

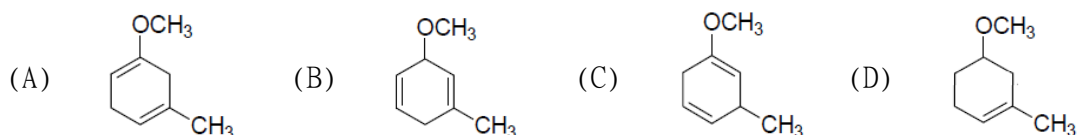
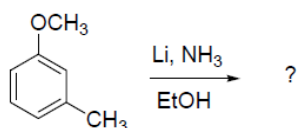
《化學》

選擇題（單選題，共50題，每題2分，共100分。答錯1題倒扣0.5分，倒扣至零分為止。未作答時，不給分亦不扣分）

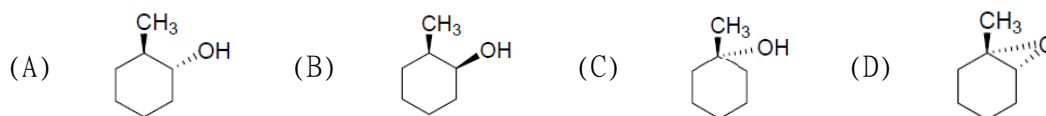
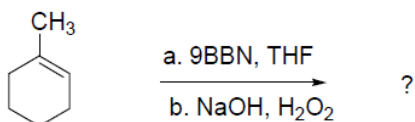
Useful information:

Value, X	2	3	5	7	10	100
ln X	0.6931	1.0986	1.6094	1.9459	2.3026	4.6052

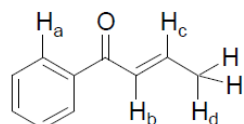
(A) 1. What product would be obtained from the following reaction?



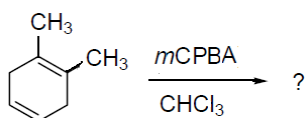
(A) 2. What product would be obtained from the following reaction?

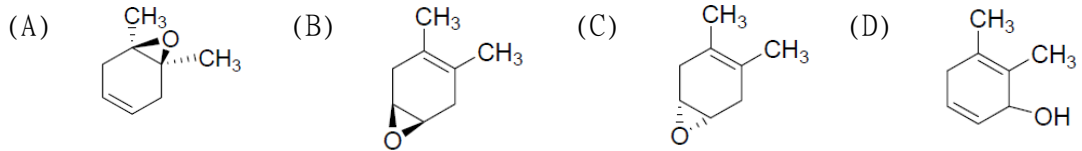


(D) 3. There are 4 different hydrogens in the compound described below. Which one is the most acidic hydrogen?



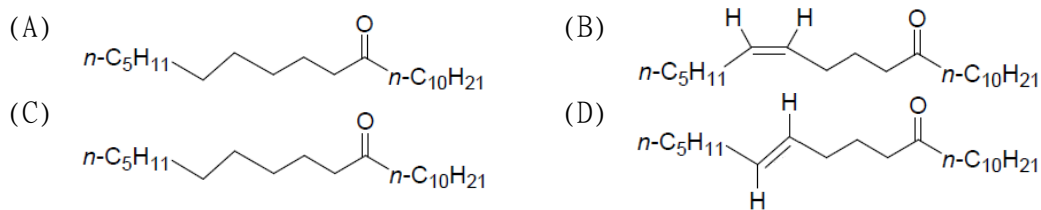
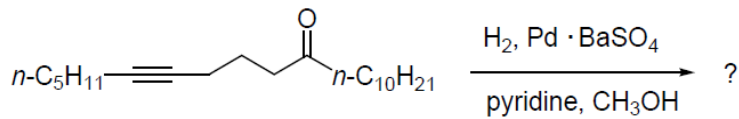
(A) 4. What product would be obtained from the following reaction?



