

M.Sc. Part-II Semester-III  
Theoretical Organic Chemistry – I  
Paper 1  
Sample Question Paper

Q 1) Which of the following statements is wrong?

- a) It is not necessary for a nucleophile to have an unshared electron pair.
- b) A species can react as an electrophile if it contains an atom (other than hydrogen) with an incomplete valence octet.
- c) A species can react as an electrophile, even if it has one or more unshared electron pairs.
- d) Any species bearing a lone pair can normally react as a nucleophile.

Q 2) Which of the following can react readily either as a nucleophile or as an electrophile?

- a)  $(\text{CH}_3)_3\text{B}$
- b)  $(\text{CH}_3)_2\text{O}$
- c)  $\text{CH}_3\text{CO}_2\text{H}$
- d)  $\text{H}_2\text{C}=\text{CH}_2$

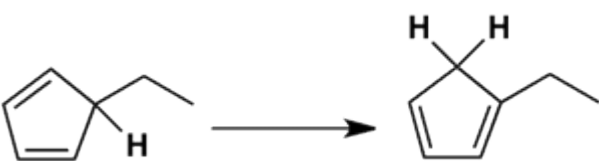

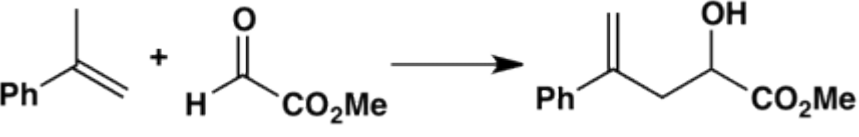
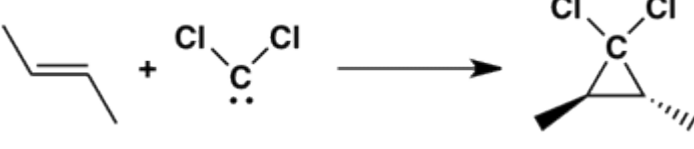
Q 3) Which of the following statements is wrong?

- a) The higher the energy of its HOMO, the more reactive a nucleophile will usually be.
- b) The higher the energy of its LUMO, the more reactive an electrophile will usually be.
- c) In an exothermic reaction, the enthalpy of the product(s) is lower than that of the reactant(s).
- d) The equilibrium constant of an endergonic reaction is smaller than 1.

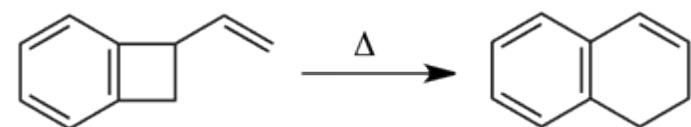
Q 4) Which of the following groups has the highest priority according to the Cahn-Ingold-Prelog sequence rules?

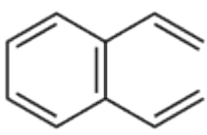
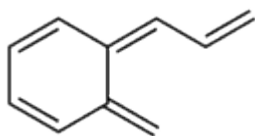
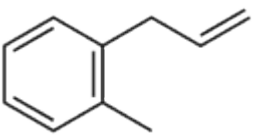
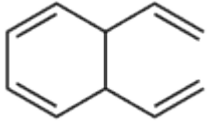
- a)  $\text{CH}_3$
- b)  $\text{CH}_2\text{Cl}$
- c)  $\text{CH}_2\text{OH}$
- d)  $\text{CHO}$

Q 5) Which of the following reactions is classified as a sigma tropic rearrangement?

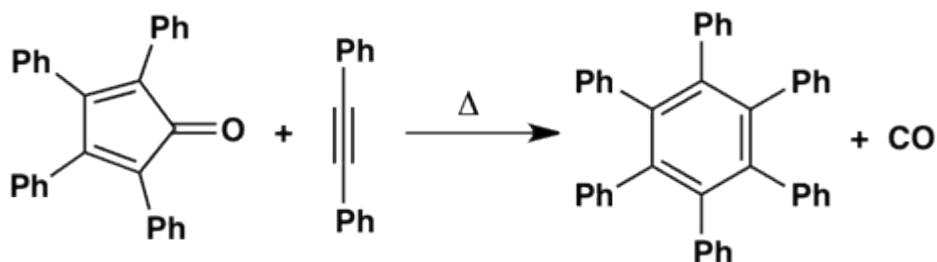
- a) 
- b) 
- c) 
- d) 

Q 6) Which of compounds (a)-(d) is the likely intermediate of the following transformation involving two electrocyclic reactions (ring opening and ring closure)?



