

STUDENT ID NUMBER: \_\_\_\_\_  
YOUR MODULE:                    06710            06712            06714

**Mid-semester Test**  
for modules 06710-12-14

- Module 06710**    Topics in Organic and Organometallic Chemistry  
**Answer sections 1, 2, 3 and 4**
- Module 06712**    Topics in Organic and Inorganic Chemistry  
**Answer sections 1, 2, 4 and 5**
- Module 06714**    Topics in Organic and Bioinorganic Chemistry  
**Answer sections 1, 2, 3 and 5**

General remarks – please read !

- The duration of the test is **40 minutes**.
- Each question contains four possible answers **(A), (B), (C)** or **(D)**.
- There is **only one correct answer** for each question.
- Select your answer by **circling clearly** the appropriate letter **on this answer sheet**.
- If you need to change your answer then do so by crossing out the first answer clearly.



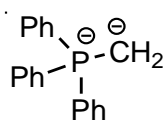
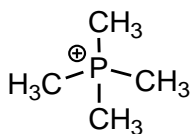
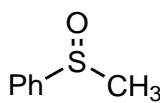
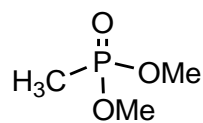
choice of answer



choice discarded

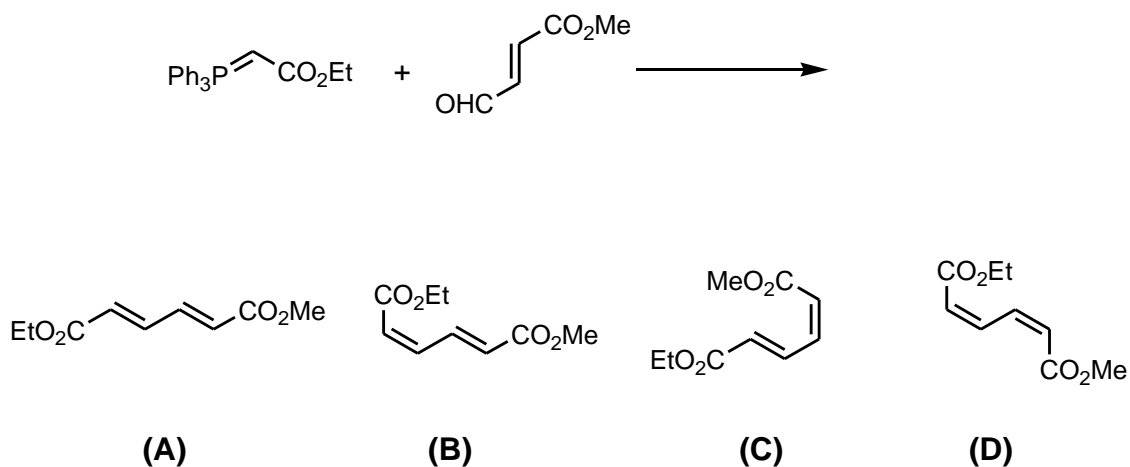
Hand your test in before you leave and do not forget to **add your student ID** to your test sheet (see above) and **circle the appropriate module number**.

1. Consider the following statements regarding the compounds below, and identify the correct statement accordingly.

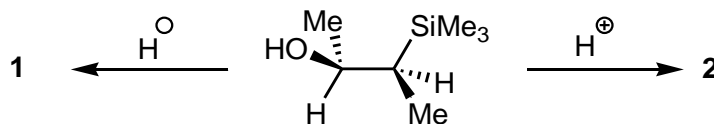
**1****2****3****4**

- (A) **1** is a phosphonium ion and **4** is a phosphonate.
- (B) **1** is an ylid and **2** is a phosphonium ion.
- (C) **2** is an ylid and **3** is a sulfoxide.
- (D) **4** is a phosphonate and **3** is a sulfone.
2. Consider the following statements which relate to the **Wittig reaction** and identify the **true** statement accordingly.
- (A) An unstabilized ylid gives predominantly the (*E*)-alkene.
- (B) Using a stabilized ylid and Schlosser modification conditions allows for a switch from (*E*)- to (*Z*)-alkene selectivity.
- (C) Reaction of a stabilized ylid with an aldehyde gives rise to a betaine intermediate reversibly.
- (D) A stabilized ylid gives predominantly the (*Z*)-alkene.