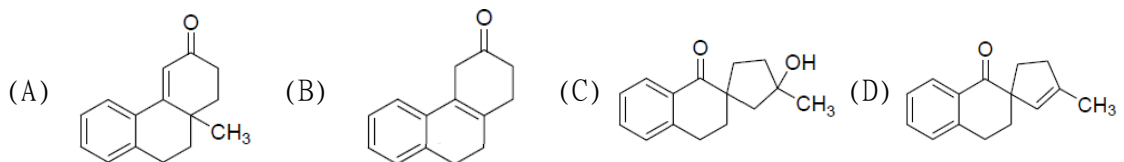
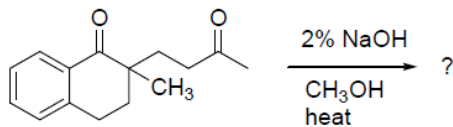


- (D) 5. In the following reaction, $2\text{H}_2\text{O}_2(l) \longrightarrow 2\text{H}_2\text{O}(l) + \text{O}_2(g)$, hydrogen peroxide functions as
1. an oxidizing agent.
 2. a reducing agent.
 3. an acid.
- (A) 1 only (B) 2 only (C) 3 only (D) 1 and 2 only

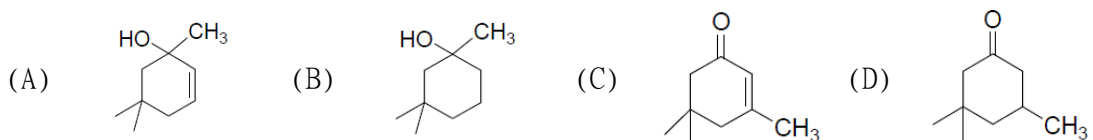
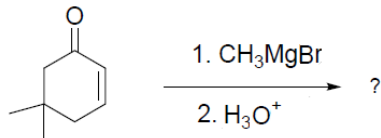
- (B) 6. What major product would be obtained from the following reaction?



- (A) 7. What final product would be obtained from following reaction?



- (A) 8. What final product would be obtained from following reaction?

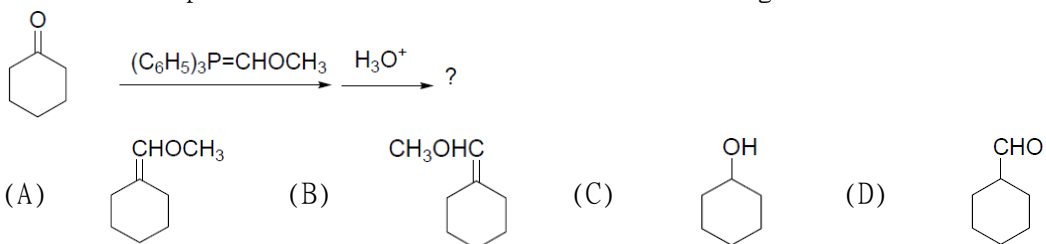


- (B) 9. Which one of the following contains both ionic and covalent bonds?

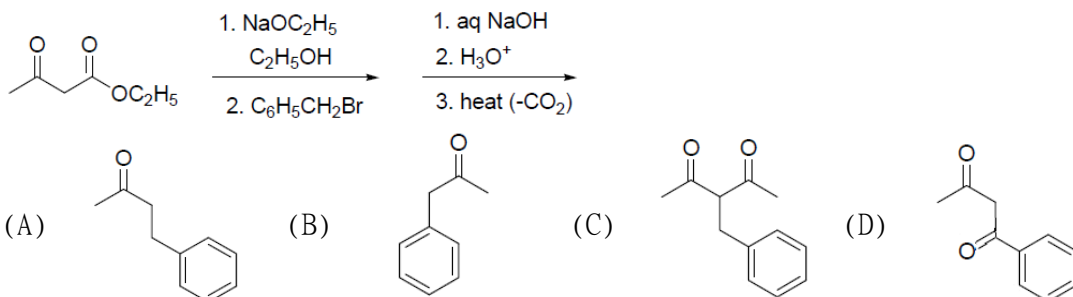
- (A) NaCl (B) NaOH (C) HOH (D) SiO₂

- (C) 10. Based on molecular structure, which of the following substances should have the lowest boiling point?
- (A) H_2Te (B) H_2Se (C) H_2S (D) H_2O