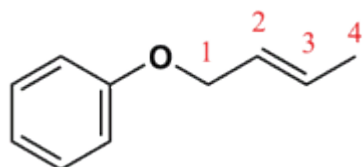
- a) 
- b) 
- c) 
- d) 

Q 7) The following involves two pericyclic reactions. Which combination indicates correctly the types of reaction involved?



- a) [4+2] cycloaddition + [2+2] cycloreversion
- b) cheletropic reaction + [4+2] cycloaddition
- c) [4+2] cycloaddition + [4+1] cycloreversion
- d) [4+2] cycloaddition + cheletropic reaction

Q 8) Which side-chain carbon makes a new bond to the benzene ring upon Claisen rearrangement of the following allylic phenyl ether?

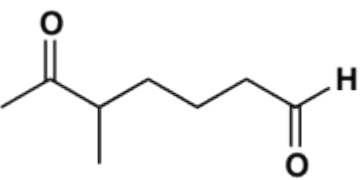
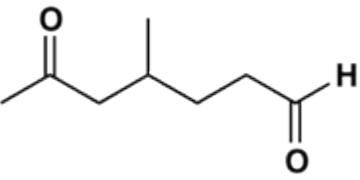
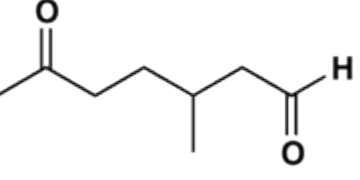
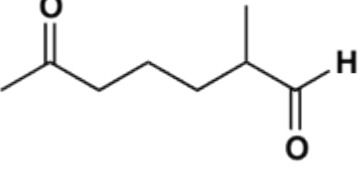


- a) C1
- b) C2
- c) C3
- d) C4

Q 9) Which of the following is impossible as a resonance form of ozone?

- a)  $\text{O}=\text{O}^+-\text{O}^-$
- b)  $-\text{O}-\text{O}^+=\text{O}$
- c)  $\text{O}=\text{O}=\text{O}$
- d)  $-\text{O}-\text{O}^{++}-\text{O}^-$

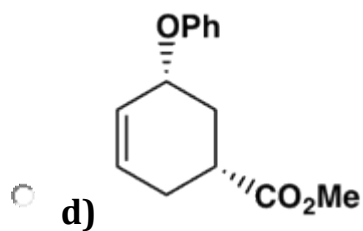
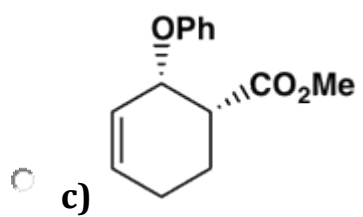
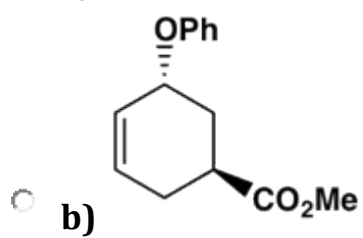
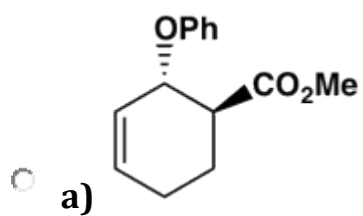
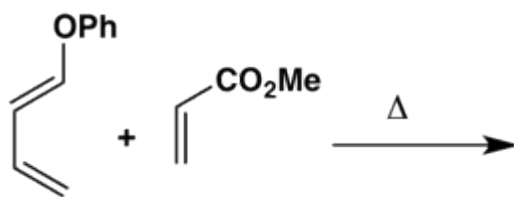
Q 10) Which of the following is the main product in the ozonolysis of 1,3-dimethylcyclohexene followed by a workup with Zn and ethanoic acid?

