

Sustainability Profiles in General Chemistry

Test Bank

SIMPLE SUBSTANCES

GREENHOUSE GASES

Which of the following statements about greenhouse gases is FALSE?

- A. Atmospheric gases that can absorb IR radiation are greenhouse gases because they absorb some of the IR radiation that would otherwise be radiated back into space.
- B. CO_2 and CH_4 are nonpolar molecules that can absorb IR radiation, causing them to have a temporary dipole.
- C. Because of the Earth's natural greenhouse effect, Earth is warm enough to allow water in the liquid phase and life as we know it to exist.
- D. Increasing concentrations of greenhouse gases such as CO_2 and CH_4 causes increased absorption of IR radiation and higher average temperatures.
- E. O_2 and N_2 are greenhouse gases because they have strong dipole-dipole forces.**

What kind of light is absorbed by greenhouse gases like CO_2 to cause warming of the atmosphere?

- A. visible
- B. ultraviolet
- C. infrared**
- D. microwaves
- E. x-rays
- F. radio waves

Which statement about the greenhouse effect is false?

- A. O_2 and N_2 are greenhouse gases because they are polar molecules.**
- B. Greenhouse gases raise the Earth's temperature by absorbing outgoing IR radiation from the Earth's surface.
- C. Burning fossil fuels increases the concentration of CO_2 in the atmosphere because combustion reactions produce CO_2 .
- D. Naturally occurring levels of greenhouse gases keep the Earth warm enough for liquid water to exist, along with plant and animal life.
- E. Human activity has led to higher levels of greenhouse gases and higher global temperatures.

FOSSIL FUEL COMBUSTION AND CO₂ EMISSIONS

What category of fuels make up most of the world's energy use?

- A. Nuclear
- B. Fossil fuels**
- C. Solar and wind
- D. Hydroelectric
- E. Biofuels

Which of the following is a combustion reaction?

More than one answer is possible. Select all of the correct answers.

- A. CH₄(g) + 2 O₂(g) → 2 H₂O (l) + CO₂(g)**
- B. (NH₄)₃PO₄(aq) + 3 CuNO₃(aq) → Cu₃PO₄(s) + 3 NH₄NO₃(aq)
- C. KOH (aq) + HNO₃(aq) → H₂O (l) + KNO₃ (aq)
- D. 2 C₈H₁₈(g) + 25 O₂(g) → 16 CO₂(g) + 18 H₂O(g)**
- E. C₂₅H₅₂(s) + 38 O₂(g) → 25 CO₂(g) + 26 H₂O(l)**

NO_x AND SO_x

Which of the following statements is true regarding NO_x and SO_x gases?

- i. NO_x gases are predominantly formed because of the use of internal combustion engines in industry and motor vehicles.**
- ii. NO is predominantly formed by sunlight allowing N₂ and O₂ to react.
- iii. NO is predominantly formed by lightning.
- iv. SO_x gases are associated with ozone (O₃) formation.
- v. NO_x and SO_x gases are not formed as the result of human activities.

AMMONIA

Which of the following are important applications of modern day ammonia (NH₃) production?

- i. Alternative fuel to replace fossil fuels**
- ii. Manufacturing of fertilizers**
- iii. A refrigerant to replace chlorofluorocarbons (CFCs)
- iv. Production of explosives

- A. i & iii B. i & iv C. ii & iii **D. ii & iv** E. i & ii

The main environmental risk of excess accessible nitrogen from the Haber-Bosch process is

- i. a build up of naturally explosive materials
- ii. dead zones caused by algal blooms
- iii. N₂O (a potent greenhouse gas) emissions**
- iv. oversupply of bat guano

Which of the following are important uses of ammonia (NH₃)? More than one answer is possible. All correct answers must be given in order to receive full credit.

- A. Fertilizing manufacturing**
- B. Explosives manufacturing**
- C. Industrial synthesis of hydrochloric acid (HCl)
- D. Desalination of water
- E. Water purification

ACID RAIN

Which of the following is a true statement about acid rain?

- A. SO_x from burning high sulfur coal in power plants and from smelting in a metal refinery can be removed by reacting the smokestack gases containing them with compounds like CaCO₃.**
- B. Lakes made acidic from acid rain improve life for organisms that live there.
- C. Ozone (O₃) and chlorofluorocarbons (CFCs) contribute to acid rain
- D. Normal rainwater has a neutral pH.
- E. Acid rain comes from nuclear power plants.

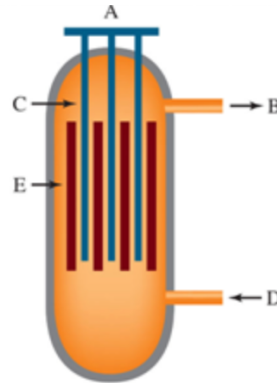
OCEAN ACIDIFICATION

What is the main cause of ocean acidification?

- i. Carbon dioxide gas in the atmosphere dissolving into the ocean.**
- ii. Increasing pressure of oxygen gas over the ocean.
- iii. Changes in climate patterns.
- iv. Precipitation of calcium carbonate in the ocean.
- v. The increase of global temperatures.

NUCLEAR REACTORS

The schematic below represents the reactor core of a nuclear power plant. Which of the choices below correctly match the description with part shown in the diagram?



- i. cooling water out of the core
- ii. control rod
- iii. cooling water into the core
- iv. fuel rod

1. **B...i; C...ii; D...iii; E...iv**
2. B...iii; C...ii; D...i; E...iv
3. B...i; C...iv; D...iii; E...ii
4. B...ii; C...i; D...iii; E...iv
5. B...i; C...ii; D...iv; E...iii

What are the main pros (arguments for) for nuclear power?

- i. No CO₂ is emitted
 - ii. Nuclear power can be produced 24/7 unlike wind and solar.
 - iii. Nuclear power is very energy dense.
 - iv. There have been no incidents of nuclear power plant accidents.
 - v. The waste from nuclear power plants is harmless.
 - vi. The technology for making nuclear power plants is similar to the technology used for making nuclear weapons.
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- A. iv, v, and vi
 - B. i, iv, and v
 - C. i, ii, and iii**
 - D. i and ii
 - E. vi only

What happened when the experimental Integral Fast Reactor (IFR), a fourth generation liquid sodium cooled reactor that has passive safety features, lost electrical power to its safety features and overheated?

A. It shut down with no operator action

- B. Hydrogen gas was produced from overheated coolant and it exploded
- C. Diesel-powered secondary cooling systems kicked in
- D. An explosion similar to detonating a nuclear bomb
- E. The core melted and started to melt the earth beneath it (sometimes called the China syndrome assuming the meltdown would make its way to the other side of the planet)

What role does the nuclear reaction play in a nuclear power plant?

A. Heat from the nuclear reaction boils water.

- B. Radiation from the nuclear reaction turns a turbine.
- C. A nuclear transducer converts radiation to electricity similar to the way a solar panel works.
- D. Hydrogen is produced when the nuclear fuel comes in contact with water. Exploding hydrogen drives an engine similar to a car engine.
- E. Nuclear reactions produce a vacuum; fast moving air results as air is sucked in to replace the evacuated region. The fast moving air turns a turbine.