## VITEEE 2023 Question Paper

## Physics

Question 1. Orbital angular momentum of an electron in 4d orbital (root6tv2pi root4n2pi root8tV2pi root12tV2pi)

Solution. The orbital angular momentum (L) of an electron in a specific orbital can be calculated using the formula:  $L = \sqrt{(I(I + 1))}\hbar$  Where: L is the orbital angular momentum. I is the orbital quantum number, which corresponds to the specific orbital.  $\hbar$  (h-bar) is the reduced Planck's constant, approximately equal to  $1.0545718 \times 10^{-34} J \cdot s$ . For a 4d orbital, the value of the orbital quantum number (I) is 2 because 4d is associated with n = 4 and I = 2. Now, we can calculate the orbital angular momentum (L) for the 4d orbital:  $L = \sqrt{(2(2 + 1))}\hbar L = \sqrt{(2(3))}\hbar L = \sqrt{(6)}\hbar$  So, the orbital angular momentum of an electron in a 4d orbital is  $\sqrt{(6)}\hbar$ . Now, let's evaluate the value of  $\sqrt{(6)}\hbar$  in the specified format:  $\sqrt{(6)}$  is approximately equal to 2.44949.  $\hbar$  is approximately equal to  $1.0545718 \times 10^{-34} J \cdot s$ . Now, multiply these two values: 2.44949 \* ( $1.0545718 \times 10^{-34} J \cdot s$ )  $\approx 2.60015 \times 10^{-34} J \cdot s$ , which is not exactly one of the provided options (root6tv2pi, root4n2pi, root8tV2pi, root12tV2pi). It seems there may be a formatting issue with the provided options.

Question 2. Two spheres with unequal radii have charge- if they are connected by a thin wire what will happen to charges?

Solution. Potential Equilibrium: When two conductors are connected by a wire, they come to the same electric potential. This is because charges move through the wire until there is no potential difference between the conductors. Surface Charge Density: On a spherical conductor, the surface charge density (charge per unit area) is inversely proportional to the radius of the sphere. So, a smaller sphere will have a higher surface charge density compared to a larger sphere, given the same amount of charge. Redistribution of Charges: If two spheres with unequal radii are connected and one of them initially has a charge, charges will move from the sphere with the higher surface charge density (smaller sphere) to the one with the lower surface charge density (larger sphere) until both spheres reach the same potential. If both spheres initially have charges, then the movement of charges will depend on the magnitude and sign of the charges on both spheres and their radii. Final State: The exact distribution of charges at the end will depend on the initial charges and the radii of the spheres. However, the key idea is that charges will redistribute until both spheres have the same electric potential. The smaller sphere will have a higher surface charge density than the larger sphere in this final state. In summary, when two spheres with unequal radii are connected by a thin wire, charges will move between the spheres until they both come to the same electric potential, with the smaller sphere ending up with a higher surface charge density than the larger one.

Question 3. Which of the following is not equal to 1 in boolean algebra {A Abar A Abar whole bar A+Abar A+Abar whole bar

Solution. In Boolean algebra, variables can have only two values: 0 (false) or 1 (true). The given operations and symbols are:- \( \overline{A} \) (Abar) represents the NOT operation, which inverts the value of A.- \( A \land \overline{A} \) (A AND Abar) represents the AND operation.- \( A \lor \overline{A} \) (A OR Abar) represents the OR operation. Given the expressions: 1. \( A \)- this is simply A, so its value depends on A (either 0 or 1). 2. \( \overline{A} \) (Abar)- the NOT operation, so its value is the opposite of A. 3. \( \overline{A \land \overline{A} \) (A AND Abar whole bar)- Since \( A \land \overline{A} \) will always be 0 (because you're ANDing a value with its inverse), taking the NOT of this will result in 1. 4. \( A \lor \overline{A} \) (A OR Abar)- This will always be 1 because you're ORing a value with its inverse. 5. \( \overline{A \lor \overline{A}} \) (A OR Abar whole bar)- Since \( A \lor \overline{A} \) is always 1, taking the NOT of this will result in 0. From the above expressions, the only one that is NOT equal to 1 is: \[ \overline{A \lor \overline{A} \] (A OR Abar whole bar).

Question 4. Which of the following is metal compound semiconductor {NaCl GaAs Si Ge)

Solution. Out of the given options:- NaCl (Sodium chloride) is an ionic compound.- GaAs} (Gallium arsenide) is a compound semiconductor.- Si (Silicon) and Ge (Germanium) are elemental semiconductors. So, the metal compound semiconductor among the provided options is: GaAs (Gallium arsenide).

