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Supplemental Materials

for

Using Pre-Assessment and In-Class Questions to Change Student Understanding of Molecular Movements

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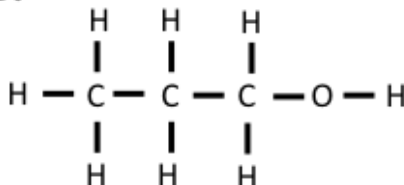
Circle the molecules below that are NOT able to diffuse through a membrane composed only of phospholipids (without proteins). Provide one or two sentences explaining your reasoning.
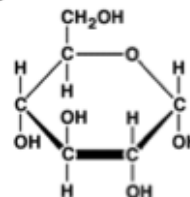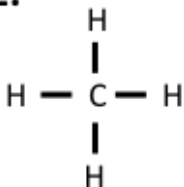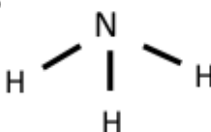
A.

$$O = O$$
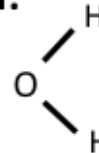
B.

```
    H   H   H
    |   |   |
H — C — C — C — O — H
    |   |   |
    H   H   H
```

C.

CH₂OH structure (cyclic sugar)

D.

K⁺

E.

```
    H
    |
H — C — H
    |
    H
```

F.

```
      N
   /  |  \
  H   |   H
      H
```

G.

Cl⁻

H.

```
      H
     /
    O
     \
      H
```

I.

$$O = C = O$$

J.

```
    H   H     O
    |   |    ‖
H — C — C — C
    |   |    \
    H   H     O⁻
```

K.

```
    H   H   H
    |   |   |
H — C — C — C — H
    |   |   |
    H   H   H
```
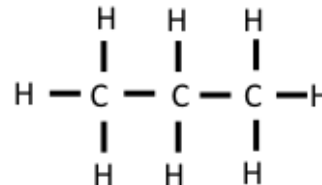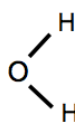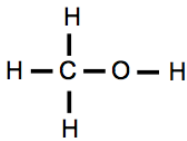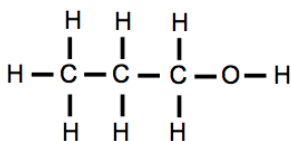
The correct answers are polar molecules B, C, F, J and charged molecules D and G.

2. Which of the molecule(s) below will diffuse FASTEST through a membrane composed only of phospholipids (without proteins). Provide one or two sentences explaining your reasoning.
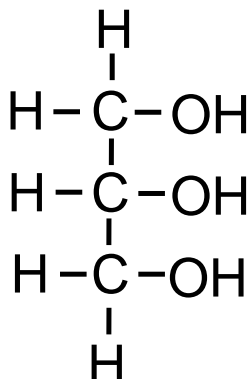
```
    H   H   H
    |   |   |
H — C — C — C — O — H
    |   |   |
    H   H   H
```

```
    H
    |
H — C — O — H
    |
    H
```

```
      H
     /
    O
     \
      H
```
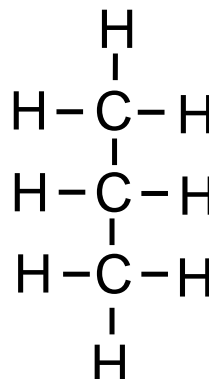
The correct answer is C.

Question 1.

Which of the following is LESS able to diffuse through a membrane composed only of phospholipids (without proteins)?

A.

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-OH$$
$$H-\underset{|}{\overset{|}{C}}-OH$$
$$H-\underset{\underset{H}{|}}{\overset{|}{C}}-OH$$

B.

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-H$$
$$H-\underset{|}{\overset{|}{C}}-H$$
$$H-\underset{\underset{H}{|}}{\overset{|}{C}}-H$$

The correct answer for question 1 is A.

Question 2.

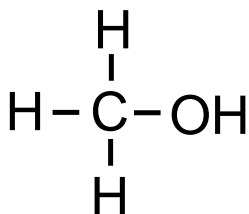## The reason(s) this molecule is LESS able to diffuse through such a membrane is because:

a) The molecule *can* interact chemically with the polar/ charged head groups of the phospholipids.

b) The molecule *cannot* interact chemically with the polar/ charged head groups of the phoshpholipids.

c) The molecule *can* interact chemically with the hydrophobic fatty acid tails of the phospholipid.

d) The molecule *cannot* interact chemically with the fatty acid tails of the phospholipid.
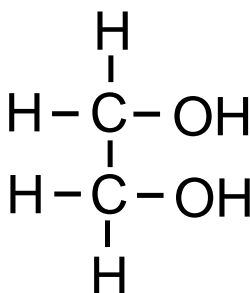
The correct answer for question 2 is D.

Question 3.

Which of the following will diffuse FASTEST through a
membrane composed only of phospholipids (without
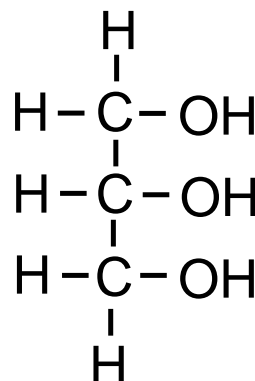proteins)?

A   B   C
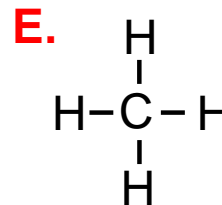
```
     H                      H                           H
     |                      |                           |
H – C – OH             H – C – OH               H – C – OH
     |                      |                           |
     H                 H – C – OH               H – C – OH
                            |                           |
                            H                 H – C – OH
                                                        |
                                                        H
```

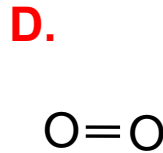The correct answer for question 3 is A.

