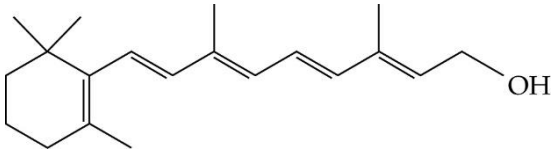
Quiz (Introduction to Selected Homologous Series)

Section A: Multiple-choice

1. The structural formula of vitamin A is shown below.



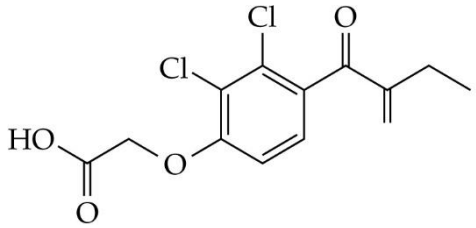
The molecular formula of vitamin A is

A. $C_{13}H_{22}O$.
B. $C_{20}H_{34}O$.
C. $C_{20}H_{30}O$.
D. $C_{20}H_{28}O$.

2. Which of the following systematic names of a compound is INCORRECT?

A. 1,2,2-trimethylpropane
B. 2,2,3-trimethylbutane
C. 2,2-dimethyl-3-ethylhexane
D. 2,4-dimethylpentane

3. Consider the following compound:



Which of the following functional groups are NOT present in the compound?

A. Carbon-carbon double bond
B. Carbonyl group
C. Carboxyl group
D. Ester group

4. Primary amines have lower boiling points than alcohols with a similar relative molecular mass because

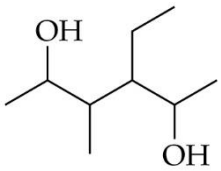
(1) there are no hydrogen bonds between primary amine molecules.
(2) the hydrogen bonds between primary amine molecules are weaker than those between alcohol molecules.
(3) primary amines consist of non-polar molecules while alcohols consist of polar molecules.

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

5. Which of the following series of compounds does NOT have hydrogen bonds among their molecules?

A. Alcohols
B. Carboxylic acids
C. Esters
D. Primary amines

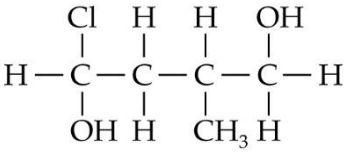
6. Consider the following compound:

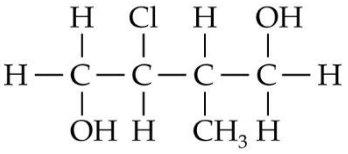


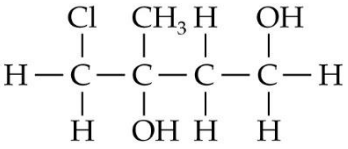
What is the systematic name of the compound?

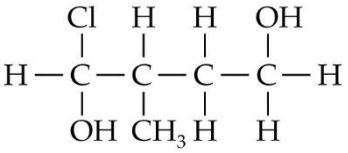
A. 3,4-dimethylhexane-2,5-diol
B. 3-ethyl-4-methylhexane-2,5-diol
C. 4-methyl-3-ethylhexanediol
D. 4-ethyl-3-methylbutane-1,4-diol

7. Which of the following is the structural formula of 1-chloro-2-methylbutane-1,4-diol?

A.


B.


C.


D.


8. Which of the following statements about trichloromethane are correct?

(1) It consists of polar molecules.
(2) Its trivial name is chloroform.
(3) It is highly soluble in water.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

Section B: Structured questions

The following table shows some physical properties of the first three members of some homologous series:

Homologous series	First three members	Boiling point (°C)	Solubility in water
P	p_1	–24.1	Insoluble
	p_2	12.3	Insoluble
	p_3	46.5	Insoluble
Q	q_1	101	Very soluble
	q_2	118	Very soluble
	q_3	141	Very soluble
R	r_1	64.6	Very soluble
	r_2	78.3	Very soluble
	r_3	97.2	Very soluble
S	s_1	–161	Insoluble
	s_2	–88.6	Insoluble
	s_3	–42.1	Insoluble

(a) Which series are the most likely to be alcohols and carboxylic acids? Explain your answer.

(b) Which series has the weakest intermolecular forces among its molecules?

(c) Based on the information given, suggest how q_1 and r_1 are separated from a mixture of q_1 and r_1. Briefly explain your answer.

Suggested Answer

Section A

1.	C	5.	C
2.	A	6.	B
3.	D	7.	D
4.	B	8.	A

Section B

(a) *R* are alcohols.
Q are carboxylic acids.

Both alcohols and carboxylic acids are soluble in water.

In carboxylic acids, both –C=O group and –OH group can participate in hydrogen bond formation. Hence, more extensive hydrogen bonds form between carboxylic acid molecules than alcohols molecules. The boiling points of carboxylic acids are higher than those of alcohols.

(b) *S*

(c) Distillation
They have different boiling points.