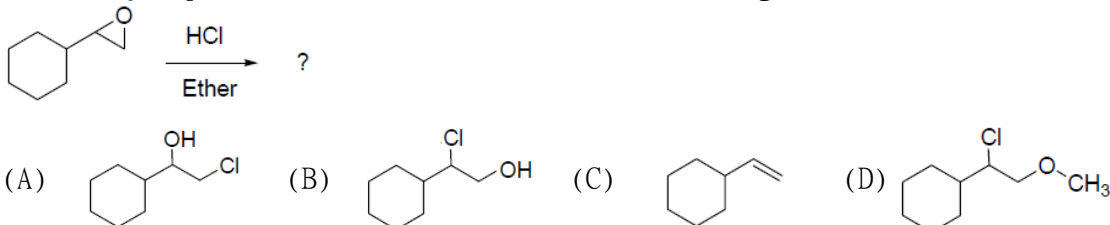
(D) 11. What final product would be obtained from following reaction?



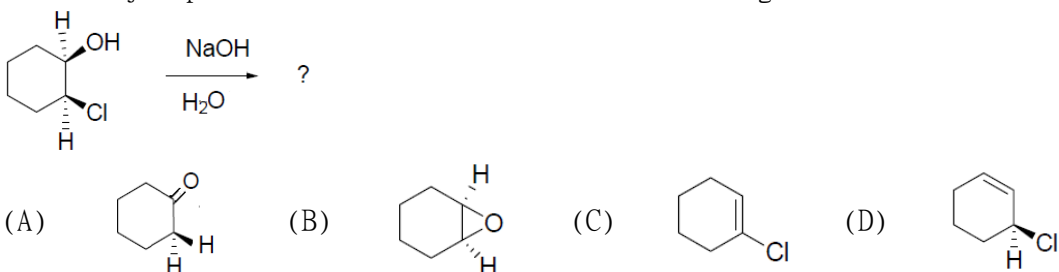
(A) 12. What major product would be obtained from following reaction?



(A) 13. What major product would be obtained from following reaction?



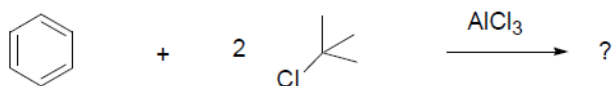
(A) 14. What major product would be obtained from following reaction?

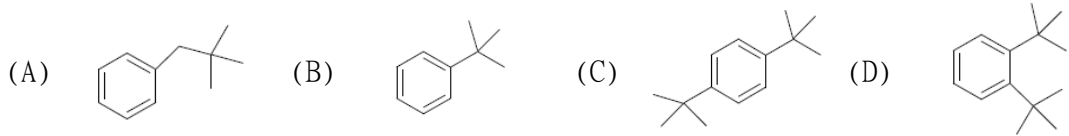


(A) 15. How many orbitals have the following quantum numbers: $n = 3$, $l = 2$, $m_l = -2$?

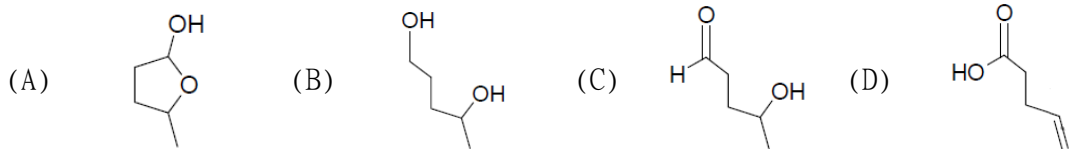
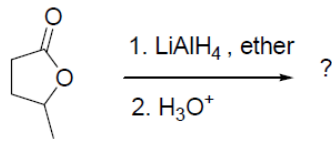
- (A) 1 (B) 3 (C) 5 (D) 7

(C) 16. What major product would be obtained from following reaction?