Question 4.
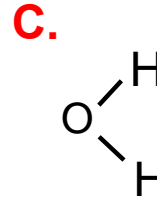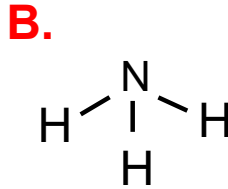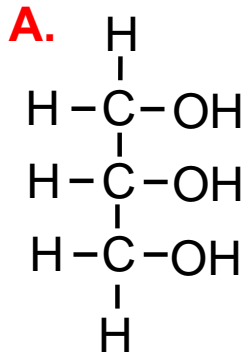
The reason(s) that this molecule diffuses faster through such
a membrane is because:

    a) it's the most polar.

    b) it's the most nonpolar.

    c) it's the smallest.
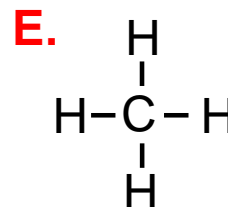
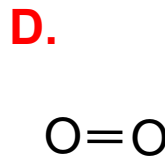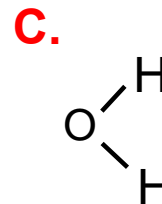The correct answer for question 4 is C.

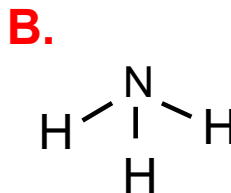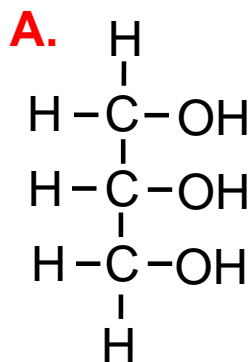Question 5.

Which of the following will diffuse FASTEST through a membrane composed only of phospholipids (without proteins)?

A.

```
      H
      |
H - C - OH
      |
H - C - OH
      |
H - C - OH
      |
      H
```

B.

```
      N
H      H
      H
```

C.

```
      H
  O
      H
```

D.

```
O = O
```

E.

```
      H
      |
H - C - H
      |
      H
```

The correct answer for question 5 is D.

Question 6.

Which of the following will diffuse SLOWEST through a membrane composed only of phospholipids (without proteins)?
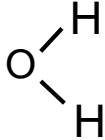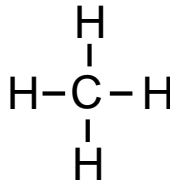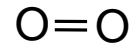
A.

```
      H
      |
H - C - OH
      |
H - C - OH
      |
H - C - OH
      |
      H
```

B.

```
      N
H      H
      H
```

C.

```
      H
  O
      H
```

D.

```
O = O
```

E.

```
      H
      |
H - C - H
      |
      H
```

The correct answer for question 6 is A.

Question 7.

Which of the following will diffuse FASTEST through a membrane composed only of phospholipids (without proteins)?
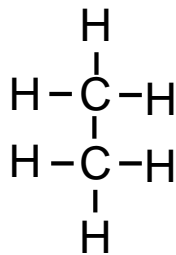
A.

O
⟨ H
⟨ H

B.

H
|
H−C−H
|
H

C.

O=O

D.

H
|
H−C−H
|
H−C−H
|
H

E.

H
|
HO−C−H
|
H−C−OH
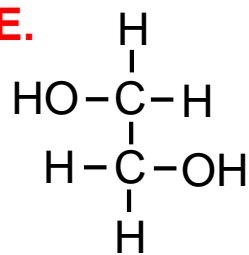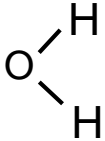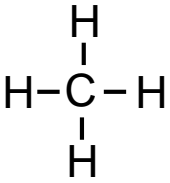|
H

The correct answer for question 7 is C.

Question 8.

Which of the following will diffuse SLOWEST through a membrane composed only of phospholipids (without proteins)?
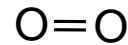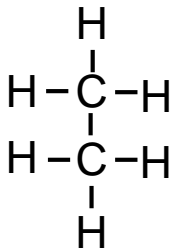
A.

O
⟨ H
⟨ H

B.

H
|
H−C−H
|
H

C.

O=O

D.

H
|
H−C−H
|
H−C−H
|
H
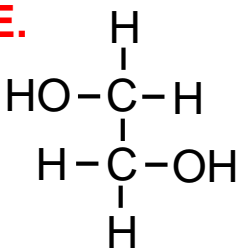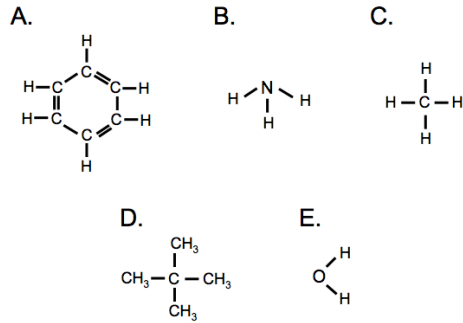
E.

H
|
HO−C−H
|
H−C−OH
|
H

The correct answer for question 8 is E.

Appendix 3: Midterm exam questions on MMTM.

Which of the following molecules will diffuse the FASTEST through a pure lipid bilayer (without proteins)?

The correct answer is C.

Explain why you picked your answer (in two sentences):

_____

_____