

Chem 2



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BUSTER**

Multiple choice questions may have more than one correct answer. Indicate all that apply. Assign the hazard or division for each of the following and explain what the primary hazard is for each compound.

a) Diborane

b) Ethylamine

c) Fluorine, compressed gas

d) Benzyl chloride

Answer:

a) Diborane is of the hazard class 2.3 (Poisonous Gas). It is poisonous to the extent that it poses a health hazard.

b) Ethylamine is of the hazard class 2.1 (Flammable gas). It ignites when it comes in contact with fire.

c) Fluorine is of the hazard class 2.3 (Poisonous gas). It poses a hazard if inhaled.

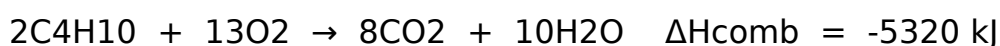
d) Benzyl chloride is of the hazard class 6.1 (Poison). It is toxic to humans on being ingested or on coming into contact with skin.

2. Which is the better fuel on a per gram basis: butane (C₄H₁₀) or diethyl ether (CH₃CH₂OCH₂CH₃)? Show your calculations of ΔH for both combustion reactions.

From a greenhouse gas perspective, which is the better fuel? (less CO₂ released per kJ of heat produced).

Answer:

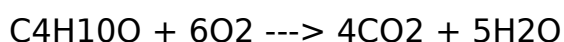
Butane



$\Delta H_{\text{c}} = -2660 \text{ kJ/mol}$ of butane combusted

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Diethyl Ether



$$\Delta H_c = -2732.1 \text{ kJ/mole}$$

The ratio of the number of moles of CO₂ produced for a kJ of heat is 0.

001503 for butane. For diethyl ether this value is 0.001464. Hence, less CO₂

is produced in case of diethyl ether per kJ of heat produced. Consequently,

from the greenhouse gas standpoint, diethyl ether is a better fuel.

4. You are shipping 50 gallons of spent nitric acid solution, of 40% strength.

Which of the following statements is not true?

- a) The container should be labeled as both a corrosive substance and as an oxidizer.
- b) The material can only be stored on the deck of a cargo vessel.
- c) There is no need to placard a vehicle transporting this material.
- d) You are not transporting a reportable quantity.

Answer:

a) and b) are false.

5. If a material fits into more than one hazard class, which one would take precedence?

- a) Corrosive
- b) Oxidizer
- c) Flammable gas
- d) Pyrophoric

Answer:

c) Flammable gas

6. Which of the following statements is true?

a) An accident involving transport of hazardous materials where a fatality is

involved must be reported as soon as possible, but within no more than 12 hours.

b) The accident mentioned above should be reported to the Federal Emergency Management Agency.

c) If the pesticide dichlorvos is transported by barge, it must be listed as a marine pollutant.

d) Diethyl zinc should be labeled as spontaneously combustible.

e) If a driver leaves his truck, he should make sure that the shipping papers are with him at all times.

f) It is not permissible to ship carbon monoxide cylinders on a passenger aircraft.

g) Anhydrous hydrazine should be labeled as a corrosive, flammable liquid and poison.

h) The reportable quantity for acetonitrile is 1000 lbs.

i) A flash point of 50 °C is rated by DOT as a combustible liquid.

Answer:

a), c), d), f), g), i) are true

7. A mixture of hydrogen and oxygen gas shows no apparent reaction at room temperature, yet it explodes when a match is lit. What is the correct explanation for this observation?

The activation energy for this reaction is so high that there is insufficient thermal energy at room temperature for the reaction to occur.

Molecular hydrogen and oxygen are more stable than water at room temperature.

Unless the concentrations of hydrogen and oxygen are in the ratio of 2:1 respectively, no reaction takes place, between them.

The reaction is exothermic at higher temperatures, but endothermic at room temperature.

Answer: The activation energy for this reaction is so high that there is insufficient thermal energy at room temperature for the reaction to occur.

8. This incident actually occurred in Somerville, Massachusetts in 1980 injuring 480 people. A railcar placarded 1809 is involved in an accident and the contents of the car begin leaking. The liquid is headed towards storm drains and so firefighters apply water to the spilled liquid creating a tower of noxious fumes hundreds of feet high which the wind was blowing towards Boston and Cambridge. Ultimately 17, 000 people were evacuated.

a) What is the chemical in the tank car?

b) Write a balanced chemical equation for the reaction of the chemical with water.

c) What types of health effects would you expect from exposure to both the leaking material from the tank car and from the products resulting from application of water?

Answer:

a. phosphorous trichloride

b. $\text{PCl}_3 + 3 \text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_3 + 3 \text{HCl}$

c. Phosphorus trichloride is toxic, but when it is exposed to water, the products that result come in contact with the skin and this can produce burns.

9. Give an example of a pyrophoric material from the Hazardous Materials Table.

Answer:

Phosphorus is a pyrophoric substance.

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10. If you are shipping a solid material that contains mercury of an unknown composition, what would the proper shipping name be?

Answer:

Mercury compounds, solid, n. o. s.

11. You are transporting a cylinder of phosphine. What is the shipping description? If there is an accident and the contents of the cylinder are released, what could you expect? If the accident happens at night, how far downwind should you protect people?

Answer:

Proper Shipping Name: Phosphine

Hazard Class: 2. 3

Identification Number: UN 2199

Shipping Label: POISON GAS, FLAMMABLE GAS

If an accident occurs we can expect a fire hazard or poisoning by inhalation.

For a small spill at night, 1. 9miles, and for a large spill at night, 6 miles, people downwind should be protected

12. Which of the following labels would not be correct?

a)lead dioxide – dangerous when wet

b)bromine – flammable liquid

c)picric acid wetted with less than 30% water – mass explosion hazard

d)carbon dioxide – flammable gas

Answer:

a) , b) , d) are incorrect.

13. Based upon packing group, which of the following pose the greatest risk in transportation?

a)Sulfuric acid

b)Elemental mercury

c)Lead dioxide

d)Aluminum hydride

Answer: d) Aluminium hydride.