NCERT Solutions for Class 10 Science Chapter 14: NCERT Solutions for Class 10 Science Chapter 14 Sources of Energy explain the different types of energy we use, such as renewable and non-renewable sources.

The chapter discusses how energy is produced and why it is important to use environmentally friendly options like solar, wind, and water power. These solutions help students understand the concepts easily and think about how different energy sources affect the environment. The clear explanations and step-by-step answers make it easier for students to study and prepare for their exams.

NCERT Solutions for Class 10 Science Chapter 14 Sources of Energy Overview

NCERT Solutions for Class 10 Science Chapter 14 Sources of Energy have been prepared by the subject experts of Physics Wallah. These solutions provide a clear and detailed understanding of various energy sources, their advantages, and their impact on the environment.

The experts at Physics Wallah have ensured that the explanations are simple, making it easier for students to grasp complex concepts. This comprehensive guide helps students effectively prepare for their exams by offering accurate and well-structured answers to all the questions in the chapter.

NCERT Solutions for Class 10 Science Chapter 14 Sources of Energy PDF

NCERT Solutions for Class 10 Science Chapter 14 Sources of Energy are available in a downloadable PDF format. This PDF provides detailed explanations and answers to all the questions in the chapter making it a valuable resource for students preparing for their exams.

The solutions are easy to understand, helping students grasp the key concepts of different energy sources and their uses. You can access the PDF through the link provided below ensuring you have a reliable study aid at your fingertips.

NCERT Solutions for Class 10 Science Chapter 14 Sources of Energy

Here, we have provided NCERT Solutions for Class 10 Science Chapter 14 to help students prepare more effectively for their exams.

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Q1. What is a good source of energy?

Solution:

A good source of energy has the following properties:

- **Be economical:** It should be affordable and cost-effective.
- **Easy storage and transportation:** It should be easy to store and transport without significant loss or difficulty.
- **Easy availability:** It should be readily available and accessible.
- **High energy output:** The work done per unit volume or mass should be large, providing substantial energy for various uses.

Q2. What is good fuel?

Solution:

A good fuel is one that is easily available and produces a large amount of heat energy when burned. It should also be cost-effective, easy to store and transport, and cause minimal environmental impact.

Q3. If you could use any source of energy for heating your food, which one would you use and why?

Solution:

Natural gas would be an ideal choice for heating and cooking food because:

- It is easy to use.
- It is readily available.
- It can be transported easily.
- It burns cleanly, producing minimal smoke.
- It is highly inflammable, making it efficient for cooking.

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Q1. What are the disadvantages of fossil fuels?

Solution:

The disadvantages of fossil fuels include:

- Burning fossil fuels like coal and petroleum causes significant air pollution by releasing large amounts of pollutants.
- The release of gases like carbon dioxide during combustion contributes to global warming.
- The oxides of carbon, nitrogen, and sulfur released from fossil fuels can harm soil fertility and contaminate drinking water.

Q2. Why are we looking at alternate sources of energy?

Solution:

We are exploring alternate sources of energy because fossil fuels are non-renewable, meaning they exist in limited quantities and cannot be easily replenished. If we continue to consume fossil fuels at the current rate, they will eventually run out. To ensure a sustainable future, it is important to shift to alternative energy sources that are renewable and less harmful to the environment.

Q3. How has the traditional use of wind and water energy been modified for our convenience?

Solution:

Traditionally, wind energy was used through windmills for tasks like drawing water from wells. Today, windmills have been adapted to generate electricity. The kinetic energy of the wind turns the blades of the windmill, which in turn rotates a turbine connected to an electric generator, producing electricity.

Similarly, in the past, the natural flow of waterfalls was used to harness potential energy. Nowadays, with fewer natural waterfalls, we construct dams to store water at a height. When released, the water flows over turbines, converting potential energy into electricity. This modification allows us to efficiently generate electricity from both wind and water.

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14.3 ALTERNATE OR NON-CONVENTIONAL SOURCE OF ENERGY

Q1. What kind of mirror – concave, convex or plain – would be best suited for use in a solar cooker? Why?

