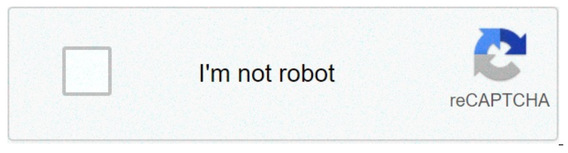

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4.1 chemical energy and atp worksheet answers

By the end of this section, you will be able to: Explain what metabolic pathways have been the first and second law of thermodynamics to explain the difference between kinetic and potential energy Describe endergonic and exergonic reactions Explain how enzymes as molecular catalysts watch a video heterotrophs.Scientists use of bioenergetics term to describe the concept of energy flow (Figure 4.2) through living systems, such as cells. cellular processes such as construction and decomposition of complex molecules occurs through gradual chemical reactions. Some of these chemical reactions are spontaneous energy and release, while others require energy to proceed. Just as living beings must continually consume food to replenish their energy supplies, the cells have to continuously produce more energy to replenish that used by many chemical reactions that require energy that constantly take place. Together, all the chemical reactions that take place within cells, including those that consume or produce energy, are referred to as the cell's metabolism. Consider the sugar metabolism. This is a classic example of one of many cellular processes that use and produce energy. Living beings consume sugars as a major energy source, © because the sugar molecules have a large amount of energy stored within their bonds. For the most part, photosynthetic organisms like plants produce these sugars. During photosynthesis, plants use the energy (originally from sunlight) to convert carbon dioxide (CO_2) into sugar molecules (such as glucose: $C_6H_{12}O_6$). They consume carbon dioxide and oxygen produced as a waste product. This reaction is summarized as: $6CO_2 + 6H_2O$ + energy -> $C_6H_{12}O_6 + 6O_2$ © Because this process involves synthesizing a molecule-storing energy, requires energy input to proceed. During the reactions in the light of the photosynthesis, the energy is supplied by a molecule called adenosine triphosphate (ATP), which is the primary energy currency of all cells. Just like the dollar is used as currency to buy assets, cells use ATP molecules as Currency energy to perform an immediate job. On the contrary, the energy storage molecules such as glucose are consumed only to be broken in order to use their energy. The reaction that harvests energy of a sugar molecule in the cells that need oxygen to survive you can sum up the reverse reaction to photosynthesis. In this reaction, oxygen is consumed and carbon dioxide is released as a waste product. The reaction is summarized as: $C_6H_{12}O_6 + 6O_2$ Â> $6CO_2 + 6H_2O$ + energy Both of these reactions involve many steps. The manufacturing processes and the breaking down of sugar molecules illustrate two examples of metabolic pathways. A metabolic pathway is a series of chemical reactions that take a molecule and modifies start, step by step, through a series of intermediate metabolites, eventually yielding a final product. In the example of sugar metabolism, the first pathway sugar synthesized from smaller molecules, and the other path is broken into smaller sugar molecules. These two opposing processesÃ ¢ the first and the second requires energy producing Energya paths are referred to as anabolic (building polymers) and catabolic (break down polymers in their monomers), respectively. As a result, the metabolism is composed of synthesis (anabolism) and degradation (catabolism) (Figure 4.3). They 'important to know that chemical reactions in metabolic pathways do not happen on their own. Each reaction step is facilitated, or catalyzed by a protein called a Enzymes are important to catalyze all kinds of organic reactions those that require energy as well as those that the energy of release. Paths, figure 4.3 catabolic are those that generate energy by distinguishing larger molecules. Anabolic paths are those that require energy to synthesize larger molecules. Both types of paths are needed to maintain the energy balance of the cell s. Thermodynamic thermodynamics the study of energy and energy transfer involving physical matter. The relevant question for a particular case of energy transfer is called a system, and everything outside of that matter is called the surroundings. For example, when heating a pot of water on the stove, the system includes the stove, the pot and the water. The energy is transferred within the system (between the stove, pot and water). There are two types of systems: open and closed. In an open system, energy can be exchanged with its surroundings. The hob © system is open because the heat can be lost in the air. A closed system can not exchange energy with its surroundings. Biological organisms are open systems. The energy is exchanged between them and their surroundings while using energy from the sun to perform photosynthesis or consume energy storage molecules and release energy to the environment doing the work and releasing the heat. Like all things in the physical world, energy is subject to physical laws. The laws of