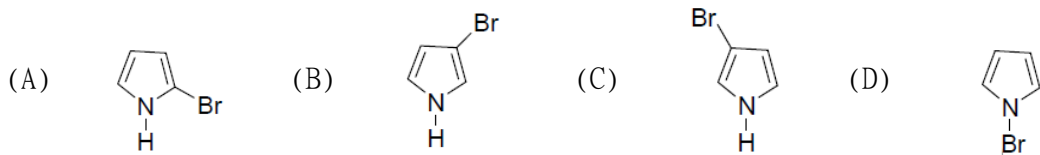
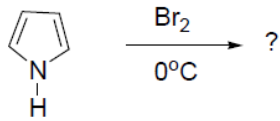




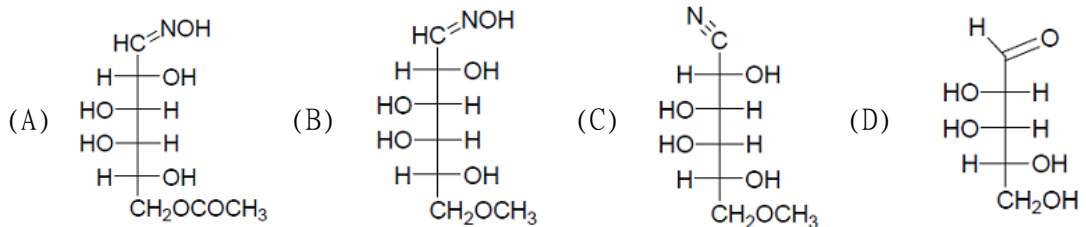
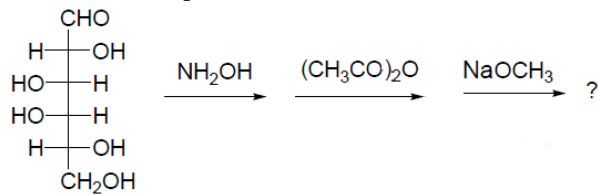
(B) 17. What major product would be obtained from following reaction?



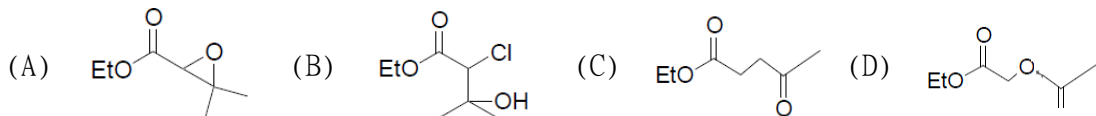
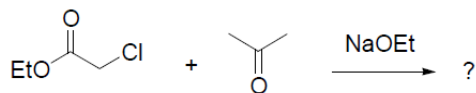
(A) 18. What major product would be obtained from following reaction?



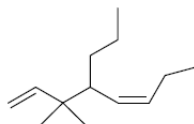
(D) 19. What final product would be obtained from following sequential reactions?



(A) 20. What final product would be obtained from following reaction?

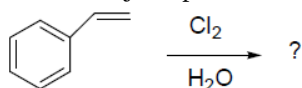


(C) 21. Which one is the correct IUPAC name for the following compound?



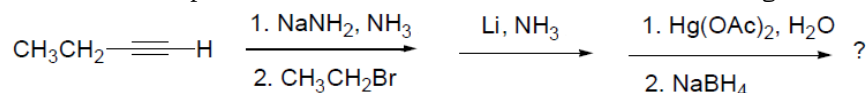
- (A) (E)-3,3-Dimethyl-4-propylocta-1,5-diene
 (B) (E)-6,6-Dimethyl-5-propylocta-3,7-diene
 (C) (Z)-3,3-Dimethyl-4-propylocta-1,5-diene
 (D) (Z)-3,3-Dimethyl-4-propylhepta-1,5-diene

(B) 22. What major product would be obtained from following reaction?



