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Question: 1

If an atom's outer shell is filled, what must be true?

- A. It reacts with other atoms through chemical reactions.
- B. It exchanges electrons to form bonds with other atoms.
- C. It has 32 electrons in its outer shell.
- D. It is a stable atom.

Answer: D

Explanation:

It is a stable atom. If an atom's outer shell is filled, it is a stable atom. The outer shell refers to one of many energy levels, or shells, that electrons occupy around a nucleus. An atom whose outer shell is not filled wants to become stable by filling the outer shell. It fills its outer shell by forming bonds. The atom can do this by gaining electrons or losing electrons in ionic compounds, or if the atom is a part of a molecule, by sharing electrons. If an atom has a full outer shell, such as the noble gases, it does not readily react with other atoms and does not exchange electrons to form bonds. These atoms are known as inert. Therefore, Answers A and B cannot be true. Answer C, having 32 electrons in its outer shell, is not necessarily true because not all elements have the fourth shell that can hold 32 electrons. Some have fewer shells that hold fewer electrons.

Question: 2

Which type of nuclear process features atomic nuclei splitting apart to form smaller nuclei?

- A. Fission
- B. Fusion
- C. Decay
- D. Ionization

Answer: A

Explanation:

Fission is a nuclear process where atomic nuclei split apart to form smaller nuclei.

Nuclear fission can release large amounts of energy, emit gamma rays and form daughter products. It is used in nuclear power plants and bombs. Answer B, Fusion, refers to a nuclear process whereby atomic nuclei join to form a heavier nucleus, such as with stars. This can release or absorb energy depending upon the original elements. Answer C, Decay, refers to an atomic nucleus spontaneously losing energy and emitting ionizing particles and radiation. Answer D, Ionization, refers to a process by which atoms obtain a positive or negative charge because the number of electrons does not equal that of protons.

Question: 3

Electrons with greater amounts of energy are found _____ the nucleus than electrons with less energy.

- A. closer to
- B. farther from
- C. more often inside
- D. more randomly around

Answer: B

Explanation:

Electrons with greater amounts of energy are found farther from the nucleus than electrons with less energy. The principle quantum number describes the level or shell that an electron is in. The lower the number, the closer the electron is to the nucleus and the lower it is in energy.

Question: 4

The process whereby a radioactive element releases energy slowly over a long period of time to lower its energy and become more stable is best described as

- A. combustion
- B. fission
- C. fusion
- D. decay

Answer: D

Explanation:

The process whereby a radioactive element releases energy slowly over a long period of time to lower its energy and become more stable is best described as decay. The nucleus undergoing decay, known as the parent nuclide, spontaneously releases energy most commonly through the emission of an alpha particle, a beta particle, or a gamma ray. The changed nucleus, called the daughter nuclide, is now more stable than the parent nuclide, although the daughter nuclide may undergo another decay to an even more stable nucleus. A decay chain is a series of decays of a radioactive element into different more stable elements.

Question: 5

Which of the following is a type of simple machine?

- A. A bicycle
- B. A pair of scissors

- C. A screw
- D. A shovel

Answer: C

Explanation:

A screw is a type of simple machine. A screw is an inclined plane wrapped around a shaft. A wedge is also an inclined plane. A compound machine is a machine that employs two or more simple machines. Answer A, a bicycle, is a compound machine, consisting of a combination of the simple machines: wheels, levers, pulleys and wedges (used as stoppers). Answer B, a pair of scissors, is also a compound machine consisting of wedges (the blades) that pivot on a lever. Answer D, a shovel, is a compound machine consisting of a lever (the handle) and a wedge (the head of the shovel).

Question: 6

In which of the following scenarios is work not applied to the object?

- A. Mario moves a book from the floor to the top shelf.
- B. A book drops off the shelf and falls to the floor.
- C. Mario pushes a box of books across the room.
- D. Mario balances a book on his head and walks across the room.