3. For the following reaction select the major product.

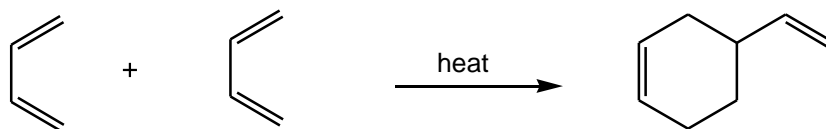


4. Consider the following statements regarding the reactions below, and identify the correct statement accordingly.

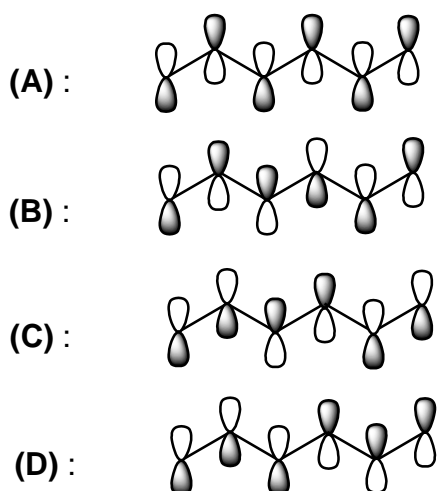


- (A) **1** and **2** are mixtures of both the (*E*)- and (*Z*)- alkenes.
- (B) The route to **2** is an *anti* elimination and **2** is the (*E*)-alkene.
- (C) The route to **1** is a *syn* elimination and **1** is the (*Z*)-alkene.
- (D) Both modes of elimination are stereospecific.

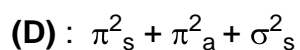
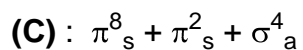
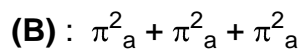
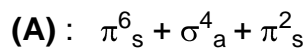
5. With regard to the following thermal cycloaddition of butadiene pick out the following statement which is correct:



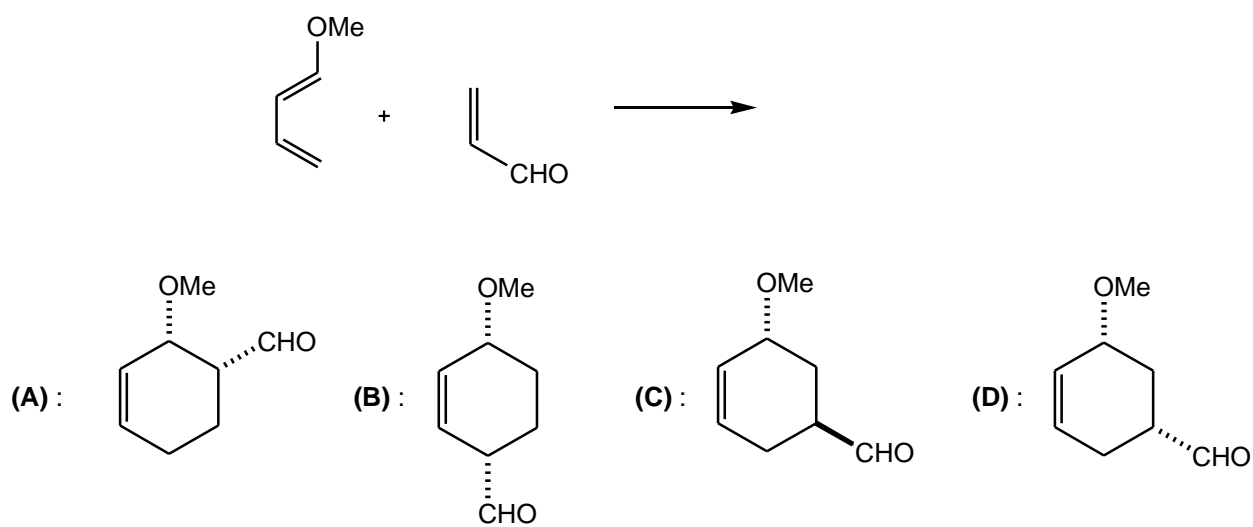
- (A) : The reaction is antarafacial and allowed  
(B) : The reaction is antarafacial and forbidden  
(C) : The reaction is suprafacial and allowed  
(D) : The reaction is suprafacial and forbidden
6. With regard to hexatriene, identify the highest occupied molecular orbital (HOMO) for a **FOUR**-electron component:



