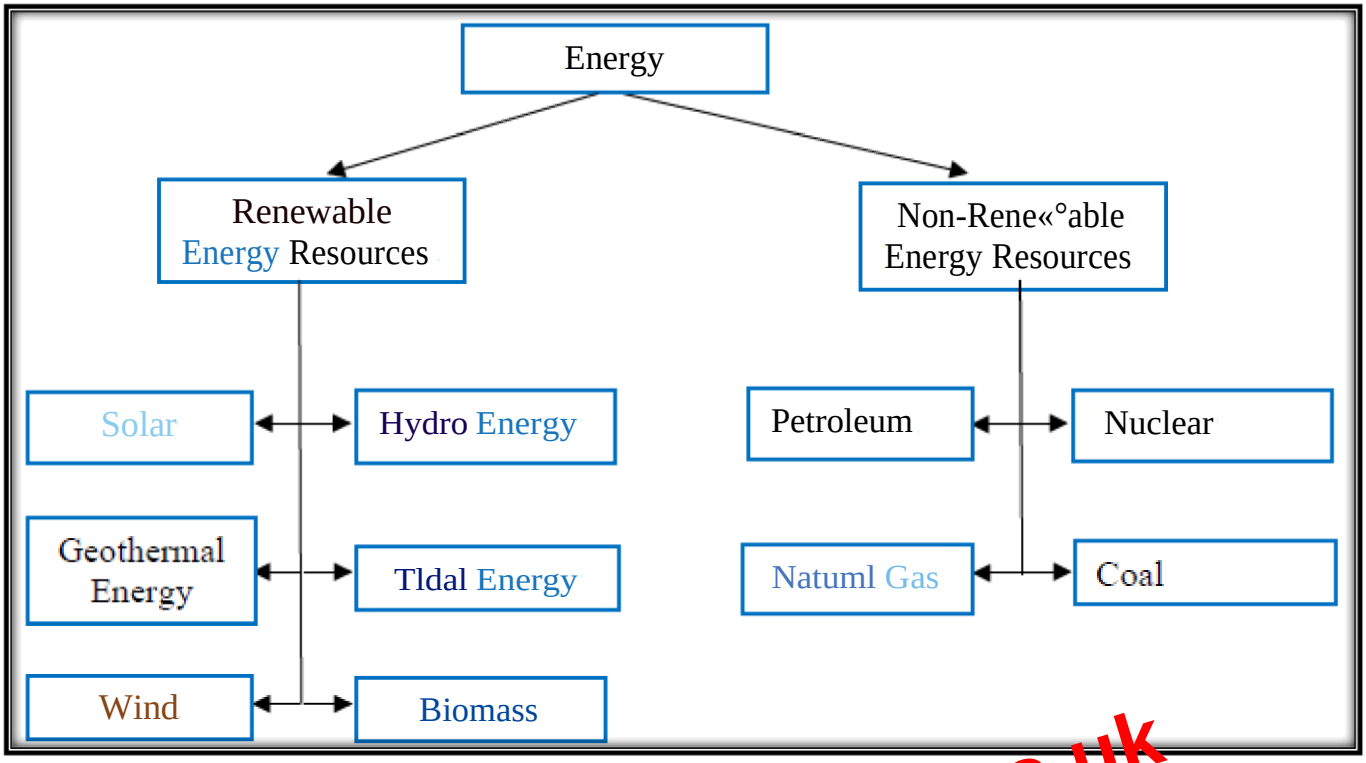

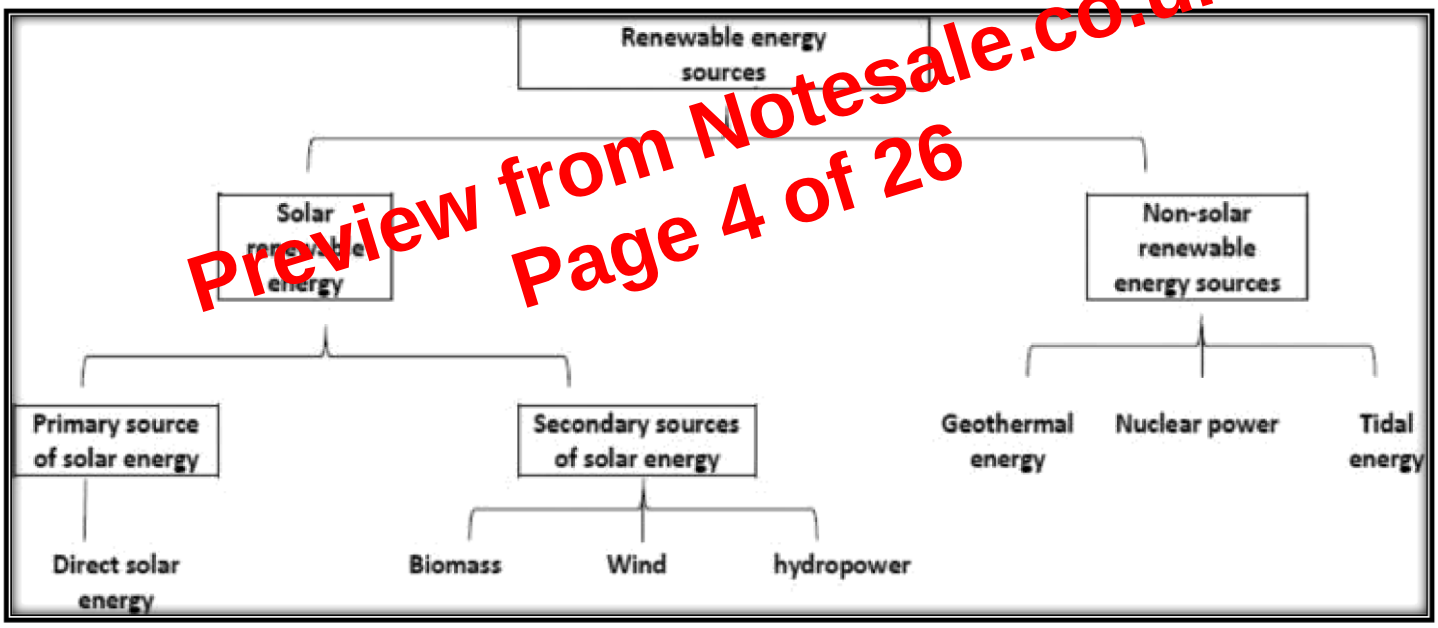

A. Watts (W)
B. Kilowatts (kW)
C. Kilowatt-Hours (kWh)
D. Volts (V)

Q3. What is electrical energy?
A. The ability to do work.
B. The energy of moving electrons.
C. The energy of electricity.
D. The force of moving atoms.

Q4. What energy production method produces the most air pollution?
A. Natural gas energy
B. Nuclear energy
C. Hydroelectric energy
D. Coal energy

Q5. What is the major drawback or risk of nuclear energy production?
A. It creates air pollution.
B. It creates water pollution.
C. It creates radioactive waste.
D. It destroys ecosystems.

Q6. What is a drawback or risk of wind energy production?
A. It can kill birds or bats.
B. It creates air pollution.
C. It creates water pollution.
D. All of the above.

Q7. What is a benefit of wind energy production?
A. It is renewable.
B. It doesn't create pollutants.
C. It has relatively low maintenance costs.
D. All of the above.

Q8. What is a drawback of solar energy production?
A. It isn't renewable.
B. It is expensive to set up.
C. It only works if the sun is out.
D. All of the above.

Q9. An electric generator converts_____energy into electrical energy.

- The first and second generations contain the most-studied photovoltaic materials: silicon, gallium arsenide, cadmium telluride, and copper indium gallium selenide. These materials are all inorganic semiconductors, and generally work in the most direct manner: a photon is absorbed – creating an exciton, which is thermally dissociated (inorganic semiconductors typically have high dielectric constants) and subsequently transported to the electrodes via an electric field.

First Generation Solar Cells

- As silicon is the most-studied material, it can achieve some of the highest performances (with a peak efficiency of 26.1%) and was the first material to reach the commercial market. As such, the majority of solar panels use silicon as the photoactive material.