Solution:

A concave mirror is best suited for use in a solar cooker. This is because a concave mirror can focus sunlight to a single point. When sunlight hits the curved surface of the concave mirror, it converges at a focal point, which increases the intensity of the heat at that spot. This concentrated heat is then used to cook food more efficiently by raising the temperature significantly.

Q2. What are the limitations of the energy that can be obtained from the ocean?

Solution:

The energy derived from the ocean, including tidal energy, wave energy, and ocean thermal energy, has several limitations:

Tidal Energy: The generation of tidal energy depends on the relative positioning of the Earth, the Sun, and the Moon. This positioning affects the strength and predictability of tides. Converting tidal energy into electricity requires the construction of high dams, which can be costly and environmentally impactful.

Wave Energy: To generate electricity from wave energy, very strong and consistent waves are needed. This can be challenging to achieve consistently, as wave strength varies with weather and seasonal changes.

Ocean Thermal Energy: Capturing ocean thermal energy requires a significant temperature difference between the warm surface water and the cold deep water. This temperature gradient must exceed 20°C to be effective, which may not be present in all locations.

Q3. What is geothermal energy?

Solution:

Geothermal energy is the heat energy that comes from within the Earth. It is obtained from the Earth's internal heat, which is stored in molten rocks and magma. This energy is harnessed from hot spots where molten rock or magma comes close to the Earth's surface, creating hot springs or steam. Geothermal power plants use this heat from hot springs or steam to generate electricity by converting it into mechanical and then electrical energy.

Q4. What are the advantages of nuclear energy?

Solution:

The advantages of nuclear energy include:

- **High Energy Output:** A large amount of energy is produced from a small amount of nuclear fuel. For example, fission of one atom of uranium can produce up to 10 million times more energy than burning one atom of carbon.

- **Low Pollution:** Nuclear energy does not produce air pollutants or greenhouse gases during operation, making it a cleaner energy source compared to fossil fuels.
- **Efficient Fuel Use:** Nuclear power plants have a high energy density, meaning they require less fuel compared to traditional energy sources to produce the same amount of energy.

14.4. ENVIRONMENTAL CONSEQUENCES

Q1. Can any source of energy be pollution-free? Why or why not?

Solution:

No source of energy can be completely pollution-free. Although renewable sources like solar and wind energy are considered environmentally friendly, their production and installation processes can have some environmental impact.

For example, manufacturing solar panels involves the use of chemicals and materials that may cause pollution. Similarly, while nuclear energy produces no emissions during operation, it generates hazardous waste from the fission process that needs careful handling and disposal. Therefore, while some energy sources are cleaner and have lower environmental impacts, none are entirely free of pollution.

Q2. Hydrogen has been used as rocket fuel. Would you consider it a cleaner fuel than CNG? Why or why not?

Solution:

Yes, hydrogen is considered a cleaner fuel than CNG (Compressed Natural Gas). CNG contains hydrocarbons, which release carbon dioxide (CO_2) and other pollutants when burned. In contrast, hydrogen fuel, when used in combustion or fuel cells, primarily produces water vapor as a byproduct and does not emit carbon dioxide or other pollutants. Therefore, hydrogen is a cleaner fuel because it generates no harmful emissions, making it a more environmentally friendly option compared to CNG.

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Q1. Name two energy sources that you would consider to be renewable. Give reasons for your choices.

Solution:

Two renewable energy sources are:

- **Wind Energy:** Wind energy is harnessed from the movement of air, which is driven by the uneven heating of the Earth's surface. This natural process is continuous and not depleted by use. As long as the Earth has an atmosphere and sunlight continues to heat the planet, wind energy will be available indefinitely.
- **Solar Energy:** Solar energy is derived from the sun's radiation, produced through nuclear fusion processes in the sun's core. Since the sun is expected to continue shining for billions of years, solar energy is a reliable and renewable source. The sun's energy is abundant and inexhaustible on a human timescale.

Q2. Give the names of two energy sources that you would consider to be exhaustible. Give reasons for your choices.

Solution:

- **Wood:** Wood is derived from forests, which take many years to grow and regenerate. Due to deforestation and overharvesting, the availability of wood is decreasing. As forests are not replenished quickly enough to meet current consumption rates, wood is considered an exhaustible energy source.
- **Coal:** Coal is formed from the remains of ancient plants and animals buried over millions of years. Once extracted and used, coal cannot be replenished on a human timescale. With increasing industrialization and consumption, the reserves of coal are depleting, making it an exhaustible source of energy.