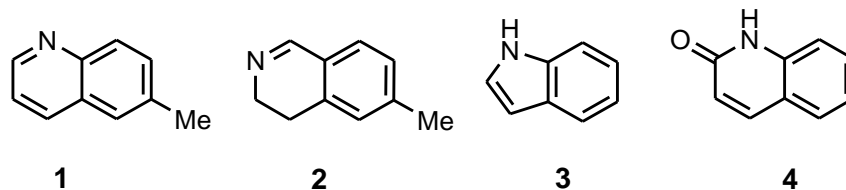
7. With reference to the Woodward-Hoffmann rules pick out the combination which is thermally allowed:



8. For the following reaction select the correct product:

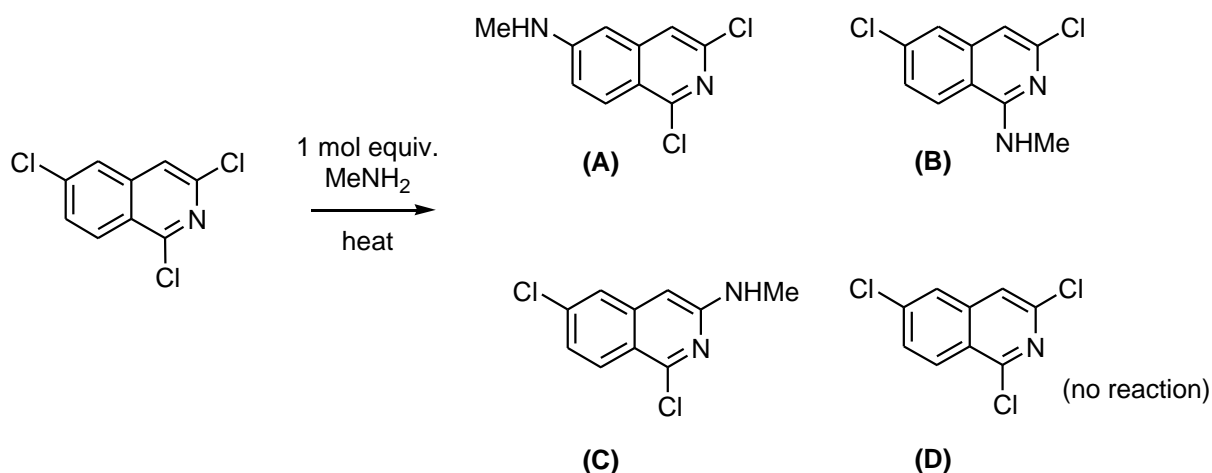


9. Consider the following statements regarding the compounds below and identify the correct statement accordingly.

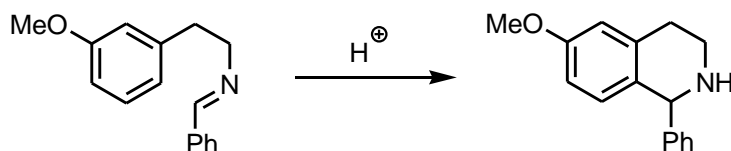


- (A) 1 is 6-methylquinoline and 2 is 6-methyl-3,4-dihydroquinoline.
- (B) 2 is 4-methyl-1,2-dihydroisoquinoline and 3 is indole.
- (C) 2 is 6-methyl-3,4-dihydroquinoline and 4 is 2-quinolone.
- (D) 1 is 6-methylquinoline and 2 is a 6-methyl-3,4-dihydroisoquinoline.
10. Consider the benzo and pyrido rings that make up quinoline and then decide which of the following statements is true.
- (A) The benzo ring is more reactive towards nucleophiles than the pyrido ring.
- (B) The pyrido ring is more reactive towards nucleophiles than the benzo ring.
- (C) Neither ring is reactive towards nucleophiles.
- (D) The pyrido ring is reactive towards both electrophiles and nucleophiles