- a) 
- b) 
- c) 
- d) 

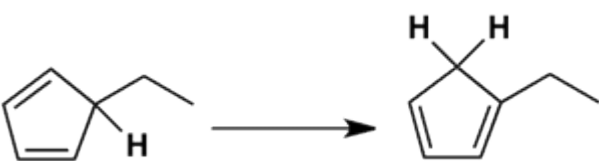

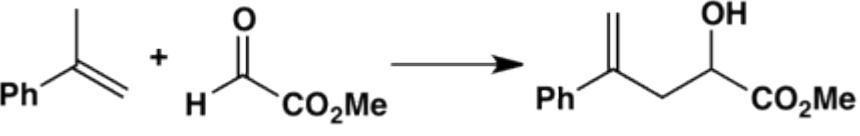
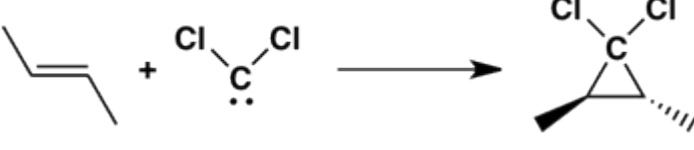
Q 11) Which of the following normally reacts as an electrophile?

- a)  $(\text{CH}_3)_3\text{CH}$
- b)  $\text{H}_2\text{C}=\text{CH}_2$
- c)  $(\text{CH}_3)_2\text{O}$
- d)  $\text{CH}_3\text{Cl}$

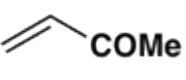
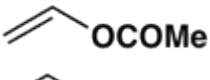
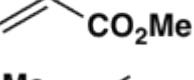
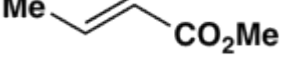
Q 12) Which of adducts (a)-(d) is the main kinetic product of the following Diels-Alder reaction?



Q 13) Which of the following is classified as an electrocyclic reaction?

- a) 
- b) 
- c) 
- d) 

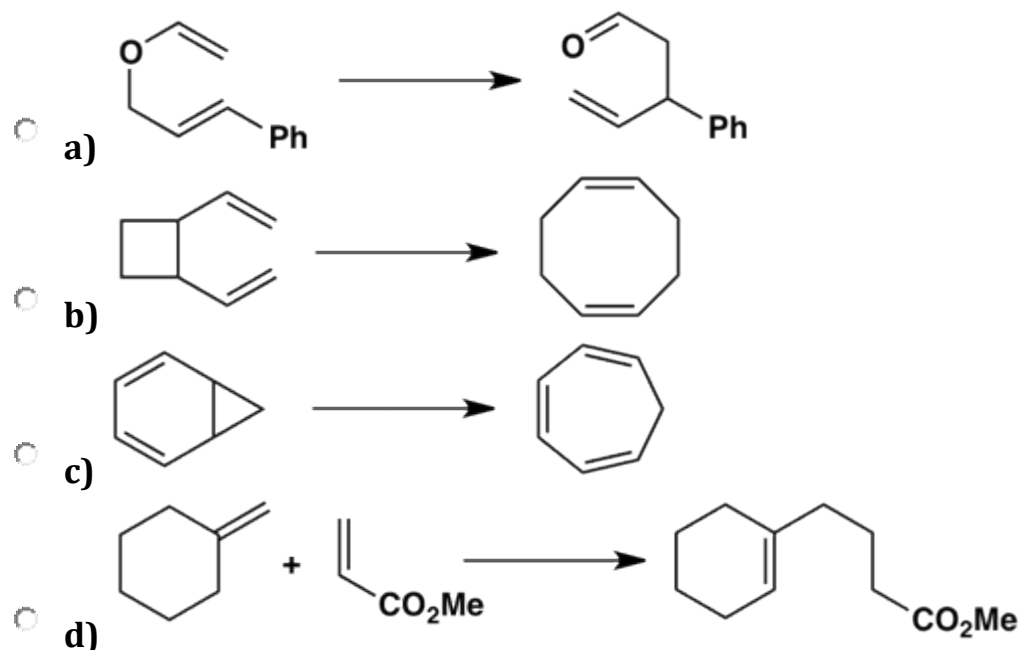
Q 14) Which of the following dienophiles is the least reactive in normal Diels-Alder reactions?

- a) 
- b) 
- c) 
- d) 

Q 15) Which of the following reacts most readily as an electrophile?

- a) HBr
- b) CH<sub>3</sub>Br
- c) CH<sub>3</sub>OH
- d) (CH<sub>3</sub>)<sub>4</sub>N

Q 16) Which of the following reactions is classified as an electrocyclic reaction?



Q 17) Which of the following statements about a  $\pi$ -bonding molecular orbital is true?