Question 5. A girl focused monochromatic orange light instead of monochromatic green light through a convex lens What will happen to focal length? (increase decrease does not change changes by a factor of?

Solution. When a monochromatic light passes through a lens, its focal length is affected by the refractive index of the lens material for that specific wavelength of light. The phenomenon that describes the dependency of the refractive index on the wavelength of light is called dispersion. In general, the refractive index of most materials decreases as the wavelength of light increases. This means that materials tend to have a higher refractive index for blue/violet light (shorter wavelength) and a lower refractive index for red/orange light (longer wavelength). Given:- Orange light has a longer wavelength than green light.- The focal length (f) of a lens is inversely proportional to the refractive index (n) for a specific wavelength, provided the lens shape remains constant. Thus, when the girl switches from focusing on a monochromatic green light (shorter wavelength, higher refractive index) to monochromatic orange light (longer wavelength, lower refractive index), the focal length for the orange light will be slightly longer compared to that of the green light. In simpler terms, the focal length will \*\*increase\*\* when she switches from green to orange light.

Question 6. If the acceleration of a particle is proportional to x what will the gain in kinetic energy be proportional to? (x root x x squared. ex)

Solution. Given that the acceleration \( a \) of a particle is proportional to its displacement \( x \): \( a \propto x \) or \( a = kx \) where \( k \) is some constant of proportionality. From Newton's second law: \[ a = \frac{F}{m} \] So, the force \( F \) acting on the particle is given by: \[ F = ma = mkx\] Work done \( W \) by a force when a particle is displaced by an amount \( x \) in the direction of the force is: \[ W = \int F \, dx \] \[ W = \int mkx \, dx \] This work results in a gain in kinetic energy, so: \[ \Delta KE = W \] Integrating the expression for \( F \) concerning \( x \): \[ W = mk\int x \, dx \] \[ W = mk\times \frac{x^2}{2} \] \[ \Delta KE = \frac{mkx^2}{2} \] From the above equation, the gain in kinetic energy is proportional to \( x^2 \).

Question 7. A body has speed 2 + root2 mis if speed increases by 2m/s how will kinetic energy b affected? (Halved Doubled Increases by a factor of 1 (root2)

Solution. To determine how the kinetic energy will be affected, we can compare the initial kinetic energy to the kinetic energy after the speed increases. The formula for kinetic energy (K.E) is: \[ K.E =  $\frac{1}{2} m v^2 \$  where: (m ) = mass of the body (which remains constant in bothscenarios) (v) = speed of the body 1. Initial speed:  $[v_1 = 2 + \sqrt{2}]$  Initial kinetic energy:  $[K.E_1 = \frac{1}{2} m (2 + \frac{2})^2 ] [K.E_1 = \frac{1}{2} m (4 + 4 + 2)] [K.E_1 = \frac{1}{2} m (4 + 4)] [K.E_1 = \frac{1}{2} m (4 + 4 + 2)$ \frac{1}{2} m (6 + 4\sqrt{2}) \] 2. After speed increases by 2 m/s: \[ v 2 = (2 + \sqrt{2}) + 2 = 4 +  $\left\{2\right\}$  Kinetic energy with the increased speed:  $\left[K.E_2 = \frac{1}{2} m (4 + \frac{2})^2 \right]$ K.E 2 =  $\frac{1}{2} m (16 + 8 + 2) | K.E 2 = \frac{1}{2} m (18 + 8 + 2) | Now, we$ want to find the ratio: \[ \frac{K.E\_2}{K.E\_1} \] \[ \frac{K.E\_2}{K.E\_1} = \frac{\frac{1}{2} m (18 + 8\sqrt{2})}{\frac{1}{2} m (6 + 4\sqrt{2})} \] \[ \frac{K.E\_2}{K.E\_1} = \frac{18 + 8\sqrt{2}}{6 +  $4 \left\{ \frac{2}{3} + \frac{2}{K.E} \right\} = \frac{9 + 4}{2} \frac{1}{3} + \frac{1}{5} \frac{1}{5}$ multiply the numerator and the denominator by the conjugate of the denominator: \[ \frac{K.E\_2}{K.E\_1} = \frac{9 + 4\sqrt{2}}{3 + 2\sqrt{2}} \times \frac{32\sqrt{2}}{3 - 2\sqrt{2}} \[ \frac{K.E 2}{K.E 1} = \frac{27-18\sqrt{2} + 12\sqrt{2}-8}{9-4} \] \[ \frac{K.E 2}{K.E 1} = \frac{19- 6\sqrt{2}}{5} \] So, the kinetic energy has changed by a factor of \( \frac{196\sqrt{2}}{5} ) times. By evaluating the above expression, you will find that the kinetic energy has increased, but to determine by what exact factor or whether it has doubled or halved, we'd have to further compute and compare. At a glance, it seems that the kinetic energy hasn't doubled or halved but has increased by a certain factor that's different from  $( |sqrt{2})$  or its reciprocal.