- (A) (B) (C) (D)

(A) 23. What final product would be obtained from following reaction?



- (A) (B) (C) (D)

(C) 24. Which statements describe the bonding in the water molecule?

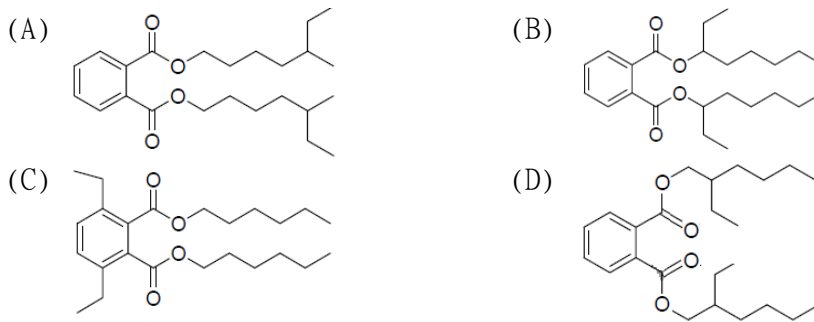
1. polar covalent
2. π bond
3. sp^3 hybridization

- (A) 1 only (B) 1 and 2 only (C) 1 and 3 only (D) 2 and 3 only

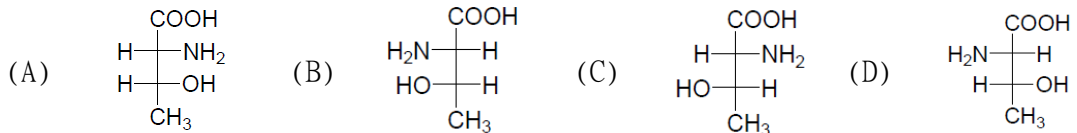
(D) 25. In the following S_N2 reaction which one would be predicted to be the fastest?

- (A) $\text{H}_2\text{O} + \text{CH}_3\text{Br} \longrightarrow \text{HOCH}_3 + \text{HBr}$
 (B) $\text{OH}^- + \text{CH}_3\text{Br} \longrightarrow \text{HOCH}_3 + \text{Br}^-$
 (C) $\text{H}_2\text{S} + \text{CH}_3\text{Br} \longrightarrow \text{HSCH}_3 + \text{HBr}$
 (D) $\text{SH}^- + \text{CH}_3\text{Br} \longrightarrow \text{HSCH}_3 + \text{Br}^-$

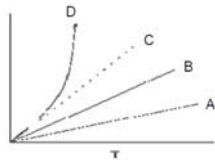
(D) 26. Bis(2-ethylhexyl)phthalate, commonly abbreviated DEHP, is an organic compound with the formula $\text{C}_6\text{H}_4(\text{C}_8\text{H}_{17}\text{COO})_2$. It is sometimes called dioctyl phthalate and abbreviated DOP. Being produced on a massive scale by many companies, it has acquired many names and acronyms, including BEHP and di-2-ethylhexyl phthalate. Recently, the illegal use of the plasticizer DEHP in clouding agents for use in food has been reported in Taiwan, what is the structure of DEHP?



(C) 27. In the following four stereoisomers of 2-amino-3-hydroxybutanoic acid which chiral carbons have 2R,3S configuration?

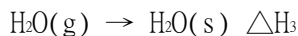
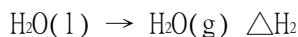
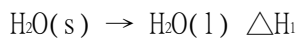


(A) 28. The volume-temperature plots below were made at different values of constant pressure while the number of moles of gas in each experiment remained the same. Which curve represents measurements at highest pressure?