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Q1. A solar water heater cannot be used to get hot water on
a. A sunny day
b. A cloudy day
c. A hot day
d. A windy day

Solution: b) A cloudy day

A solar water heater relies on sunlight to heat the water. On a cloudy day, the amount of sunlight reaching the solar collector is significantly reduced because the clouds block and reflect the sunlight. This lack of adequate solar energy means that the solar water heater cannot effectively heat the water.

Q2. Which of the following is not an example of a biomass energy source?
a. Wood
b. Gobar-gas
c. Nuclear energy
d. Coal

Solution: c) Nuclear energy

Biomass energy comes from organic materials such as plants and animal waste. Examples include wood, which comes from trees, gobar gas, which is produced from animal dung, and coal, which is derived from ancient plant and animal remains. Nuclear energy, on the other hand, is generated through the fusion or fission of atoms, not from biological materials. Therefore, nuclear energy is not a biomass energy source.

Q3. Most of the sources of energy we use represent stored solar energy. Which of the following is not ultimately derived from the sun's energy?
a. Geothermal energy
b. Wind energy
c. Nuclear energy
d. Biomass

Solution: c) Nuclear energy

Nuclear energy is generated through nuclear fission or fusion, processes that do not depend on solar energy. In fission, uranium atoms are split into lighter nuclei, and in fusion, lighter nuclei combine to form a heavier nucleus, producing a large amount of energy. These processes occur independently of sunlight.

In contrast:

- **Geothermal energy** comes from the Earth's internal heat, which is indirectly related to solar energy because the Earth's heat is partly influenced by the solar energy absorbed by the Earth's surface.
- **Wind energy** results from the uneven heating of the Earth's surface by the sun, which creates air movement.
- **Biomass** is derived from plants and animals that have harnessed solar energy through photosynthesis.

Q4. Compare and contrast fossil fuels and the sun as direct sources of energy.

Solution:

Fossil Fuels:

- **Origin**: Fossil fuels, such as coal, oil, and natural gas, are derived from the remains of dead plants and animals buried under the Earth's surface over millions of years.
- **Renewability**: They are non-renewable resources. Once depleted, they cannot be replenished within a human time scale.
- **Environmental Impact**: Burning fossil fuels releases pollutants, including carbon dioxide, which contributes to air pollution and global warming.
- **Availability**: Fossil fuels are finite and unevenly distributed around the globe, making their extraction and use dependent on geographical locations and economic factors.

Solar Energy:

- **Origin**: Solar energy is derived directly from the sun's radiation, which reaches the Earth's surface.
- **Renewability**: It is a renewable resource. Solar energy is abundant and can be harnessed as long as the sun exists.
- **Environmental Impact**: Using solar energy produces no direct pollutants or greenhouse gases, making it a cleaner alternative to fossil fuels.
- **Availability**: Solar energy is widely available but depends on geographic location, weather conditions, and time of day for effective utilization.

Comparison:

- **Sustainability**: Solar energy is sustainable and does not deplete natural resources, whereas fossil fuels are finite and contribute to environmental degradation.
- **Impact on Environment**: Solar energy is environmentally friendly, while fossil fuels have significant negative impacts on air quality and climate.

Q5. Compare and contrast biomass and hydroelectricity as sources of energy.

Solution:

Biomass:

- **Origin**: Biomass energy is derived from organic materials such as dead plants, animals, and agricultural waste. Examples include wood, crop residues, and animal dung (e.g., gobar gas).
- **Renewability**: Biomass is considered a renewable resource because organic materials can be replenished through natural processes and agricultural practices.
- **Conversion Process**: Biomass is converted into energy through combustion (burning) or biochemical processes (e.g., fermentation to produce biogas).
- **Environmental Impact**: Biomass combustion can release pollutants and greenhouse gases, but it is generally considered more sustainable than fossil fuels. The impact depends on how the biomass is sourced and managed.
- **Availability**: Biomass availability is linked to agricultural practices and land use. It is widely accessible in rural and agricultural areas.