Question 8. Semiconductors chapter base emitter numerical

Solution. In a bipolar junction transistor (BJT), the base and the emitter are two of the three regions. The third region is the collector. The emitter is highly doped, the base is thin and lightly doped, and the collector is moderately doped. The operation of the BJT depends on the movement of charge carriers through these regions.

Question 9. Percentage mass defect

Solution. The concept of mass defect is fundamental in nuclear physics and pertains to the difference between the mass of a nucleus and the sum of the masses of its nucleons (protons and neutrons). This mass difference is converted into energy, which is the binding energy of the

nucleus — essentially the energy required to disassemble a nucleus into its constituent protons and neutrons. The mass defect ( $\Delta$ m) can be calculated using the equation: \[ \Delta m = \text{(sum of masses of individual nucleons)}- \text{(actual mass of the nucleus)} \] Once you have the mass defect, you can convert it into energy (E) using Einstein's mass-energy equivalence relation: \[ E = \Delta m \times c^2 \] where \( c \) is the speed of light. To find the percentage mass defect, use: \[ \text{Percentage Mass Defect} = \left( \frac{\text{Mass Defect}}{\text{Total Mass of Individual Nucleons} \right) \times 100\% \]

Question 10. The half-life of x is 3.8 days, what will be the mass of 2mg material after days?

Solution. The formula for the remaining quantity of a substance after \( n \) half-lives is: \[ \text{Remaining mass} = \text{Initial mass} \times \left( \frac{1}{2} \right)^n \] Where:- \(\text{Initial mass}\) is the starting amount of the material (2 mg in this case).- \( n \) is the number of half-lives that have passed. Given the half-life of \( x \) is 3.8 days, you can calculate \( n \) by dividing the total time by 3.8. For example, if you're asking about 7.6 days (which is 2 half-lives), \( n \) would be 2. Once you know \( n \), plug it into the formula to find the remaining mass. For example: If you're asking about 7.6 days, which is 2 half-lives: \[ \text{Remaining mass} = 2 \text{mg} \times \left( \frac{1}{2} \right)^2 = 2 \text{mg} \times 0.25 = 0.5 \text{mg} \] So, after 7.6 days, 0.5 mg of the material will remain.

Question 11. The binding energy of the nucleus on the surface will be (the same as the interior more than the interior depends on the surroundings of the nucleus less than interior)

Solution. The binding energy of a nucleus refers to the energy required to disassemble a nucleus into its constituent protons and neutrons. It's an important concept in nuclear physics, often associated with the stability of atomic nuclei. The question appears to be discussing the difference in the binding energy of nucleons on the surface of the nucleus compared to those in the interior. Nucleons (protons and neutrons) in the interior of a nucleus are surrounded by other nucleons from all sides, while those on the surface have fewer neighbouring nucleons because one side is exposed to the outside. As a result, nucleons on the surface experience fewer nuclear forces acting on them than those in the interior. This means that nucleons on the surface are less tightly bound than those in the interior. Therefore, the binding energy of a nucleus on the surface will be \*\*less than the interior\*\*.

Question 12. Body of mass M kept on frictionless surface connected to spring of constant k attached to vertical wall. The bullet enters inelastically and settles in the block. calculate compression (options given in terms of M m v. K)

Solution. To solve this problem, we can use the conservation of momentum and energy. Initially, the bullet moves with velocity (v ) and the block is at rest. Once the bullet embeds itself in the block inelastically, they will move together with a common velocity (u ). Using the conservation of momentum:  $[m \ cdot v = (M + m) \ cdot u ] [u = \ rac{m \ cdot v}{M + m} ]$  Now, when the bullet and block move together with velocity (u ) and compress the spring, they will come to a stop at maximum compression. At this point, all the kinetic energy of the bullet-block system will

be converted to potential energy in the spring. Using the conservation of energy: Initial kinetic energy = Potential energy in the spring at maximum compression  $\left[\frac{1}{2} (M + m) u^2 = \frac{1}{2} k x^2 \right]$  Where (x ) is the compression of the spring. Plugging in our value for (u ):  $\left[\frac{1}{2} (M + m) \left(\frac{1}{2} (M + m) \right) \left(\frac{1}{2} (M + m) \left(\frac{1}{2} k x^2 \right)\right]$  After simplifying and solving for (x ), you get:  $[x = \frac{1}{2} k (M + m)] \left(\frac{1}{2} k (M + m)\right)$  This is the compression of the spring in terms of (M ), (m ), (v ), and (k ).