- The band gap of silicon is 1.1 eV, enabling broad absorption of solar radiation. However, this is lower than the optimum band gap (1.34 eV), resulting in energy losses when absorbing high energy photons.
- In addition, the band gap is indirect – reducing the absorption efficiency and thus requiring relatively thick layers to efficiently harvest sunlight. As with all inorganic materials, silicon has a high dielectric constant of 11.7 – allowing for the thermal separation of charge-carriers after generation.

Second Generation Solar Cells

a. **Gallium arsenide (GaAs)**

- It boasts the highest performance of any photovoltaic material, reaching 29.1%. This is because GaAs has a direct and more favorable band gap of 1.43 eV – resulting in improved absorption with thinner layers and reduced energy loss.
- Additionally, GaAs has superior electron-transport properties to silicon.
- However, it is very expensive to produce as it requires high material purity, which generally limits it to space-based applications (such as satellites and rovers).

b. **Cadmium Telluride (CdTe)**

- Cadmium telluride (CdTe) is a high-efficiency thin-film photovoltaic technology which has achieved an efficiency of 22.1%.

MCQs

Q1. How many types of solar cells?

A. 1
B. 2
C. **3**
D. 4

Q2. The solar cell efficiency is about _____

A. 25 %
B. 15 %
C. 48%
D. 30%

Q3. The source of energy used for satellite is _____

A. Solar Cells
B. Edison Cells
C. Fuel Cells
D. Cryogenic Cells

Q4. A solar cell is a _____

A. P-type semiconductor
B. N-type semiconductor
C. Intrinsic semiconductor
D. P-N Junction

Q5. Which of the following materials cannot be used as solar cells materials?

A. Si
B. GaAs
C. CdS
D. PbS

Q6. During the collection of e-h pairs, holes are collected by _____

A. Front contact

B. Back contact

C. Si-wafer

D. Finger electrodes

Q7. What should be the band gap of the semiconductors to be used as solar cell materials?

A. 0.5 eV