(A) A (B) B (C) C (D) D

(B) 29. Consider the following changes:



Using Hess' Law, the sum all of $\Delta H_1 + \Delta H_2 + \Delta H_3$ is

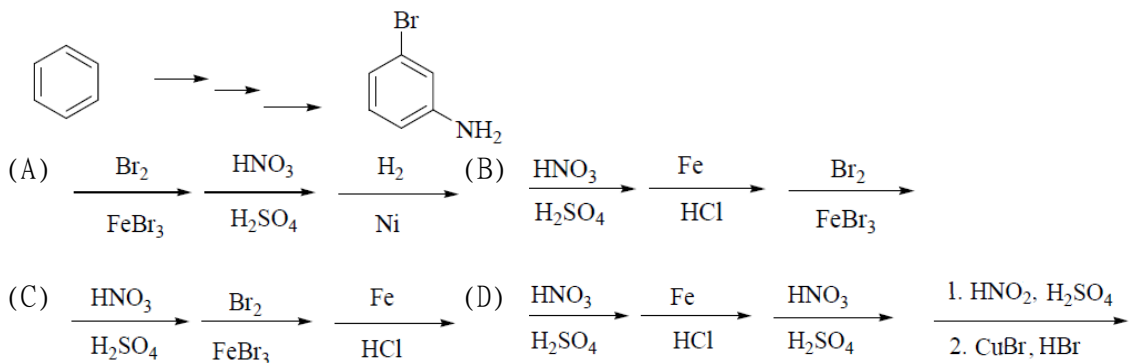
(A) > 0

(B) $= 0$

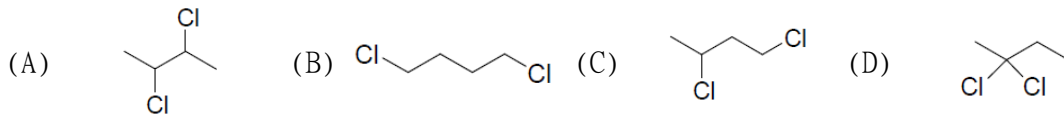
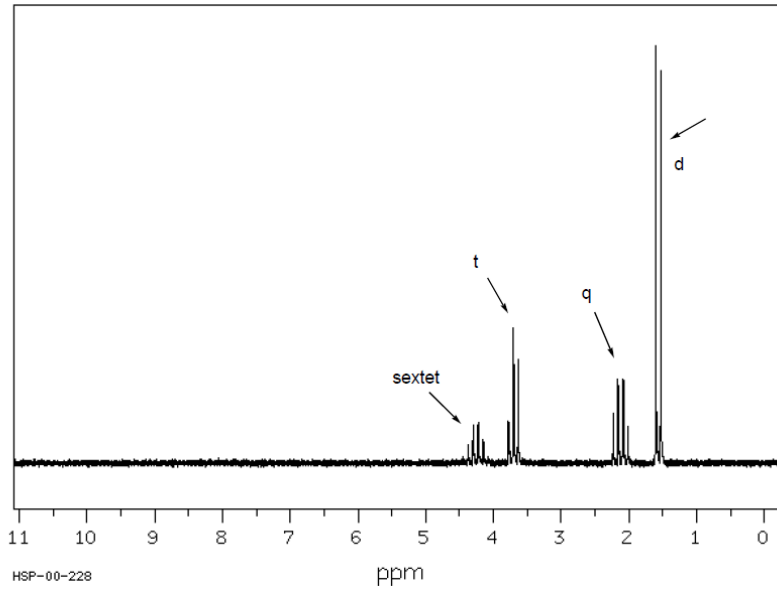
(C) < 0

(D) sometimes > 0 and sometimes < 0

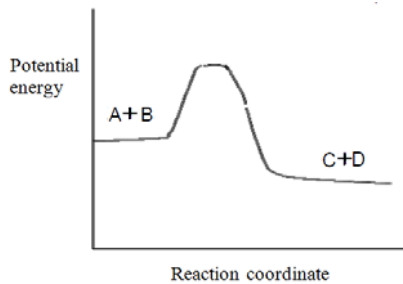
(C) 30. Choose the best series of reactions (A-D) for the synthesis of 3-bromoaniline from benzene shown below.



(C) 36. Which structure of molecular formula $C_4H_8Cl_2$ fits the 1H NMR spectrum shown below?



