

Advanced Renewable Energy Concepts

Renewable Energy · Answer Key · 18 Questions

1. Which component of a photovoltaic (PV) solar panel is primarily responsible for converting sunlight into electricity through the photovoltaic effect?

- A) The inverter
- B) The silicon semiconductor cells**
- C) The mounting brackets
- D) The protective glass layer

2. In wind turbine technology, what is the primary purpose of the 'nacelle'?

- A) To anchor the turbine to the ground
- B) To house the gearbox, generator, and control systems**
- C) To collect rainwater for cooling
- D) To provide a landing platform for maintenance crews

3. Which type of renewable energy relies on the heat generated within the Earth's core?

- A) Hydropower
- B) Biomass energy
- C) Geothermal energy**
- D) Ocean thermal energy conversion

4. What is the main process by which biomass energy is generated from organic materials like wood or crops?

- A) Photosynthesis
- B) Combustion or anaerobic digestion**
- C) Evaporation
- D) Condensation

5. In a hydroelectric power plant, the potential energy of water stored at a height is converted into what form of energy as it flows through the penstock to turn the turbine?

- A) Electrical energy
- B) Thermal energy
- C) Kinetic energy**
- D) Chemical energy

6. Which of the following is a key disadvantage of concentrated solar power (CSP) systems compared to photovoltaic (PV) systems?

A) Lower land use requirements

B) Dependence on direct sunlight, limiting operation during cloudy weather or at night without storage

C) Higher efficiency in low light conditions

D) Simpler installation process

7. What is the term for the process where a device converts mechanical energy into electrical energy, a fundamental principle in most renewable energy generators?

A) Electrolysis

B) Photovoltaics

C) Induction

D) Combustion

8. Which country is a global leader in geothermal energy production, utilizing its abundant volcanic and tectonic activity?

A) Canada

B) Iceland

C) Egypt

D) Brazil

9. The efficiency of a wind turbine is often measured against the Betz limit, which states that no turbine can capture more than what theoretical percentage of the wind's kinetic energy?

A) 75%

B) 59.3%

C) 90%

D) 81.2%

10. What is a significant environmental challenge associated with large-scale hydropower dams, particularly concerning river ecosystems?

A) Increased air pollution

B) Disruption of fish migration patterns

C) Excessive noise pollution

D) Depletion of groundwater resources

11. Which renewable energy source is most directly dependent on the phase changes of water (evaporation, condensation, precipitation)?

- A) Solar energy
- B) Wind energy
- C) Hydropower**
- D) Geothermal energy

12. In the context of renewable energy, what does the term 'grid parity' refer to?

- A) The point where renewable energy sources can generate electricity at the same cost as fossil fuel sources**
- B) The balance of electricity supply and demand on the national grid
- C) The efficiency of energy transmission lines
- D) The integration of multiple renewable energy sources

13. What is the primary fuel source for generating biogas, a renewable energy form?

- A) Coal
- B) Natural gas
- C) Decomposing organic matter**
- D) Uranium

14. Ocean thermal energy conversion (OTEC) systems harness energy from the temperature difference between warm surface water and:

- A) Warm deep-sea vents
- B) Cold deep ocean water**
- C) Evaporated ocean water
- D) Atmospheric air temperature

15. Which of the following statements accurately describes a key advantage of offshore wind farms over onshore wind farms?

- A) Lower installation costs
- B) Access to stronger and more consistent winds**
- C) Less visual impact on landscapes
- D) Easier maintenance access

16. What is the main challenge associated with the intermittency of solar and wind power, necessitating energy storage solutions?

- A) They produce too much power during peak demand
- B) Their energy output fluctuates unpredictably based on weather conditions**
- C) They require constant human intervention to operate
- D) They are not compatible with existing electrical grids

17. Which part of a solar thermal power plant is responsible for concentrating sunlight onto a receiver to generate heat?

- A) The photovoltaic cells
- B) The heat exchanger
- C) The heliostats or parabolic troughs**
- D) The inverter

18. What is a common method for converting the thermal energy produced by geothermal power plants into electricity?

- A) Using a steam turbine to drive a generator**
- B) Directly converting heat to electricity using solar panels
- C) Splitting water molecules through electrolysis
- D) Burning biomass in a furnace