Question 13. Electron Jumps from the 4th orbital to the ground state in the hydrogen atom. What is the number of visible spectral lines? (6.4 2.3)

Solution. When an electron jumps from a higher energy level to a lower energy level in a hydrogen atom, it emits a photon corresponding to the energy difference between the two levels. The emitted photon can be observed as a spectral line. For the electron transitioning from the (n = 4) level (4th orbital) to the (n = 1) level (ground state), multiple transitions are possible: 1. (n = 4) to (n = 3) 2. (n = 4) to (n = 2) 3. (n = 4) to (n = 1) 4. (n = 3) to (n = 2) 5. (n = 3) to (n = 1) 6. (n = 2) to (n = 1) That's a total of 6 possible transitions. However, not all of these transitions produce visible light. Only the Balmer series, which involves transitions to the (n = 2) level, produces visible light. From the above transitions, the ones that are part of the Balmer series (and therefore visible) are: 1. (n = 4) to (n = 2) 2. (n = 3) to (n = 2) So, there are \*\*2 visible spectral lines\*\* when an electron jumps from the 4th orbital to the ground state in a hydrogen atom.

Question 14. Electrostatics-4q and +2q charges dipole present in uniform electric field direction of rotation and net force? { a) clockwise right b)clockwise left c)anticlockwise left d)anticlockwise right.

Solution. Let's analyze the situation step by step: 1. \*\*Direction of the Dipole Moment\*\*: The dipole moment (\( \vec{p} \)) is defined as the product of the magnitude of the charge and the displacement vector pointing from the negative charge to the positive charge. Given that we have charges-4q and +2q, the magnitude of the dipole moment is \( p = 4q \times d \) (assuming "d" to be the separation between the charges). The direction is from-4q to +2q. 2. \*\*Torque on a Dipole\*\*: In a uniform electric field (\( \vec{E} \)), the torgue (\( \vec{\tau} \)) on the dipole is given by:  $\left| \frac{E}{A} \right| = \frac{E}{A}$ of the rotation. Using the right-hand rule:- If  $\langle | vec{p} \rangle$  is initially aligned with  $\langle | vec{E} \rangle$ . there's no torgue and hence no rotation.- If  $( \log\{p\} )$  is not aligned with  $( \log\{E\} )$ , then the torque will try to align  $( \log{p})$  with  $( \left( E_{E} \right))$ . Since-4q is greater in magnitude than +2q, the dipole will rotate such that-4q is aligned in the direction opposite to \( \vec{E} \) and +2q is aligned in the direction of \( \vec{E} \). This will be a clockwise rotation. 3. \*\*Net Force on a Dipole in a Uniform Electric Field\*\*: Since the electric field is uniform, the force on each charge due to the field is: [F 1 = qE] [F 2 = -4qE] However, the forces on the two charges are equal in magnitude and opposite in direction. This means the net force on the dipole is zero in a uniform electric field. \*\*Conclusion\*\*: The dipole rotates clockwise due to the torgue exerted by the electric field, but there's no net force acting on it. The correct option is: b) clockwise, left (assuming "left" indicates the lack of net force).

## Chemistry

Question 1. Sn1.Sn2 question asked

Solution. SN1 and SN2 reactions are types of nucleophilic substitution reactions in organic chemistry. 1. \*\*SN1 Reactions\*\*:- Stands for "Substitution Nucleophilic Unimolecular."- Two-step mechanism: 1. Formation of a carbocation intermediate due to the leaving group departing. 2. Attack of the nucleophile on the carbocation.- Reaction rate depends only on the concentration of the substrate.- Typically occurs with tertiary and some secondary alkyl halides.- Racemization usually occurs as the nucleophile can attack from either side of the planar carbocation.- More polar solvents (like water or alcohol) can stabilize the transition state and favour the SN1 reaction. 2. \*\*SN2 Reactions\*\*:- Stands for "Substitution Nucleophilic Bimolecular."- One-step mechanism: The nucleophile attacks the substrate and the leaving group departs simultaneously.- Reaction rate depends on both the substrate and the nucleophile.- Typically occurs with primary and some secondary alkyl halides.- Inversion of configuration occurs at the carbon centre (like an umbrella flipping inside-out).- Polar aprotic solvents, which don't form hydrogen bonds, like acetone and DMSOfavor SN2 reactions.