Hydroelectricity:

- **Origin**: Hydroelectricity is generated from the kinetic energy of moving water, typically by harnessing the potential energy of water stored in reservoirs behind dams.
- **Renewability**: Hydroelectricity is a renewable resource because the water cycle continuously replenishes the water used in the process. The energy source (water) is naturally renewed through precipitation and the water cycle.

- **Conversion Process**: Water stored at a height is released and allowed to flow over turbines, which convert the kinetic energy of the falling water into mechanical energy and then into electrical energy.
- **Environmental Impact**: Hydroelectricity has a low environmental impact compared to fossil fuels, but building dams and reservoirs can disrupt local ecosystems, fish populations, and communities.
- **Availability**: Hydroelectricity depends on geographic features and water availability. Suitable locations for dams are necessary, and it may not be feasible in areas with low water flow or where large-scale infrastructure is not possible.

Comparison:

- **Renewability**: Both biomass and hydroelectricity are renewable energy sources. Biomass relies on organic material replenishment, while hydroelectricity depends on the continuous water cycle.
- **Energy Conversion**: Biomass involves combustion or biochemical processes to release energy, while hydroelectricity uses mechanical energy from flowing water to generate electricity.
- **Environmental Impact**: Hydroelectricity generally has a lower environmental impact compared to biomass, though both can affect ecosystems and require careful management to minimize harm.

Q6. What are the limitations of extracting energy from:
a. The wind?
b. Waves?
c. Tides?

Solution:

a. The Wind:

- **Speed Requirement**: Wind energy systems, such as wind turbines, require wind speeds of at least 15 km/h (9 mph) to generate electricity efficiently. Low wind speeds can result in insufficient power generation.
- **Spatial Needs**: Wind farms need a large area to be effective. The spacing between turbines must be sufficient to prevent them from interfering with each other's wind flow, which can limit the practical deployment of wind farms.
- **Intermittency**: Wind energy is intermittent and depends on weather conditions. Variability in wind speeds can lead to inconsistent power generation.

b. Waves:

- **Wave Strength**: Effective energy extraction from ocean waves requires strong and consistent wave patterns. Weak or irregular waves are less effective at generating power.

- **Location**: Wave energy systems must be placed in areas with high wave activity, which may not be accessible or suitable for installation.
- **Technological Challenges**: The harsh marine environment can pose challenges for maintaining and operating wave energy converters, leading to potential higher costs and technical difficulties.

c. Tides:

- **Alignment Requirements**: Tidal energy depends on the alignment of the sun, moon, and Earth. Strong tidal currents occur during specific times when these celestial bodies are aligned, which may not provide a continuous energy source.
- **Infrastructure Needs**: Extracting tidal energy often requires the construction of large and costly infrastructure such as dams or barrages, which can have environmental and ecological impacts.
- **Geographic Limitations**: Tidal energy is best harnessed in areas with significant tidal range and flow, limiting its applicability to specific locations.

Q7. On what basis would you classify energy sources as:
a. Renewable and non-renewable?
b. Exhaustible and inexhaustible?

Are the options given in (a) and (b) the same?

Solution:

a) Renewable and Non-Renewable:

- **Renewable Energy Sources**: These are sources of energy that are naturally replenished over time and are continuously available in nature. Examples include solar energy, wind energy, hydroelectric power, and biomass. These sources can be used repeatedly without depleting their availability.
- **Non-Renewable Energy Sources**: These are sources of energy that are limited in quantity and do not replenish quickly. Once consumed, they take millions of years to form again. Examples include fossil fuels like coal, oil, and natural gas. They are finite and can lead to resource depletion.

b) Exhaustible and Inexhaustible:

- **Exhaustible Energy Sources**: These are sources that are finite and will eventually be depleted if used excessively. They are available in limited quantities and can be exhausted over time. Examples include coal, petroleum, and natural gas.
- **Inexhaustible Energy Sources**: These are sources that are abundant and will not run out regardless of how much is used. They are continually replenished by natural processes. Examples include solar energy, wind energy, and hydroelectric power.

