

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

Open [peededu.com](https://www.peededu.com) and navigate to **Membrane Fatty Acid Explorer**. Click the **Introduction** button to read about fish adaptations to cold water and the roles of saturated fatty acids, unsaturated fatty acids, and cholesterol in membrane fluidity. Then close the popup and use the temperature slider to observe how membrane fluidity changes.

## Free Response Questions

### Question 1 – Conceptual Analysis

**Simulation Task:** *In the Membrane Fatty Acid Explorer, set the temperature slider to 30°C and observe the phospholipid tails. Then slowly decrease the temperature to -10°C. Watch how the movement of the phospholipid tails changes as the temperature drops. Also note the cholesterol molecule (gold) positioned between the phospholipids.*

**(A)** (1 pt) **Describe** the structural difference between saturated and unsaturated fatty acid tails in membrane phospholipids and how this difference affects the spacing between adjacent phospholipids.

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**(B)** (1 pt) **Explain** why the membrane of a cold-water fish remains fluid at near-freezing temperatures while a membrane composed entirely of saturated fatty acids would become rigid under the same conditions.

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**(C)** (1 pt) **Predict** how a sudden decrease in water temperature would affect the rate of facilitated diffusion of glucose across the membrane of a fish whose cells contain mostly saturated fatty acids and lack cholesterol.

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**(D)** (1 pt) **Justify** your prediction.

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## Question 2 — Analyze Model / Visual Representation

**Simulation Task:** *In the Membrane Fatty Acid Explorer, click the Introduction button and review the comparison between saturated and unsaturated fatty acids. Then close the popup and set the temperature to 10°C. Observe the positions of the channel protein (purple), the receptor protein (green) with its extensions, and the cholesterol molecule (gold) within the bilayer.*

**(A)** (1 pt) **Describe** the role of cholesterol in the plasma membrane and how its position relative to the phospholipid tails affects membrane behavior across a range of temperatures.

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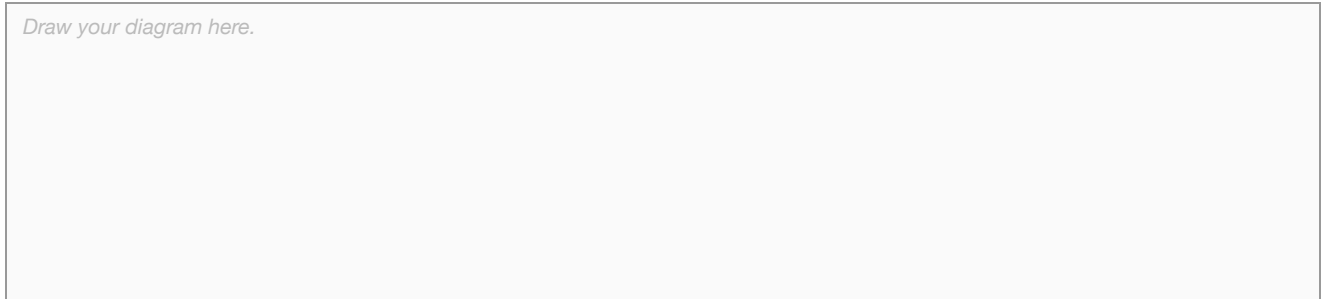
**(B)** (1 pt) **Explain** why a membrane with cholesterol maintains a more consistent fluidity across a wide temperature range compared to a membrane without cholesterol.

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**(C)** (1 pt) **Represent** the difference between a membrane rich in saturated fatty acids and a membrane rich in unsaturated fatty acids by drawing two side-by-side cross-section diagrams of a phospholipid bilayer, labeling the phospholipid heads, tails, and cholesterol in each.

*Draw your diagram here.*



**(D)** (1 pt) **Explain** how a sudden long-term drop in ocean temperature could act as a selective pressure on a fish population with genetic variation in membrane lipid composition.

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2.3.B.1