Question 2. Commercial prep of benzaldehyde (oxidation of toluene, etard rxn, oxidation of benzene phenol, oxidation of chlorobenzene)

Solution. Benzaldehyde can be prepared using several methods. From the options provided: 1. \*\*Oxidation of Toluene\*\*: Benzaldehyde can be prepared by oxidizing toluene. This can be done using a variety of oxidizing agents, but a common industrial method involves the use of chromyl chloride (\( \text{CrO} 2\text{Cl} 2 \)) in the presence of chlorinated hydrocarbons as a solvent. 2. \*\*Etard Reaction\*\*: The Etard reaction is a classic method for the oxidation of methyl groups that are adjacent to aromatic rings. In this reaction, chromyl chloride (\( \text{CrO} 2\text{Cl} 2 )) oxidizes toluene to benzaldehyde. After the oxidation, the benzaldehyde is typically extracted using an organic solvent, and the chromium complex is hydrolyzed to chromium(III) oxide. 3. \*\*Oxidation of Benzene Phenol\*\*: This is not a standard or direct method for the preparation of benzaldehyde. Phenol can be converted to benzaldehyde under specific conditions involving multiple steps, but this is not a direct or common commercial preparation. 4. \*\*Oxidation of Chlorobenzene\*\*: Benzaldehyde can also be synthesized by the hydrolysis of chlorobenzene, but this is not typically achieved through simple oxidation. The hydrolysis of chlorobenzene involves first converting chlorobenzene to benzene diazonium chloride followed by its hydrolysis to benzaldehyde. This isn't the most straightforward or efficient method for benzaldehyde synthesis and is not commonly used for commercial production. Of the options provided, the direct oxidation of toluene and the Etard reaction are viable commercial methods for the production of benzaldehyde.

Question 3. The direct formula of P total asked from solutions chap

Solution. From Raoult's Law, for a solution composed of two volatile components (1 and 2): \[ P\_{\text{total}} = P\_1 + P\_2 \] Where:- \( P\_1 \) is the partial pressure of component 1, given by \( P\_1 = x\_1 \times P^0\_1 \)- \( P\_2 \) is the partial pressure of component 2, given by \( P\_2 = x\_2 \times P^0\_2 \) In these equations:- \( x\_1 \) is the mole fraction of component 1 in the solution.- \( P^0\_1 \) is the vapour pressure of pure component 1.- \( x\_2 \) is the mole fraction of component 2. Thus, the total pressure in the solution containing two volatile components is: \[ P\_{\text{total}} = x\_1 \times P^0\_2 \] If the solution contains more components, you'll add the contributions to the total pressure from each component accordingly.

Question 4. Enantiomers, Diastereomers matrix match

Solution. 1. \*\*Enantiomers\*\*:- Non-superimposable mirror images of each other.- Have opposite configurations at all chiral centers.- Possess the same physical properties (e.g., melting point, boiling point).- Rotate plane-polarized light in opposite directions and by the same magnitude (but one is clockwise and the other is counterclockwise).- Have the same chemical properties except in chiral environments. 2. \*\*Diastereomers\*\*:- Stereoisomers that are not mirror images of each other.- Have opposite configurations at one or more (but not all) chiral centers.- Display different physical properties (e.g., melting point, boiling point).- Rotate plane-polarized light, but not necessarily in opposite directions or by the same magnitude as their counterpart.- Exhibit different chemical properties. Given these characteristics, if you have specific pairs of molecules or properties to match in a matrix, you can use the above descriptions to categorize them as enantiomers or diastereomers.

Question 5. Number of sigma bonds in the compound

Solution. 1. \*\*Single Bonds\*\*: Every single bond (whether it's between two of the same atom or two different atoms) is a sigma bond. 2. \*\*Double Bonds\*\*: A double bond contains one sigma bond and one pi bond. 3. \*\*Triple Bonds\*\*: A triple bond contains one sigma bond and two pi bonds. Given a structural formula, count the number of single, double, and triple bonds, and use the above information to determine the number of sigma bonds.

