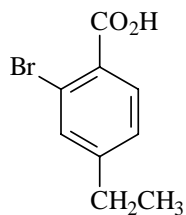
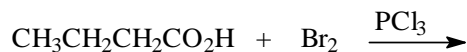


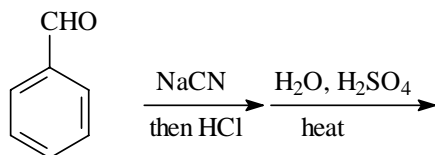
1. What is the systematic IUPAC name of the compound below?



- 1) 6-bromo-4-ethylbenzenecarboxylic acid
  - 2) 2-bromo-4-ethylbenzenecarboxylic acid
  - 3) *ortho*-bromo-*para*-ethylbenzoic acid
  - 4) 1-bromo-3-ethylbenzoic acid
2. Which of the following has the largest acid equilibrium constant,  $K_a$ ?
- 1) benzoic acid
  - 2) *ortho*-nitrobenzoic acid
  - 3) *para*-methylbenzoic acid (*para*-toluic acid)
  - 4) *para*-methoxybenzoic acid
3. What is the product of the reaction below?

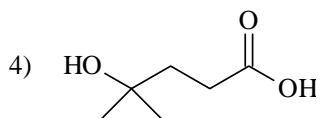
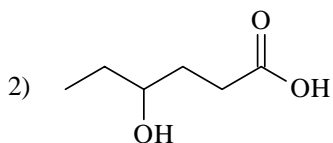
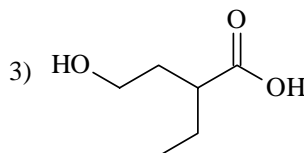
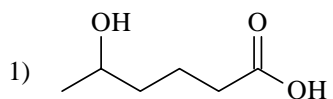
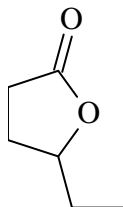


- 1) 2,3-dibromobutanoic acid
  - 2) 3-chlorobutanoic acid
  - 3) 2-bromobutanoic acid
  - 4) 2-chlorobutanoic acid
4. What is the product of the reaction sequence below?



- 1)
  - 2)
  - 3)
  - 4)
- 1) 1                      2) 2                      3) 3                      4) 4

5. Which structure below is the hydroxy acid which corresponds to the following lactone.



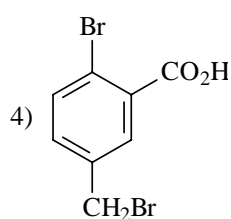
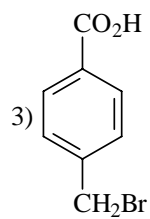
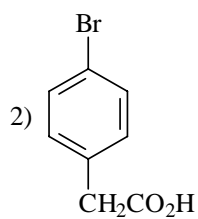
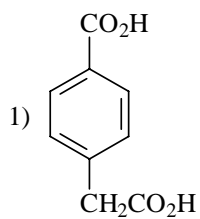
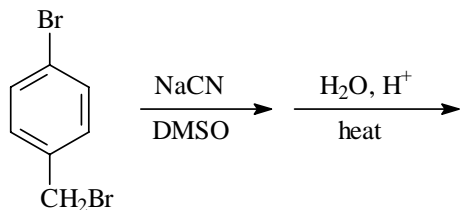
1) 1

2) 2

3) 3

4) 4

6. What is the product of the reaction shown below?



1) 1

2) 2

3) 3

4) 4

7. A mixture of 1-hexanol and hexanoic acid in diethyl ether is shaken with an aqueous sodium bicarbonate solution. Which line below correctly describes the major organic species in the two resulting immiscible solutions?

ether

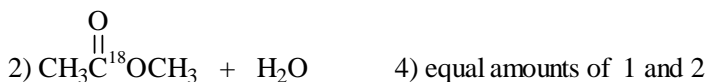
sodium bicarbonate solution

- |                     |               |
|---------------------|---------------|
| 1) hexanoic acid    | 1-hexanol     |
| 2) 1-hexanol        | hexanoic acid |
| 3) sodium hexanoate | 1-hexanol     |
| 4) 1-hexanol sodium | hexanoate     |

8. Which one of the following has the best soap cleansing properties?

- |  |   |
|--|---|
| 1) $\text{CH}_3(\text{CH}_2)_{16}\text{CO}_2\text{H}$  | 2) $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$  |
| 3) $\text{CH}_3(\text{CH}_2)_{16}\text{CO}_2\text{Na}$ | 4) $\text{CH}_3\text{CH}_2\text{CO}_2\text{Na}$ |

9. Reaction of acetic acid,  $\text{CH}_3\text{CO}_2\text{H}$ , with isotopically labeled  $\text{CH}_3^{18}\text{OH}$  and catalytic sulfuric acid gives:

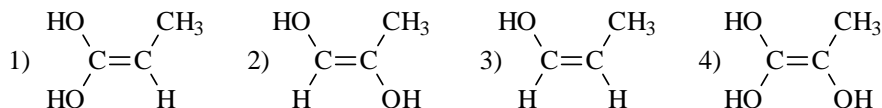


- |      |      |      |      |
|------|------|------|------|
| 1) 1 | 2) 2 | 3) 3 | 4) 4 |
|------|------|------|------|

10. What is the product of the thermal decarboxylation of dimethylpropanedioic acid?

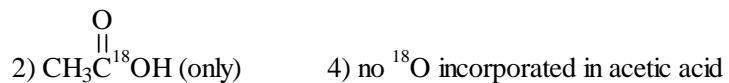
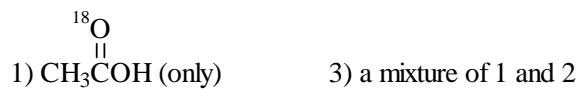
- |                               |                           |
|-------------------------------|---------------------------|
| 1) propanoic acid             | 2) 2-methylpropanoic acid |
| 3) 2,2-dimethylpropanoic acid | 4) acetic acid            |

11. Which of the following is the enol intermediate in the thermal decarboxylation of methylpropanedioic acid,  $\text{CH}_3\text{CH}(\text{CO}_2\text{H})_2$ ?



- |      |      |      |      |
|------|------|------|------|
| 1) 1 | 2) 2 | 3) 3 | 4) 4 |
|------|------|------|------|

12. Acetic acid is mixed with isotopically labeled water,  $\text{H}_2^{18}\text{O}$ , and a small amount of hydrochloric acid. Which of the following results of  $^{18}\text{O}$  incorporation would be expected?



- 1) 1                      2) 2                      3) 3                      4) 4

13. Which of the following has the largest acid equilibrium constant,  $K_a$ ?

- 1)  $\text{CH}_3\text{CO}_2\text{H}$                       2)  $\text{CH}_2\text{ClCO}_2\text{H}$   
3)  $\text{CHCl}_2\text{CO}_2\text{H}$                       4)  $\text{CCl}_3\text{CO}_2\text{H}$