(C) 37. For the system described by the figure below, which statement is *CORRECT*?

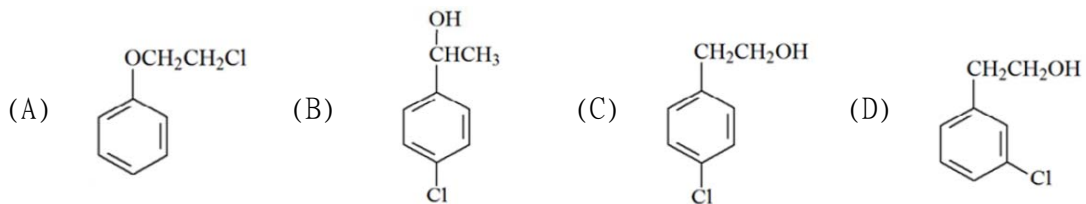


- (A) The forward reaction is endothermic
 (B) E_a for the forward reaction is greater than for the reverse reaction
 (C) The effect of a temperature change is greater for the reverse reaction than for the forward reaction
 (D) A and B are more stable than C and D

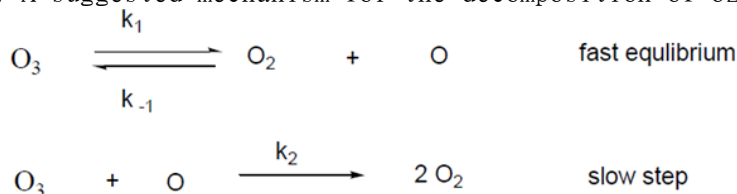
(B) 38. Which of the following concentrations can change with a change in temperature?

1. Molality
 2. Molarity
 3. mole percentage
 (A) 1 only (B) 2 only (C) 3 only (D) 1 and 2 only

- (C) 39. Carbon monoxide is a hazardous air pollutant because it
 (A) reacts with oxygen to form CO_2
 (B) catalyzes smog formation
 (C) forms a stable complex with hemoglobin
 (D) catalyzes the decomposition of ozone
- (D) 40. The proton NMR of a compound, $\text{C}_8\text{H}_9\text{ClO}$, has the following peaks. Which compound below best fits the data?
 broad singlet 2.00 (1H)
 triplet 2.41 (2H)
 triplet 3.69 (2H)
 doublet 7.02 (2H)
 doublet 7.50 (2H)



- (D) 41. A suggested mechanism for the decomposition of ozone, $2\text{O}_3 \rightarrow 3\text{O}_2$, is



According to this mechanism, the rate law will be

- (A) $k_2[\text{O}][\text{O}_3]$ (B) $\frac{k_1 [\text{O}_2][\text{O}]}{k_{-1} [\text{O}_3]}$ (C) $\frac{k_1 k_2}{k_{-1}} [\text{O}_3]^2 [\text{O}]$ (D) $\frac{k_1 k_2 [\text{O}_3]^2}{k_{-1} [\text{O}_2]}$
- (B) 42. At a given temperature, $K = 0.020$ for the equilibrium
 $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$

What is K for reaction $\text{Cl}_2(\text{g}) + \text{PCl}_3(\text{g}) \rightleftharpoons \text{PCl}_5(\text{g})$

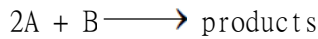
- (A) 0.020 (B) 50 (C) 100 (D) 500
- (B) 43. The table below lists the solubility product for compounds.

compound	CaCO_3	PbI_2	AgBr	$\text{Fe}(\text{OH})_2$
K_{sp}	4.8×10^{-9}	1.1×10^{-9}	5×10^{-13}	8×10^{-16}

Which salt is the most soluble (mol/L) in water?

- (A) CaCO_3 (B) PbI_2 (C) AgBr (D) $\text{Fe}(\text{OH})_2$

(D) 44. The following data were obtained for the reaction



[A] (mol/L)	[B] (mol/L)	Initial Rate [mol/(L·s)]
0.2	0.1	5
0.2	0.2	20
0.6	0.1	15

What is the order of the reaction with respect to B?

