R. Reference 8
CRCT Review Pts

Final Review Notes

Chemistry

The atom is composed of protons, neutrons, and electrons. A molecule is a group of two or more atoms held together by chemical bonds.

Compounds are formed by chemically combining two or more different elements in a set ratio. A mixture is made of two or more substances that are together in the same place but are not chemically combined.

When elements are chemically combined, they form compounds having properties that are different from those of the uncombined elements.

In liquids, the atoms and molecules are more loosely connected and can collide with and move past one another. In gases, the atoms and molecules are free to move independently, colliding frequently.

For any given substance, the relative freedom of motion of its atoms or molecules increases from liquid to gas.

A physical property of a pure substance is a characteristic that can be observed without changing it into another substance. A chemical property is a characteristic of a pure substance that describes its ability to change into other substances.

The density of a substance is the same for all samples of that substance.

The physical properties of metals include luster, malleability, ductility, and conductivity.

Most nonmetals are poor conductors of electric current and heat. Solid nonmetals are dull and brittle.

A substance that undergoes a physical change is still the same substance after the change. Chemical changes produce new substances with properties different from those of the original substances.

Chemical reactions are usually exothermic (meaning they give off heat) or endothermic (meaning they absorb heat).

The periodic table of the elements gives you information about the number of protons, neutrons, and electrons in the atom of each element.

The atomic number of an element is the number of protons in the nucleus. Each isotope of an element has a different but specific number of neutrons in the nucleus.

The properties of an element can be predicted from its location in the periodic table.

The reactivity of metals tends to decrease as you move from left to right across the periodic table.

In chemical reactions, the number of atoms stays the same no matter how they are arranged. So, their total mass stays the same.

Energy

When energy is converted from one form to another, energy is not created or destroyed. Energy is conserved.

Potential energy is the energy of position or shape. Kinetic energy is the energy of motion. In a pendulum, energy is converted between potential energy and kinetic energy.

Within any closed system, the amount of energy stays constant. In all known processes, some energy is converted to heat. Matter can change from one state to another if thermal energy is absorbed or released. For example, absorbing heat can cause a solid to melt.

Kinetic energy is the energy of motion. The kinetic energy of an object depends on the object's mass and on its velocity.

Potential energy is stored energy that results from the position or shape of an object. There are two types of potential energy. Gravitational potential energy depends on height and weight. Elastic potential energy is associated with stretched or compressed objects. An object's gravitational potential energy can be calculated using the formula: Gravitational potential energy = Weight Height

Energy comes in many different forms. Mechanical energy is associated with the position and motion of an object. Other forms of energy associated with the particles of objects include thermal, electrical, chemical, nuclear, and electromagnetic energy.

Heat can be transferred through conduction, convection, and radiation. Gases are good insulators. Double-pane windows use air to slow heat transfer. The vacuum layer in a thermos slows heat transfer.

Convection is the process that transfers heat by the movement of currents within a fluid. A convection current occurs when a heated fluid rises and is replaced by a cooler fluid. Convection currents can be used to transfer heated air throughout a building.

Conduction is the transfer of thermal energy with no overall transfer of matter. Conduction occurs within a material or between materials that are touching. Conduction in gases is slower than in liquids and solids because the particles in a gas collide less often.

Radiation is the transfer of energy through space without the help of matter to carry the energy. All objects radiate energy. As an object's temperature increases, the rate at which it radiates energy increases. The sun's energy is transferred to Earth by the process of radiation.

Force and Motion

The average speed of an object is the total distance it traveled divided by the total time elapsed. Velocity is speed in a given direction.

The equation relating distance (*d*), time (*t*), and average speed (*v*) is: Speed = distance / time

A change in velocity can involve a change in either speed or direction-or both.

Acceleration = Final Vel - Initial Vel / Time

Acceleration refers to increasing speed, decreasing speed, or changing direction.

The slope of a distance-versus-time graph represents the speed of an object.

The slope of a line on a speed-versus-time graph represents acceleration. A horizontal line on a speed-versus-time graph indicates an object moving with constant speed.

The combination of all forces acting on an object is the net force. The net force determines whether an object moves and in which direction it moves.

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The gravitational force exerted on a person or object is known as weight. The magnitude of the force of friction depends on the types of surfaces involved and on how hard the surfaces push together.

Inertia is the tendency of an object to resist a change in motion.

Newton's first law of motion states that an object will remain at rest or moving at a constant velocity unless it is acted upon by an unbalanced force.

Newton's second law of motion states that acceleration depends on the net force acting on the object and on the object's mass. Acceleration = Net Force / Mass

Net force = Mass X Acceleration

An object more dense than a fluid will sink in that fluid.

There are six basic kinds of simple machines: the inclined plane, the wedge, the screw, the lever, the wheel and axle, and the pulley.

A lever is a rigid bar that is free to rotate around a fixed point (the fulcrum). First-class levers always change the direction of the input force. Second-class levers increase force, but do not change its direction. Third-class levers increase distance, but do not change the direction of the input force.

A wheel and axle is a simple machine that consists of two disks or cylinders fastened together that rotate around a common axis. The object with the larger axis is called the wheel and the object with the smaller axis is called the axle.

A pulley is a simple machine made of a grooved wheel with a rope or a cable wrapped around it. A fixed pulley changes the direction of a force but not the amount of force applied.

A movable pulley decreases the amount of input force needed but not the direction of the force.

Waves

Waves are disturbances that transfer energy from place to place.

Transverse waves move the particles in a medium at right angles to the direction in which the waves travel.