Question 6. Which of the following complexes have sp3 hybridized metal {PdCl4-, ZnCn4-, NiCN4-)

Solution. To determine the hybridization of the central metal atom in a complex ion, one should consider the coordination number of the metal, i.e., the number of ligand attachments. 1. \*\*\[PdCl<sub>4</sub>\]<sup>2-\*\*</sup>: Palladium in this complex has a coordination number of 4, with each of the four chlorine atoms acting as monodentate ligands. The geometry of such a four-coordinate complex is typically tetrahedral. For tetrahedral geometry, the hybridization is \(sp^3\). 2. \*\*\[Zn(CN)<sub>4</sub>\]<sup>2-\*\*</sup>: Zinc in this complex also has a coordination number of 4, with each of the four cyanide ions acting as monodentate ligands. Again, the geometry is typically tetrahedral, leading to \(sp^3\) hybridization. 3. \*\*\[Ni(CN)<sub>4</sub>\]<sup>2-\*\*</sup>: Nickel in this complex has a coordination number of 4. Typically, Nickel(II) in a tetrahedral complex is an indication of low spin and, hence, \(sp^3\) hybridization. All three of the given complexes,  $[PdCl_4]^2$ ,  $[Zn(CN)_4]^2$ , and  $[Ni(CN)_4]^2$ , have  $(sp^3)$  hybridized metals.

Question 7. Which of the following has a square planar complex (and was NiCO4- don't remember options)

Solution - \[ \text{Ni(CO)}\_4 \] or Nickel tetracarbonyl is indeed a square planar complex. The reason for the square planar geometry can be explained using the Crystal Field Theory (CFT) and the 18-electron rule. In \[ \text{Ni(CO)}\_4 \], nickel is in the +0 oxidation state (i.e., it is a zerovalent nickel complex) and has an electron configuration of \[ \text{[Ar] } 3d^{10} \]. CO(carbonyl) ligands are strong field ligands and are also  $\pi$ -acceptor ligands. When these ligands bond to a metal, they can lead to the pairing of unpaired d electrons. In the case of nickel tetracarbonyl, the d-orbitals of nickel are fully paired. The 18-electron rule, which is similar in concept to the octet rule for main group elements, suggests that transition metal complexes will be most stable when they have an electron count of 18. In \[ \text{Ni(CO)}\_4 \], the electron count is indeed 18 (10 from Ni and 2 from each of the four CO ligands). The hybridization of Ni in \[ \text{Ni(CO)}\_4 \] is \( dsp^2 \), leading to a square planar geometry.

## Aptitude and English Questions

Question 1. Odd one out of 10, 26, 21, 24, 18

Solution. To determine the odd one out, we should look for a pattern or a common property among the numbers and see which one does not share that property. Given the numbers: 10, 26, 21, 24, and 18 Let's analyze:- 10 is even- 26 is even- 21 is odd- 24 is even- 18 is even From the above list, four numbers are even and only one (21) is odd. So, \*\*21\*\* is the odd one out.

Question 3) All sages are kind. All artists are kind S1. All sages are artists S2. All artists are sages S3. Some kind (persons) are artists S4. Some kind (persons) are sages. Which Statement follows a) Only S1 b) Only S4 c) Both S1 and S2 d) Both S3 and S4

Solution. Given: 1. All sages are kind. 2. All artists are kind. From the above statements: \*\*S1. All sages are artists\*\*- This does not necessarily follow from the given statements. Just because all sages are kind and all artists are kind, it doesn't mean all sages are artists. \*\*S2. All artists are sages\*\*- Similarly, this does not necessarily follow. Both sages and artists fall under the category of kind, but one group isn't necessarily entirely encompassed by the other. \*\*S3. Some kind (persons) are artists\*\*- This is true because the given statement says "All artists are kind," which means some kind persons are artists. \*\*S4. Some kind (persons) are sages\*\*- This is true because the given statement says "All artists are kind," and the given statement says "All sages are kind," which means some kind persons are artists. \*\*S4. Some kind (persons) are sages\*\*- This is true because the given statement says "All artists are kind," which means some kind persons are artists. \*\*S4. Some kind (persons) are sages\*\*- This is true because the given statement says "All artists are kind," which means some kind persons are artists. \*\*S4. This is true because the given statement says "All sages are kind," which means some kind persons are sages. Given the evaluations above, the statements that follow from the given premises are S3 and S4. The answer is \*\*(d) Both S3 and S4\*\*.