

- Explain what is meant by nuclear fission and nuclear fusion, and give an example of each.
- A glassblower has a tank of methane that she uses to repair glassware. At the start of the day the tank contains 500 moles of methane, CH₄, at a pressure of 510 atm. At the end of the day the pressure in the same tank is 320 atm. and the temperature has not changed. How many moles of methane has the glassblower used that day? (R = 0.0821 Latm/mol.K). [Answer: 186 moles]
- Complete the following nuclear reaction by adding mass numbers to each species and identifying X:

$$^{239}\text{Pu} + {}^1_0\text{n} = {}^{90}\text{Sr} + \text{X} + 3 {}^1_0\text{n}$$
[Answer: X = ¹⁴⁷Ba]
- To convert 1 mole of liquid water to water vapor requires the input of 40.6kJ of energy. Calculate the number of kJ of energy to vaporize enough water (H₂O) to cover an area of 100m square to a depth of 2.0 cm. The density of water is 1.0g/cm³. [Answer: 4.5 x 10⁶ kJ.]
- Draw the complete structure and the line formula for 6 isomers of the hydrocarbon C₇H₁₄.
- A full nanotank in your futuristic vehicle can bind enough hydrogen to take you 500 km. Each mL of nanotubes in the tank has a mass of 3.5g and the total mass of nanotubes which totally fill the tank is 12.8kg. i) What is the volume of your tank in L. ii) What mass of nanotubes is needed to take you 10.0 km. [Answers: i) 3.7L; ii) 256 g.]
- Give an example of a practical electric cell (diagram essential); show the flow of electrons; and describe the chemical processes that generate its energy.
- Which example illustrates behavior of a real gas that differs from that of an ideal gas?
 - A helium balloon that seemed full when it was purchased looks deflated after being left in the car on a winter night.
 - Water vapor condenses into raindrops.
 - The tire pressure in your car is much higher at the end of a long drive than it was when you started.
 - A "space bag" allows storage of folded clothing in a very small space because air is removed from the bag. Answer: B
- Select the set of terms that best describes the behavior of the particles in a liquid.
 - far apart; complete freedom of motion; spread to fill container
 - close together; some freedom of motion; spread to fill container
 - close together; some freedom of motion; shape of container, with definite volume
 - tightly packed together; complete freedom of motion; definite shape and volume
 - tightly packed together; no freedom of motion; definite shape and volume
Answer: C
- On a chilly morning, you enter the lab, put on your safety glasses, and open a bottle labeled "pure acetic acid." In addition to the liquid you expected to see, you observe white crystals in the bottle and a strong odor of vinegar. Which phases of matter are present in the container?
 - solid and liquid
 - solid, liquid, and gas
 - gas and solid
 - gas only
 - liquid and gas
Answer: B
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Pressure is defined as force per unit area, and it is affected by

 - the number of collisions between molecules and the walls of the container.
 - the force of the collisions between molecules and the walls of the container.
 - the strength of the attractions between the molecules of the gas.
 - the strength of the attractions between the molecules of the gas and the walls of the container.
 - III and IV only
 - I and II only
 - I and III only
 - None of these.
 - All of these.
Answer: B
- Polyesters and nylons are called **copolymers** because

- A) they are produced from chemical reactions between two different monomers.
- B) when used as fibers they are always combined with some other fiber.
- C) each monomer unit is chemically unreactive.
- D) the monomer units will only react in the presence of some other molecule, a cooperating molecule.
- E) None of these explanations is correct.

Answer: A

13. The carbon atom in a ketone functional group is

- A) slightly negative.
- B) slightly positive.
- C) strongly negative.
- D) strongly positive.
- E) neutral.

Answer: B

14. Polymers that can be chemically broken down into simpler molecules by the action of sunlight or naturally-occurring microorganisms are described as _____ polymers.

- A) thermoplastic
- B) thermosetting
- C) biodegradable
- D) crystallite
- E) cross-linked

Answer: C

15. Which sentence(s) correctly describes differences between chemical reactions and nuclear reactions?

- A) In a chemical reaction electrons are rearranged, but in a nuclear reaction the number of protons and/or neutrons in a nucleus may change.
- B) In a chemical reaction electrons are rearranged, but in a nuclear reaction only the number of protons in a nucleus may change.
- C) In a chemical reaction the protons and/or neutrons are rearranged, but in a nuclear reaction the electrons are rearranged.
- D) Nuclear reactions occur only with atoms having fewer than 56 protons, but chemical reactions can occur with any element.
- E) Chemical reactions involve much smaller amounts of energy than nuclear reactions.

Answer: A

16. The mass number of an atom is

- A) the sum of the number of protons and neutrons.
- B) the sum of the number of protons and electrons.
- C) the decimal number found below the atomic symbol on most Periodic Tables.
- D) the number of protons in an atom.
- E) the same as the atomic number of an atom.

Answer: A

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The atomic symbol for an element is ${}^{247}_{96}\text{Cm}$. An atom of this element contains _____ protons, _____ electrons, and _____ neutrons.

- A) 96, 96, 151
- B) 96, 96, 247
- C) 151, 151, 96
- D) 247, 247, 96
- E) 247, 151, 96

Answer: A

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High energy radiation produced in many nuclear reactions is known as _____.

- A) alpha rays
- B) beta rays
- C) gamma rays
- D) fusion rays
- E) fission rays

Answer: C

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