Comparison of Options (a) and (b):

The options given in (a) and (b) are related but not exactly the same:

- **Renewable vs. Inexhaustible**: Renewable sources are those that can be replenished naturally, which overlaps with inexhaustible sources, but renewable sources can still be exhausted if not managed properly (e.g., overuse of biomass). Inexhaustible sources, on the other hand, are always available in abundance and are not depleted by use.
- **Non-Renewable vs. Exhaustible**: Non-renewable sources are those that are limited and do not replenish within a human timescale, similar to exhaustible sources. However, non-renewable sources are specifically defined by their inability to replenish, while exhaustible sources are generally understood to eventually deplete due to high consumption rates.

Q8. What are the qualities of an ideal source of energy?

Solution:

An ideal source of energy should possess the following qualities:

Economical: It should be cost-effective both in terms of production and consumption, providing a good return on investment.

Easily Available: It should be readily accessible and not limited by geographical or logistical constraints.

Pollution-Free: It should produce minimal or no pollutants during extraction, processing, and use, contributing to a cleaner environment.

Easy Transportation and Storage: It should be simple to transport and store without requiring complex infrastructure or incurring high costs.

High Energy Output: It should generate a substantial amount of energy per unit mass or volume, ensuring efficient use of resources.

Q9. What are the advantages and disadvantages of using a solar cooker? Are there places where solar cookers would have limited utility?

Solution:

Advantages:

- **Renewable Energy Source**: Solar cookers use sunlight, which is an abundant and renewable source of energy.
- **Environmentally Friendly**: They produce no pollution, making them a clean alternative to conventional cooking methods that rely on fossil fuels.
- **Cost-Effective**: After the initial investment in the solar cooker, operating costs are minimal since sunlight is free.

Disadvantages:

- **Weather Dependent**: Solar cookers are ineffective on cloudy days or during rainy weather when sunlight is insufficient.
- **Slow Cooking**: They often require more time to cook food compared to conventional stoves, especially if sunlight is not intense.

Limited Utility of Solar Cookers:

Solar cookers would have limited utility in regions with low solar insolation, such as areas with frequent cloud cover, heavy rainfall, or high latitudes during winter months. They are also less practical in regions where the sunlight is not strong enough to generate adequate heat for cooking.

Q10. What are the environmental consequences of the increasing demand for energy? What steps would you suggest to reduce energy consumption?

Solution:

Environmental Consequences:

- **Greenhouse Gas Emissions**: The burning of fossil fuels for energy leads to the release of greenhouse gases such as carbon dioxide, contributing to global warming and climate change.
- **Air and Water Pollution**: Industrialization and energy production can cause significant air and water pollution, affecting both human health and ecosystems.
- **Resource Depletion**: Over-reliance on non-renewable resources like coal and oil leads to their depletion, causing long-term environmental and economic issues.

Steps to Reduce Energy Consumption:

1. **Adopt Renewable Energy Sources**: Transition to renewable energy sources like solar, wind, and hydropower to reduce reliance on fossil fuels.
2. **Improve Energy Efficiency**: Use energy-efficient appliances and technologies to minimize energy waste.
3. **Conserve Resources**: Reduce unnecessary energy use by turning off lights and appliances when not in use, and opting for energy-saving devices.
4. **Promote Public Transportation**: Reduce the use of private vehicles and encourage the use of public transportation to decrease fossil fuel consumption and emissions.
5. **Support Sustainable Practices**: Engage in and support practices that promote sustainability and reduce environmental impact, such as recycling and reducing waste.

Benefits of NCERT Solutions for Class 10 Science Chapter 14 Sources of Energy

- **Comprehensive Understanding**: These solutions provide detailed explanations of concepts related to different sources of energy, such as renewable and non-renewable sources, energy conversion, and environmental impacts. This helps students develop a thorough understanding of the chapter.
- **Clear Explanations**: The solutions break down complex topics into simpler, easy-to-understand segments, making it easier for students to grasp the principles and mechanisms of energy sources.
- **Practice Problems**: By working through the problems provided in the solutions, students can practice and reinforce their knowledge. This helps in better preparation for exams and enhances problem-solving skills.
- **Exam Preparation**: The solutions are designed to align with the NCERT curriculum and exam pattern, helping students focus on the types of questions that are likely to appear in their exams. This targeted practice can improve performance.
- **Time Management**: By practicing with these solutions students can learn to manage their time effectively during exams, as they become familiar with the format and types of questions that are commonly asked.