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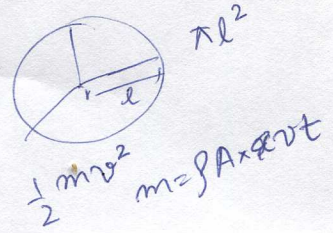# DEE-53106 Introduction to Renewable Energy Sources

Examination, 3.3.2014

Calculator is not need/allowed in the exam.

Answers to all the three questions should fit into one common writing paper.

1. Answer to two out of three question (a, b and c).
   a) The velocity of wind is v and the length of the windmill blade is l. Derive equations for the energy and power of wind facing a windmill starting from the basic equation of kinetic energy.
   b) What is the theoretical maximum conversion efficiency of solar radiation to electrical energy? Remember to validate your arguments.
   c) Name three important technical achievements/advancements in the utilization of primary energy resources, which have happened during the last decade.

2. a) Name the top four renewable energy sources of the installed electricity production capacity worldwide in order of magnitude according to the latest available statistics.
   b) Name the renewable energy sources, which have increased their proportion of the installed worldwide electricity production capacity during the last decade.

3. a) What is the most commonly used energy conversion principle (from one form of energy to other) in electricity production worldwide?
   b) What energy conversion principle is the second common in use in electricity production worldwide?
   c) Define the theoretical maximum efficiencies of those conversion principles.
   d) What primary energy sources are converted to electrical energy using both of those conversion principles?