11. The product formed in the following reaction is:

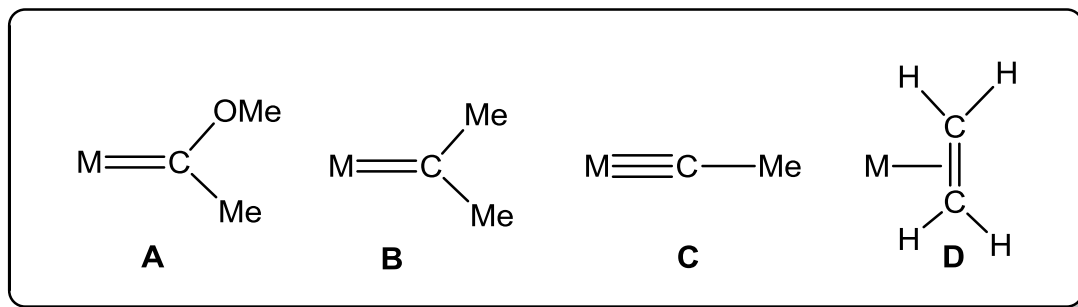


12. Consider the following reaction and identify the correct statement.



- (A) If the methoxy group is changed for an electron-withdrawing group then the reaction rate will increase.
- (B) The product shown is the minor isomer; the 8-methoxytetrahydroquinoline is the major product.
- (C) The product shown is the major isomer; the 8-methoxytetrahydroquinoline is the minor product.
- (D) If the methoxy group is changed for an electron-withdrawing group then the reaction rate will not change significantly.

Consider the following compounds which relate to questions 13 and 14.



13. Which of the species **A – D** contains a Fischer carbene fragment?

(A)

(B)

(C)

(D)

14. Which of the species **A – D** has a bond order of 2 between the metal and the hydrocarbon fragment?

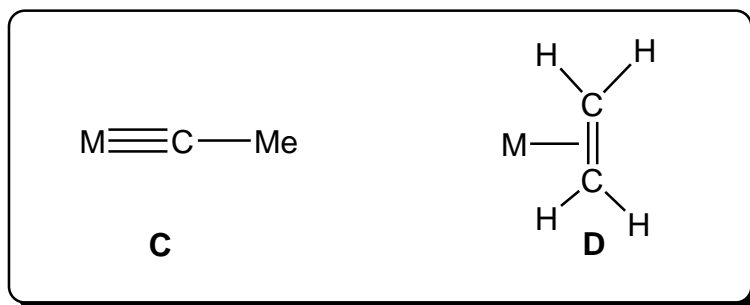
(A)

(B)

(C)

(D)

Consider the following compounds which relate to questions 15 and 16.



15. Which one of the following statements about bonding between the carbon fragment and the metal in species C is correct?
- (A) It contains one  $\sigma$ - and two  $\pi$ -bonds.
  - (B) It contains one  $\sigma$ - bond, one  $\pi$ -bond and some  $\pi$ -back bonding.
  - (C) It contains one  $\sigma$ - and two lots of  $\pi$ -back-bonding.
  - (D) It contains none of the above.
16. For species D, which one of the following statements is correct?
- (A) An increase in  $\pi$ -back bonding will weaken the M-C bonds.
  - (B) An increase in  $\pi$ -back bonding will make the alkene more reactive towards nucleophiles.
  - (C) An increase in  $\pi$ -back bonding will weaken the C=C bond.
  - (D) An increase in  $\pi$ -back bonding will increase the C=C stretching frequency.

17. Which of the following statements regarding ion pumps and channels in cell membranes is correct?
- (A) Ion pumps operate via passive transport and ion channels via active transport
  - (B) Both ion pumps and channels operate via passive transport
  - (C) Neither channels nor pumps are passive ion transport systems
  - (D) ATP hydrolysis is essential to the transport by ion channels
18. Why do organisms use biomineral structures that consist of both organic and inorganic materials?
- (A) Organisms can't create solely inorganic materials.
  - (B) The inorganic component gives hardness and pressure resistance and the organic component gives elasticity and tensile strength.
  - (C) The organic component gives hardness and pressure resistance and the inorganic component gives elasticity and tensile strength.
  - (D) Inorganic materials can be used to template the organic materials.
19. Some steps in the catalytic cycle of cytochrome P450 can be bypassed by addition of another species. Identify the species.
- (A) Superoxide
  - (B) Peroxide
  - (C) Water
  - (D) Fe(II) acetate
20. Comparison of methane monooxygenase (MMO) and cytochrome P450 reveals which of the following differences?
- (A) Cytochrome P450 contains one haem group and the MMO R2 protein contains two haem groups.
  - (B) Cytochrome P450 can hydroxylate methane and MMO cannot.
  - (C) Cytochrome P450 contains a iron haem unit and MMO contains a dinuclear non-haem unit.
  - (D) Cytochrome P450 has been structurally characterised and MMO has not.

*Add your student ID to the front of your paper and circle the appropriate module number.*