# Model Questions in DPR514 Energy and Environment

**Give your answer in point form only.**

**1)** What do you understand by the first and second laws of thermodynamics.

**2)** Describe the difference between energy, work and power. Use an example if necessary.

**3)** Explain the concept exergy.

**4)** a) Explain Carnot efficiency in relation to a heat engine.

b) What is the Carnot effficiency of a heat engine that has steam injected into it at 850°C and that rejects the steam at 225°C?

c) An inventor claims to have developed a new heat engine that operates with a much cooler (thus safer) flame, at 150°C, and discharges waste heat to the environment at 30°C. The promotional literature for the device claims an efficiency of 45%: that 45% of the fuel energy is converted to useful work. Calculate the physical limit to the efficiency of this heat engine. Is the claim possible?

**5)** Using simplified diagrams, describe how the following power plants produce electricity:

a) Steam turbine power plant

b) Gas turbine power plant

c) Combined (steam turbine – gas turbine) power plant

**6)** Nearly 40% of global electricity needs is provided by coal.

a) Using simplified diagrams, describe how electricity is produced from coal.

b) Describe five different environmental impacts of the use of coal as an energy source.

c) Suggest potential ways to mitigate the above described environmental impacts.

**7)** Using simplified diagrams, describe how a nuclear power plant produces electricity. State three advantages and three disadvantages of the use of nuclear power.

**8)** What are the two major problems created by depending on fossil fuels for most of our energy?

**9)** Describe in detail three different technologies available for getting energy from sunlight. State and discuss the environmental and socioeconomic issues related to the three technologies.

**10)** Global energy consumption is in the order of 15 TW. Solar energy that reaches the earth is in the order of 86,000 TW. Please discuss (giving ten different reasons) why most of the global energy requirement is met by the use of fossil fuel (burning of which is known to be causing global warming and climate change) instead of by the use of renewable solar energy.

**11)** Describe three advantages and three disadvantages of mega hydropower production. State how to mitigate the disadvantages that you mention.

**12)** State and discuss three adverse impacts of wind farms and mini hydropower. Discuss how you would mitigate the adverse impacts.

**13)** Photochemical smog is one of the environmental phenomena resulting from some gaseous pollutants, products of some fuels-utilizations. Coal, the only solid fossil fuel, is of major concern environmentally due to its negative effects through its extraction/mining and utilization.

a) Clearly explain how photochemical smog is formed and name the gaseous pollutants involved in its formation (i.e., the causal agents). Show the major source of these pollutants.

b) Name and clearly explain the two environmental conditions for photochemical smog.

c) Name and clearly explain three environmental effects of coal extraction/mining.

**14)** Direct utilization of some fuels, with minimum control strategies, has resulted in an environmental phenomenon known as Acid Rain, a product with devastating impacts on various earth systems.

a) Discuss in details the scientific background of this phenomena, i.e., how it is formed; clearly indicating how energy is associated with it.

b) Name and clearly explain the environmental effects of acid rain, i.e., problems associated with acid rain.

c) Outline and briefly explain the potential control that can be applied to minimize the acid rain problems.

**15)** Describe the following elaborating at least five different features of each:

a) Global warming

b) Particulate matter pollution

c) Thermal pollution

d) Water for energy

e) Altering land use caused by energy production and use

**16)** Petroleum-derived fuels, such as petrol, diesel and kerosene, are the major source of transportation fuels today. Burning of these fuels emits carbon dioxide with is considered to be the major cause of global warming and climate change. Biofuels (such as bioethanol and biodesel) are considered as sound alternatives to fossil fuel based transportation fuels.

a) Explain what you understand by biofuel.

b) Why is burning biofuel considered a better alternative to burning fossil fuel?

**17)** Ethanol from corn and diesel from soybean are promoted as auto fuel additives. List as many socioeconomic and environmental impacts of such fuels to replace our dependence on oil.

**18)** Biomass is seen as an alternative to fossil fuel.

a) Name three different biomass-based energy technologies.

b) Explain each one of them in detail.

c) State three environmental impacts associated with each biomass-based technology.

d) State three socioeconomic impacts associated with each biomass-based technology.

e) Propose mitigation measured for the impacts that you mentioned in parts (c) and (d).

**19)** What do you understand by "hydrogen as a fuel of the future"? Discuss the merits and demerits of such choice of fuel

**20)** What are some of the advantages associated with getting our energy from photovoltaics? Come up with at least three.

**21)** What are some of the disadvantages associated with getting our energy from photovoltaics? Come up with at least three.

**22)** a) What do you understand by fuel cell technology?

b) Where is fuel cell technology used?

c) Describe three different fuel cell technologies available today.

d) State three advantages and three disadvantages of the use of fuel cell technology.

e) Discuss why fuel cell technology has not yet replaced the fossil fuel engines in automobiles.

**23)** Efficient use of energy is seen today as a policy tool to reduce energy related greenhouse gas emissions, and also to avert the impending energy crisis. Critically discuss the above policy.

**24)** What do you understand by rebound effect?

**25)** What is lifecycle assessment? Explain giving appropriate examples.

**26)** Bob Dudley, Group Chief Executive, BP at launch of BP Energy Outlook 2030, London, 18 January, 2012 identified the following five "opportunities" for the world to face the impending energy related crisis: efficiency; technology; competition; natural gas; biofuels. He stated that *competition* helps to drive *technology*, which in turn helps to drive *efficiency*, and growth of energy sources, *natural gas* and *biofuels*, are examples of this process at work. Critically discuss the potential of the above "opportunities" in averting an impending energy related crisis.

**27)** What is CDM? Explain in detail with examples.

**28)** Explain demand-side management of energy with examples.

**29)** Choose any development process in effect in Sri Lanka. Critically analyse the energy implications of the chosen development process.

**30)** Propose energy systems suitable for (i) electricity generation, (ii) transport, and (iii) other energy uses for a sustainable Sri Lanka, and the national energy policies and strategies required to make it a reality.

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