- A) A  $\pi$ -bonding molecular orbital is formed when two p orbitals of similar phase overlap.
- B) A  $\pi$ -bonding molecular orbital is lower in energy than a  $\sigma$ -bonding molecular orbital.
- C) A  $\pi$ -bonding molecular orbital is formed when two p orbitals of opposite phase overlap.
- D) Both the statements "a  $\pi$ -bonding molecular orbital is formed when two p orbitals of similar phase overlap" and "a  $\pi$ -bonding molecular orbital is lower in energy than a  $\sigma$ -bonding molecular orbital" are true.

Q 18) Which of the following statements about a  $\pi^*$  antibonding molecular orbital is true?

- A) A  $\pi^*$  antibonding molecular orbital is formed when two p orbitals of similar phase overlap.
- B) A  $\pi^*$  antibonding molecular orbital is formed when two p orbitals of opposite phase overlap.
- C) A  $\pi^*$  antibonding molecular orbital is a higher-energy molecular orbital than a  $\pi$

bonding molecular orbital.

D) Both the statements "a  $\pi^*$  antibonding molecular orbital is formed when two p orbitals of opposite phase overlap" and "a  $\pi^*$  antibonding molecular orbital is a higher-energy molecular orbital than a  $\pi$  bonding molecular orbital" are true.

Q 19) Which pairing of molecule and point group is correct?

- a)  $\text{CH}_2\text{Cl}_2$ ,  $T_d$
- b)  $\text{CHCl}_3$ ,  $C_{3v}$
- c)  $\text{CCl}_4$ ,  $D_{4d}$
- d)  $\text{CCl}_2\text{Br}_2$ ,  $C_{2h}$

Q 20) Which of the following molecules or ions possesses an inversion centre (centre of symmetry)?

- a)  $[\text{PF}_6]^-$
- b)  $\text{SiH}_4$
- c)  $\text{BF}_3$
- d)  $\text{PF}_5$

Q 21) Which of the following does not normally react as a nucleophile?

- a)  $(\text{CH}_3)_2\text{O}$
- b)  $(\text{CH}_3)_2\text{OH}^+$
- c)  $\text{CH}_3\text{CH}_2\text{OH}$
- d)  $\text{CH}_3\text{CH}_2\text{O}^-$

Q 22) Which of the following can react as a nucleophile?

- a)  $(\text{CH}_3)_3\text{B}$
- b)  $(\text{CH}_3)_3\text{CH}$
- c)  $(\text{CH}_3)_3\text{N}$
- d)  $(\text{CH}_3)_3\text{O}^+$

Q 23) The reactions which take place, when molecules absorb ultraviolet or visible radiation are called\_\_\_\_\_



- a. Photochemical reactions
- b. Condensation reactions
- c. Thermal reactions
- d. Fries rearrangement

Q 24) Most of the UV-radiation below \_\_\_\_\_nm is absorbed by the glass.

- a. 400nm
- b. 360nm
- c. 310nm
- d. 420nm

Q 25) The \_\_\_\_\_ light has longer wavelength than the light needed for the original excitation.

- a. Phosphorescent
- b. Absorbent
- c. Fluorescent
- d. Both a. and b.

Q 26) Cyclohexanone on alpha-cleavage yield an intermolecular hydrogen abstraction gives

- a. Ring opened aldehyde
- b. Carboxylic acid
- c. Cyclopentane
- d. Ketene

Q 27) What is Chemiluminescence?

- a. Emission of light
- b. Absorb ultraviolet radiation
- c. Radiation in IR region
- d. Absorb visible radiation

Q 28) According to Jablonski diagram, Internal conversion involving a spin inversion to\_\_\_\_\_

- a. S1-T1
- b. T1-T0
- c. S1-S0
- d. T1-S0

Q 29) The efficiency of a photochemical reaction is usually expressed in terms of

- a. Photoexcitation
- b. Percentage yield
- c. Quantum yield
- d. Quantum field

Q 30) Phenol ester in solution on photolysis give a mixture of \_\_\_\_\_

- a. o-and m-acyl phenols
- b. p-and m-acyl phenols
- c. o-and p-acyl phenols
- d. o-acyl phenols

Q 31) Diazomethane on photolysis in the presence of cis-2-butene to give

- a. cis-cyclopropanes
- b. cis-1,2-dimethyl cyclopropanes
- c. trans-1,2-dimethyl cyclopropanes
- d. trans-cyclopropanes

Q 32) Acetophenone with ( $\lambda$  max 270nm undergoes \_\_\_\_\_ from its S1-T1 efficiently.

