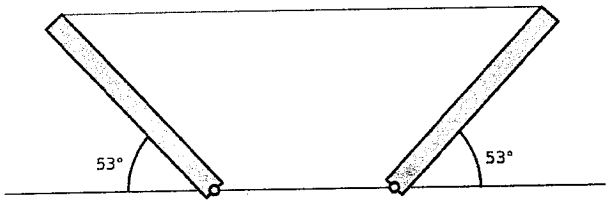
Write CLEARLY in each paper your name, student number, degree programme, the code of the study module, the date of the exam, and the exam you chose.

1. Define the following terms as shortly as possible: a) Phase velocity b) Escape velocity c) Doppler shift d) Entropy e) Wave interference and f) Isobaric process

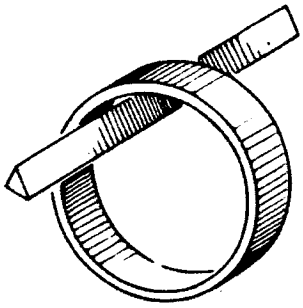
2. Answer the following question shortly but precisely
   (a) Why is adiabatic prosess sometimes called isentropic process (an isentropic process is constant-entropy process)?
   (b) How do mechanical waves reflect in a spring?
   (c) What is the essential content of the second law of Kepler?

3. A 4.00 m, 0.542 kg wire is used to support two 24 kg posts of equal length, so that the wire is horizontal. The posts stand at an angle of 53° with respect to the surface of Earth. The speed of sound in air is 344 m/s. Due to the strong wind, a standing wave at the 8th harmonic frequency of the wire is excited. Determine the frequency of the wave motion.



Problem 3

4. A thin ring is supported by a sharp-edged post which goes through the ring, so that the ring can swing about its contact point.The thickness of the ring is negligible compared to its radius $R = 0.1$ m. The moment of inertia of the right with respect to its center of mass is $I_{CM} = mR^2$. Determine the angular frequency and period of the small oscillations of the ring.



Problem 4

5. The emissivity of a metal sphere (radius 1 mm) is 0.40.
   (a) At what power does this sphere radiate into its environment at the temperature 900 °C?
   (b) The sphere is surrounded with walls which are maintained at temperature 500 °C . At which rate must heat be fed into the sphere to maintain its temperature at 900 °C?

   The Stefan-Boltzmann constant $\sigma = 5.6704 \cdot 10^{-8}\ \mathrm{W \cdot m^{-2} \cdot K^{-4}}$.