Answer: D

Explanation:

Mario balances a book on his head and walks across the room. In this example, work is not applied to the book by Mario. Work is defined as a force acting on an object to cause displacement. In this case, the book was not displaced in the direction of the force applied to it. Mario's head applied a vertical force to the book. By moving horizontally across the room, the movement of the book was not in the direction of the force applied. Therefore, there was no work applied to the book by Mario. In Answer A, Mario moves a book from the floor to the top shelf. Mario lifted the book vertically, in the same direction as the force applied. Therefore, work was done. In Answer B, A book drops off the shelf and falls to the floor, gravity has acted as the force and work was done. In Answer C, Mario pushes a box of books across the room. is also an example of work.

Question: 7

A ball is resting on the front end of a boat. The boat is moving straight forwards toward a dock. According to Newton's First law of motion, when the front of the boat hits the dock, how will the ball's motion change?

- A. The ball will remain at rest.
- B. The ball will move backwards.
- C. The ball will move forwards.
- D. The ball will move sideways.

Answer: C

Explanation:

The ball will move forwards. Newton's First law of motion states that an object in motion tends to stay in motion until a force acts to change it. The ball is moving forward with the boat. When the front of the boat hits the dock, the ball's motion does not change. It continues to move forward because the force acting to stop the boat is not acting upon the ball. The forward motion of the boat is halted by the dock. The forward motion of the ball is not stopped. Since the ball is round there is little friction to provide an equal and opposite reaction to the forward motion.

Question: 8

What two things are required for circular motion to occur?

- A. Acceleration and centripetal force
- B. Acceleration and gravitational force
- C. Constant speed and centripetal force
- D. Constant speed and gravitational force

Answer: A

Explanation:

Acceleration and centripetal force are required for circular motion to occur. Acceleration is defined as a change in direction of velocity. Centripetal force is toward the center, or inward force. Answer B, Acceleration and gravitational force, is incorrect because the force of gravity is not required for circular motion. Answer C, Constant speed and centripetal force, is also incorrect as constant speed is not required for circular motion to occur. Speed can vary and circular motion can still occur. Answer D, Constant speed and gravitational force is also incorrect as constant speed nor gravitational force are required for circular motion to occur.

Question: 9

According to Bernoulli's Principle, where will a gas flowing through a pipe exert the least amount of pressure?

- A. Where the pipe is widest
- B. Where the pipe is narrowest
- C. Where its velocity is lowest
- D. Where its kinetic energy is lowest

Answer: B

Explanation:

Where the pipe is narrowest. A fluid, either a gas or a liquid, will flow faster through a narrow section of a pipe than a wider section of pipe. Bernoulli's Principle says that the faster a fluid flows, the

less pressure the fluid exerts, Therefore. a fluid will exert a lower amount of pressure in the narrow section of pipe. A fluid moving through the pipe has the same flow throughout the wider and narrow portions. This means that the same volume and mass of fluid must go a specific distance in a certain amount of time. In a narrow portion of pipe, there is less area for the same volume and mass of fluid to flow, so the fluid must move faster to maintain the same flow as in the wider portion of pipe. A fluid moving faster through a narrow portion of pipe will exert less pressure and a fluid moving slower through a wide section of pipe will exert a greater pressure.

Question: 10

If a glass rod is rubbed with a cloth made of polyester, what will the resulting charge be on each material?

- A. The charge on the glass rod is positive and the charge on the cloth is negative.
- B. The charge on the glass rod is negative and the charge on the cloth is positive.
- C. The charge on the glass rod is neutral and the charge on the cloth is positive.
- D. The charge on the glass rod and the cloth both become neutral.

Answer: A

Explanation:

The charge on the glass rod is positive and the charge on the cloth is negative when the glass rod is rubbed with a cloth made of polyester. This is an example of static electricity — the collection of electrically charged particles on the surface of a material. A static charge can be quickly discharged, commonly called a "spark", or discharged more slowly by dissipating to the ground. A static charge occurs because different materials have a capacity for giving up electrons and becoming positive or for attracting electrons and becoming negative. The triboelectric series is a list of materials and their propensities for either giving up electrons to become positive or to gain the electrons to become negative. Polyester has a tendency to gain electrons to become negative and glass has a tendency to lose electrons to become positive.

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