- a. Internal conversion
- b. Phosphorescence
- c. Fluorescence
- d. Intersystem crossing

Q 33)) Positive charge of carbocations can be dispersed by \_\_\_\_\_

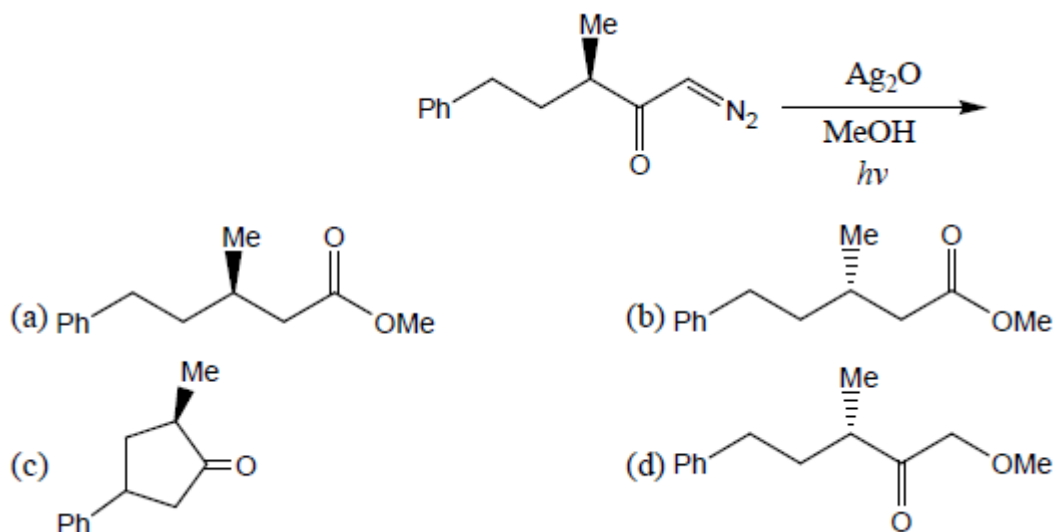
- a) (+I) effect of alkyl group
- b) Resonance in allyl or benzyl carbocation

- c) Hyperconjugation in  $1^{\circ}$ ,  $2^{\circ}$  and  $3^{\circ}$  carbocations  
 d) All of the mentioned

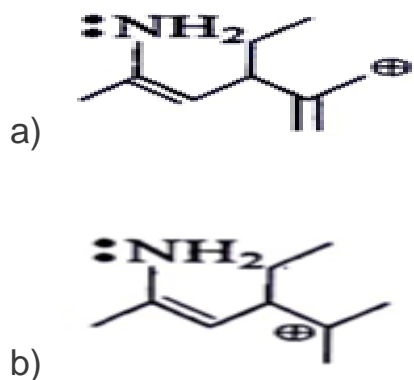
Q 34) Find the incorrect statement for a nucleophile

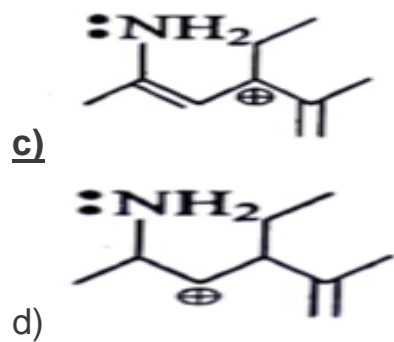
- (a) A nucleophile is a Lewis acid  
 (b) Nucleophiles do not seek electron  
 (c) Ammonia is a nucleophile  
 (d) Nucleophiles attack low electron density sites

Q 35) The major product formed in the following reaction is.....



Q 36) Among the following which is most stabilized cation?





Q 37) Which of the following free radical has the maximum ease of formation?

- a)  $1^{\circ}$
- b)  $2^{\circ}$
- c)  $3^{\circ}$
- d)  $\text{CH}_3$

Q 38) **Select** correct statement(s) about carbene:

- (a) It is obtained by photolysis of diazomethane or ketene
- (b) It can be inserted into alkenes forming cycloalkane
- (c) It can exist as single or triplet
- (d) All the statements are true.