thermodynamics govern the transfer of energy in the universe and of all the systems. In general, energy is defined as the ability to work, or make some kind of change. Energy exists in different forms. For example, the electrical energy, the light energy and thermal energy are all different types of energy. To appreciate the way in which energy flows in and out from biological systems, it is important to understand two of the physical laws that govern energy. The first law of thermodynamics states that the total amount of energy in the universe is constant and preserved. In other words, there's always been, and always will be, exactly the same amount of energy in the universe. Energy exists in many different forms. According to the first law of thermodynamics, energy can be transferred from one place to another or transformed into different forms, but it can not be created or destroyed. Transfers and the energy transformations taking place all the time. The bulbs transform electrical energy into light and heat energy. The gas stoves convert chemical energy from natural gas in thermal energy. The plants are running one of the most biologically useful energy transformations on earth: to convert the energy of sunlight into chemical energy stored within organic molecules (Figure 4.2). Some examples of energy transformations are shown in Figure 4.4. The challenge for all living organisms is to get energy from their surroundings in ways that can transfer or transform it into usable energy to function. Living cells have evolved to meet this challenge. The chemical energy stored within organic molecules such as sugars and fats is transferred and transformed through a series of chemical reactions in cellular energy within molecules of ATP. The energy in ATP molecules is readily available to do the job. Examples of the types of work that the cells must include the construction of complex molecules, transporting materials, fueling the movement of cilia or flagella and contracting muscle fibers to create movement. Figure 4.4 are shown some examples of energy transferred and transformed from one system to another and from one form to another. The food we eat provides our cells with energy necessary to perform bodily functions, just like the light energy provides plants with the means to create the chemical energy they need. (Credit Ã ¢ ¬ "Creamice - Modification of the work of D. Sharon Pruitt; Credit Ã ¢ â,¬Å KidsÃ ¢ â ¬: Changing the work up by Providence; Credit Ã ¢ â,¬Å LaafÃ ¢ â ¬: Changing the Cory working Zanker) the primary tasks for the production, transformation and use of energy for the work may seem simple. However, the second law of thermodynamics says These tasks are more difficult than they are doing. All energy transfers and transformations are never completely efficient. In any energy transfer, a certain amount of energy is lost in an unusable form. In most cases, this form is thermal energy. Thermodynamically, thermal energy is defined as the energy transferred from one one To another who doesn't work. For example, when a light bulb is turned on, some of the energies converted from electricity into the light energy is lost as thermal energy. Likewise, some energy is lost as thermal energy during cellular metabolic reactions. An important concept in physical systems is the order and disorder. More energy is lost by a system for its surroundings, the least orderly and more random system is. Scientists refer to the measure of casuality or disorder within a system as an entropy. High entropy means high disturbance and low energy. Molecules and chemical reactions also have a variable entropy. For example, entropy increases as high concentration molecules in a widespread and widespread place. The second law of thermodynamics says that energy will always be lost as heat in energy transfers or transformations. The living things are highly ordered, requiring a constant energy entry to maintain in a state of low entropy. When an object is moving, there is energy associated with that object. Think of a demolition ball. Even a slow motion demolition ball can make a great amount of damage to other objects. The energy associated with moving objects is called kinetic energy (figure 4.5). An accelerator bullet, a person walking and the rapid movement of molecules in the air (which produces heat) all have kinetic energy. Now what happens if that same immobile demolition ball is raised two above ground stories with a crane? If the suspended demolition ball is a property, is there any energy associated with it? The answer is yes. The energy that has been requested to raise the demolition ball has not disappeared, but now it is stored in the demolition ball by virtue of its position and the strength of gravity acting on it. This type of energy is called potential energy (figure 4.5). If the ball falls, the potential energy would have been transformed into kinetic energy until all the potential energy was exhausted when the ball rested on the ground. Even the demolition balls oscillate as a pendulum; Through the swing, there is a constant change of potential