Longitudinal waves move the particles parallel to the direction in which the waves travel.

Waves that require a medium through which to travel are called mechanical waves.

Light is a form of electromagnetic radiation, as are radio waves, X-rays, and gamma rays.

The electromagnetic spectrum shows the forms of radiation in order of increasing frequency and decreasing wavelength.

The color of visible light goes from red to violet as frequency increases.

Sunlight has a variety of wavelengths and includes visible, ultraviolet, and infrared rays.

An electromagnetic wave is a transverse wave made up of changing electric and magnetic fields.

Like mechanical waves, electromagnetic waves carry energy that can be transferred when they interact with matter.

Unlike mechanical waves, electromagnetic waves do not require a medium through which to travel.

When a wave hits a surface through which it cannot pass, it bounces off, or is reflected.

The angle of incidence is equal to the angle of reflection for all waves and reflecting surfaces.

When a wave moves from one medium into another medium at an angle, it changes speed, which causes it to bend, or be refracted.

Light reflected from objects makes the objects visible.

Regular reflection occurs when parallel rays of light strike a smooth surface.

Diffuse reflection occurs when parallel rays of light strike an uneven surface.

Refraction is the bending of light that occurs when light passes into a new medium.

The more the light bends when it enters a new medium, the higher the index of refraction.

The primary colors of light are red, green, and blue. When combined in equal amounts, they produce white light.

The primary colors of pigments are cyan, yellow, and magenta. When combined in equal amounts, they produce black pigment.

Secondary colors are combinations of two primary colors of light or of pigment.

Mechanical waves, such as sound and seismic waves, are produced when a source of energy causes a medium to vibrate. Sound waves travel through the air; seismic waves travel through the earth's layers.

Electromagnetic waves, such as light, transfer electric and magnetic energy and do not need a medium to travel through.

Light waves travel faster in air than in water. They travel slower in glass than in water.

When light enters a medium where its speed changes, it bends. This is called refraction.

The index of refraction of a material is a measure of how much light bends when it enters that material. The amount light bends varies with wavelength.

Sound travels through a medium as longitudinal waves.

Longitudinal waves carry mechanical energy in the form of compressions of the particles of a medium.

All forms of sound, including speech and music, are formed by vibrations of physical media.

The Doppler effect is the apparent change in the pitch of a sound as the source or observer move relative to one another.

Radar devices use the Doppler effect to determine the speed of moving objects such as cars.

The Doppler effect is also used to study weather and the expansion of the universe.

A sonar device measures the time it takes to emit a sound wave and detect the reflected wave.

Ultrasound devices emit sound waves at frequencies many times higher than human hearing can detect.

Ultrasound devices create images of body organs. They emit sound waves into a body and then detect and measure the reflected waves.

Sound waves carry energy through a variety of media (including air, solids, and liquids) at different speeds.

Sound is a form of energy that travels as longitudinal waves through a vibrating material.

The pitch of a sound depends on the frequency of the wave. The loudness depends on the amplitude or height of the wave.

Wavelength is the distance between two corresponding parts of a wave.

Frequency is the number of complete waves that pass a certain point in a certain amount of time. It is measured in hertz (Hz), or number of waves per second.

The pitch of a sound that you hear depends on the frequency of the sound wave.

Amplitude is the maximum distance the particles of a medium carrying a wave move from their rest positions.

Magnetism

Magnets attract iron and materials that contain iron. Magnets attract or repel other magnets. In addition, one part of a magnet will always point north when allowed to swing freely.

Magnetic poles that are unlike attract each other, and magnetic poles that are alike repel each other.

Magnetic field lines spread out from one pole, curve around the magnet, and return to the other pole.

A spinning electron produces a magnetic field that makes the electron behave like a tiny magnet in an atom.

In a magnetized material, all or most of the magnetic domains are arranged in the same direction.

Magnets can be made, destroyed, or broken apart.

Just like a bar magnet, Earth has a magnetic field surrounding it and two magnetic poles.

Since Earth produces a strong magnetic field, Earth itself can make magnets out of ferromagnetic materials.

Earth's magnetic field affects the movements of electrically charged particles in space.

Electricity

Charges that are the same repel each other. Charges that are different attract each other.

An electric field is a region around a charged object where the object's electric force is exerted on other charged objects.

In static electricity, charges build up on an object, but they do not flow continuously.

There are three methods by which charges can be transferred to build up static electricity: charging by friction, by conduction, and by induction.

When a negatively charged object and a positively charged object are brought together, electrons transfer until both objects have the same charge.

To produce electric current, charges must flow continuously from one place to another.

A conductor transfers electric charge well. An insulator does not transfer electric charge well.
Voltage causes a current in an electric circuit.

The greater the resistance, the less current there is for a given voltage. The unit of measure of resistance is the ohm.

Volta built the first electric battery by layering zinc, paper soaked in salt water, and silver.

Chemical reactions occur between the electrolyte and the electrodes in an electrochemical cell.

These reactions cause one electrode to become negatively charged and the other electrode to become positively charged.

Ohm's law says that the resistance is equal to the voltage divided by the current.

All electric circuits have the same basic features.
First, circuits have devices that are run by electrical energy. They are represented as resistors in a circuit. Second, a circuit has a source of electrical energy. Third, electric circuits are connected by conducting wires.

In a series circuit, there is only one path for the current to take.

In a parallel circuit, there are several paths for current to take.

You can calculate power by multiplying voltage by current.
Power = Voltage × Current

The total amount of energy used by an appliance is equal to the power of the appliance multiplied by the amount of time the appliance is used.
Energy = Power × Time