (the half inside the magnetic field), the current is directed downwards.

Lorentz's force on a current-carrying wire in a magnetic field is given by $F = I \times L \times B$, where I is the current, L is the length of wire, and B is the magnetic field.

Again using the right-hand rule, the force on the left half of the loop (the half inside the magnetic field) due to the downward current and the magnetic field pointing into the page will be directed to the right, pushing the loop out of the magnetic field.

So, the correct answer is:
2. The loop is pushed to the right, out of the page.

Ques- The arithmetic mean and the harmonic mean between 2 numbers are 27 and 12 respectively, then their geometric mean is given by:
1.15
2.18
3.17
4.16

Solution.
Let's use the formulas for the arithmetic mean (AM), harmonic mean (HM), and geometric mean (GM) for two numbers a and b.

1. $AM = \frac{a + b}{2}$
2. $HM = \frac{2}{\frac{1}{a} + \frac{1}{b}}$
3. $GM = \sqrt{a \times b}$

Given:
AM = 27
HM = 12

From the given AM:
$\frac{a + b}{2} = 27$
$a + b = 54$ .....(i)

From the given HM:
$$\frac{2}{\frac{1}{a} + \frac{1}{b}} = 12$$
$$\frac{2ab}{a + b} = 12$$
$$2ab = 12(a + b)$$
$$2ab = 12(54)$$
$$2ab = 648$$
$$ab = 324$$ .....(ii)

Now, the geometric mean is:
$$GM = \sqrt{a \times b}$$
$$GM = \sqrt{324}$$
$$GM = 18$$

So, the correct answer is:
2. 18