- (A) 0 (B) 1/2 (C) 1 (D) 2

(D) 45. Which process(es) is (are) most likely to lead to acid rain?

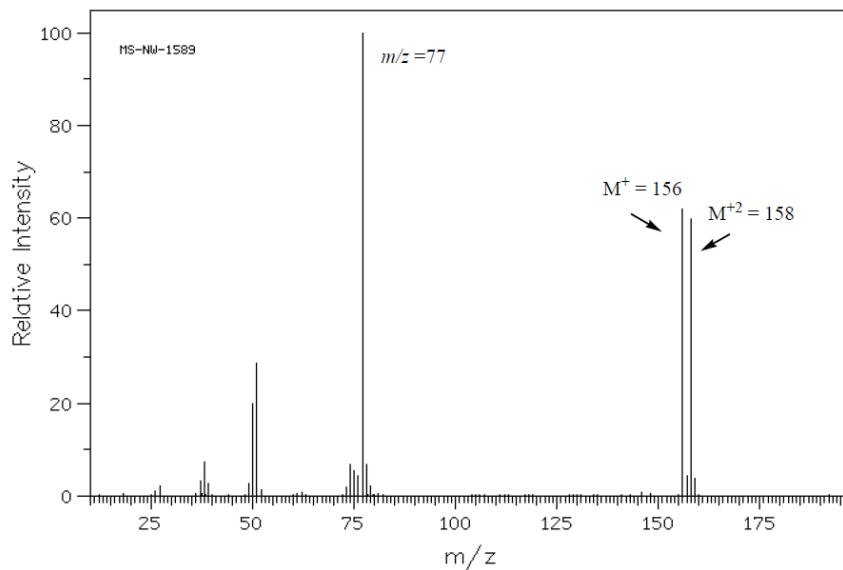
1. pollutants from a copper smelter
2. the burning of coal containing sulfur
3. excessive spraying of herbicides or insecticides

- (A) 1 only (B) 2 only (C) 3 only (D) 1 and 2 only

(D) 46. Which of the following coordination compounds will immediately form a precipitate when combined with an AgNO_3 solution?

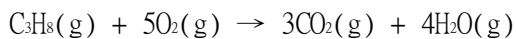
- (A) $\text{Cr}(\text{NH}_3)_3\text{Cl}_3$ (B) $\text{K}[\text{Cr}(\text{NH}_3)_2\text{Cl}_4]$
 (C) $\text{Cr}(\text{NH}_3)_2(\text{H}_2\text{O})(\text{Cl}_3)$ (D) $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$

(D) 47. A compound which EI-MS spectrum is shown below, has $M^+ = m/z$ 156, $M^{+2} = m/z$ 158, and $m/z = 77$ (base peak). What is the possible formula for this compound?



- (A) $\text{C}_5\text{H}_{10}\text{Cl}$ (B) $\text{C}_5\text{H}_{12}\text{Br}$ (C) $\text{C}_6\text{H}_5\text{Cl}$ (D) $\text{C}_6\text{H}_5\text{Br}$

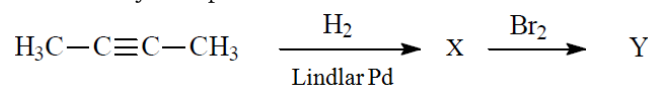
(C) 48. Consider the following reaction, which is spontaneous at room temperature:



One would predict that

- (A) ΔH is + and ΔS is + (B) ΔH is - and ΔS is - .
 (C) ΔH is - and ΔS is + (D) ΔH is + and ΔS is - .

(D) 49. Identify compound Y.



- (A) 2-bromobutane
 (B) meso-2,3-dibromobutane
 (C) 2,3-dibromo-2-butene
 (D) racemic (2R,3R) and (2S,3S)-2,3-dibromobutane

(A) 50. Which of the following cannot undergo an E₂ reaction?

