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Q716 - Engineering Safety & Environmental Protection

1. A three inch overboard discharge line, located six feet below the waterline, has ruptured and separated from the hull. What would be the minimum number of strokes per minute required from a 8" x 12" x 12" duplex double acting reciprocating bilge pump, operating at 82% efficiency, to keep the bilge level from continuing to rise

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Flow of Gallons of Water Per Minute (gpm) Through Various Hole Diameters (in) at Various Heads (ft) of Water

	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	14 ft	16 ft
1 in	28 gpm	40 gpm	49 gpm	56 gpm	63 gpm	69 gpm	74 gpm	79 gpm
2 in	111 gpm	157 gpm	192 gpm	222 gpm	248 gpm	272 gpm	294 gpm	314 gpm
3 in	250 gpm	354 gpm	433 gpm	500 gpm	559 gpm	612 gpm	661 gpm	707 gpm
4 in	445 gpm	629 gpm	770 gpm	889 gpm	994 gpm	1089 gpm	1176 gpm	1257 gpm
5 in	695 gpm	982 gpm	1203 gpm	1389 gpm	1553 gpm	1701 gpm	1837 gpm	1964 gpm
6 in	1000 gpm	1414 gpm	1732 gpm	2000 gpm	2236 gpm	2449 gpm	2646 gpm	2828 gpm
7 in	1361 gpm	1925 gpm	2357 gpm	2722 gpm	3043 gpm	3333 gpm	3601 gpm	3849 gpm
8 in	1777 gpm	2514 gpm	3078 gpm	3555 gpm	3974 gpm	4354 gpm	4702 gpm	5027 gpm
9 in	2249 gpm	3181 gpm	3896 gpm	4499 gpm	5030 gpm	5510 gpm	5951 gpm	6362 gpm
10 in	2777 gpm	3927 gpm	4809 gpm	5553 gpm	6209 gpm	6802 gpm	7347 gpm	7854 gpm

- **45 strokes per minute**
- 56 strokes per minute
- 87 strokes per minute
- 98 strokes per minute

Note:

The pump must deliver approximately 45 strokes per minute to match the flooding rate and prevent the bilge from rising, based on a calculated inflow of 192 gallons per minute through a likely 2-inch rupture at a 6-foot head.

2. If deck cargo is carried, it should be stowed so that it _____.

- is not higher than 12 inches above the deck
- will be easily visible from the bridge
- **does not block access to the fire station hydrant**
- will cover less than 25 percent of deck space

Note:

Deck cargo must be stowed to ensure unobstructed access to firefighting equipment, specifically fire station hydrants, to maintain immediate readiness in emergency situations.

3. Before entering any space that has been sealed, its oxygen level should be tested. What level of oxygen in the space is equal to fresh air?

- 10.0%
- 15.8%
- **20.8%**
- 25.8%

Note:

Fresh air contains approximately 20.8% oxygen by volume; therefore, a space should have 20.8% oxygen to be considered equivalent to fresh air.

4. How does good housekeeping prevent fires on a vessel?

- Allowing better access in an emergency
- Improving personnel qualifications
- **Eliminating potential fuel sources**
- Eliminating trip hazards

Note:

Good housekeeping prevents fires by eliminating potential fuel sources, directly addressing the 'fuel' component of the fire triangle. Fire prevention focuses on controlling fuel and ignition sources, and good housekeeping practices like cleaning spills and properly storing combustibles reduce the risk of fire ignition or spread. Options related to emergency access, personnel qualifications, and trip hazards address safety and response, not primary fire prevention.

5. A burning mattress is considered as which of the following classes of fire?

- **Class "A"**
- Class "B"
- Class "C"
- Class "D"

Note:

A burning mattress is classified as a Class A fire because it is composed of ordinary combustible solids like cloth and foam, which aligns with the definition of Class A fires involving materials such as wood and paper.

6. A fire in a pile of dunnage would be classified as a _____.

- **class "A"**
- class "B"
- class "C"
- class "D"

Note:

Dunnage, typically wood, is an ordinary combustible material and therefore classified as a Class A fire, which involves wood, paper, textiles, and rubbish.

7. A class "D" fire would involve the burning of _____.

- diesel oil
- **magnesium**
- dunnage
- electrical insulation

Note:

Class D fires involve combustible metals; magnesium is a combustible metal.

8. A magnesium fire is classified as class _____.

- Class A
- Class B
- Class C
- **Class D**

Note:

Magnesium fires are classified as Class D because magnesium is a combustible metal. Class D fires specifically involve combustible metals like magnesium, while Class A covers ordinary combustibles, Class B covers flammable liquids and gases, and Class C covers energized electrical equipment.

9. The process that occurs when heat is generated by a chemical reaction within a substance and continues to a point of ignition is known as _____.

- **spontaneous combustion**
- chemical combustion
- radiation ignition
- chemical ignition

Note:

Spontaneous combustion is the correct term; it describes ignition resulting from heat generated by internal chemical reactions without an external ignition source. This process occurs when heat buildup exceeds dissipation, leading to ignition temperature. The term distinguishes itself from other options by specifically denoting self-heating and ignition without external factors, unlike chemical combustion, radiation ignition, or chemical ignition.

10. Which of the conditions listed is necessary for a substance to burn?

- The temperature of the substance must be equal to or above its fire point
- The mixture of vapors with air must be between the LEL and the UEL
- The air must contain oxygen in sufficient quantity
- **All of the above**

Note:

Combustion requires sufficient heat to reach the fire point, a vapor/air mixture within the explosive limits (LEL and UEL), and adequate oxygen. Therefore, all listed conditions are necessary for a substance to burn.