energy (higher at the top of the swing) to kinetic energy (higher at the bottom of the swing). Other examples of potential energy include the energy of the water held behind a dam or a person in the process of Skydive from an airplane. Figure 4.5 still water has potential energy; Moving water, like in a waterfall or a sliding river, has kinetic energy. (Credit Ã ¢ â,¬ å "DamÃ ¢ â,¬: modification of the work of Ã ¢ â,¬ å" pascalÃ ¢ â,¬ / flickr; credit Ã ¢ â,¬ Ã ¢ â,¬ å "awaterfall": Modification of the work of Frank Gualtieri) is, potential energy is not only associated with the location of matter, but also with the structure of the subject. Even a ground spring has potential energy if it is compressed; so it makes an elastic Tense is pulled. At the molecular level, there are together the obligations that hold together the atoms of the molecules in a particular structure that has a potential energy. Remember that the anabolic cell trails require energy to synthesize complex molecules from the simpler and catabolic paths release Energy When complex molecules are divided. The fact that energy can be issued by the breakdown of some chemical bonds implies that such bonds have potential energy. In fact, there is a potential energy stored within the ties of all molecules Food we eat, which eventually exploited for use. This is because these obligations can release energy when broken. The potential energy type that exists within chemical bonds and is released when those obligations are broken, is called chemical energy. Chemical energy is responsible Provision of living cells with energy from food. The release of energy occurs when the molecular bonds within the food molecules are broken. Watch a video on Kilocalories. Visit the site and select Ã ¢ â,¬ "pendulumÃ ¢ â,¬ from the" work and energy "menu to see the movement of kinetic energy and potential of a moving pendulum. After learning that chemical reactions release energy when ties of energy storage are broken, a one Next question is the following: how is the energy associated with these quantified chemical reactions expressed? How can the energy released from a reaction be compared to that of another reaction? A free energy measure is used to quantify such energy transfers. We remind you that according to the second law of thermodynamics, all energy transfers involves the loss of a certain amount of energy in a form that can be used as heat. Free energy specifically refers to the energy associated with a chemical reaction that is available after losses are valued. In other words, free energy is usable energy, or energy that is available to do the job. If energy is released during a chemical reaction, then the variation of free energy, indicated as Ã ¢ g (delta g) will be a negative number. A negative clear energy variation also means that the reaction products are less free energy than reagents, because they release certain free energy during the reaction. The reactions that have a negative variation of free energy and consequently release free energy are called esoic reactions. Think: Esoician energy means is about to get out of the system. These reactions are also indicated as spontaneous reactions, and their products have less stored energy reagents. An important distinction must be traced between the spontaneous term and the idea of a chemical reaction that occurs immediately. Contrary to the daily use of the term, a spontaneous reaction is not the one that occurs suddenly or quickly. The iron rust is an example of a spontaneous reaction that occurs slowly, gradually, over time. If a chemical reaction absorbs energy, rather than issue energy to accounts, then the G for that reaction will be a positive value. In this case, the products have more free reagents energy. Therefore, the products of these reactions can be designed as molecules-storage energy. These chemical reactions are called ergonic reactions and are non-spontaneous. An endergonic reaction does not take place alone, without adding free energy. Figure 4.6 Some examples of ergonomic processes are shown (those who require energy) and esoic processes (those than the release energy). (Credit A: Natalie Maynor's work modification, Credit B: Modification of work from USDA, Credit C: Changing the work of Cory Zanker; Credit D: Modification of work from Harry Malsch) Look each of the processes indicated and decide If it is Endergonic or Esoorgonica. There is another important concept that must be considered as regards the ergonomic and esorgian reactions. Exergonic reactions require a small amount of energy to move forward before being able to proceed with their energy release steps. These reactions have a net energy release, but still require a certain energy input in principle. This small amount of energy supply needed for all chemical reactions that occurs is called activation energy. Watch an animation of movement from free energy transition of the reaction. A substance that helps a chemical reaction that occurs is called a catalyst, and the molecules that catalyze biochemical reactions are called enzymes. Most enzymes are protein â €