# CHEM 363 – Physical Chemistry

**Class Test** **Wednesday 23 May 2007**

**Time Allowed:** 60 minutes

**Instructions:** Answer **both questions.**
Questions 1 and 2 are worth **equal marks**.

---

1. Compare and contrast the following:

   (a) Conversion *versus* yield *versus* selectivity

   (b) Ideal mixture *versus* regular mixture *versus* athermal mixture

   (c) Activation energy *versus* activation volume

   (d) Consecutive reaction *versus* parallel reaction

   (e) Parallel-flow heat exchange *versus* counter-current heat exchange

   (f) Ideal tubular reactor *versus* continuously stirred tank reactor

**Note**: all parts are worth equal marks; only *short* answers consisting of *essential* information are required.

2. (a) Outline the systems of labelling used for electronic states of atoms and of diatomic molecules under the headings: (i) Russell-Saunders coupling versus *j*-*j* coupling, and (ii) Hund's coupling cases a, b, c and d. Your outline should include examples of atoms and molecules to which the various angular-momentum coupling schemes would be expected to apply.

   (b) Draw a diagram of a basic laser and explain the purpose of the various components. Briefly explain how the basic design could be modified to obtain (i) shorter light pulses from a pulsed laser, and (ii) a narrower wavelength distribution from a cw laser.