

Nuclear Reactor Theory 0302750

Course web

<http://nuclear.bau.edu.jo/ju-reactors>

or

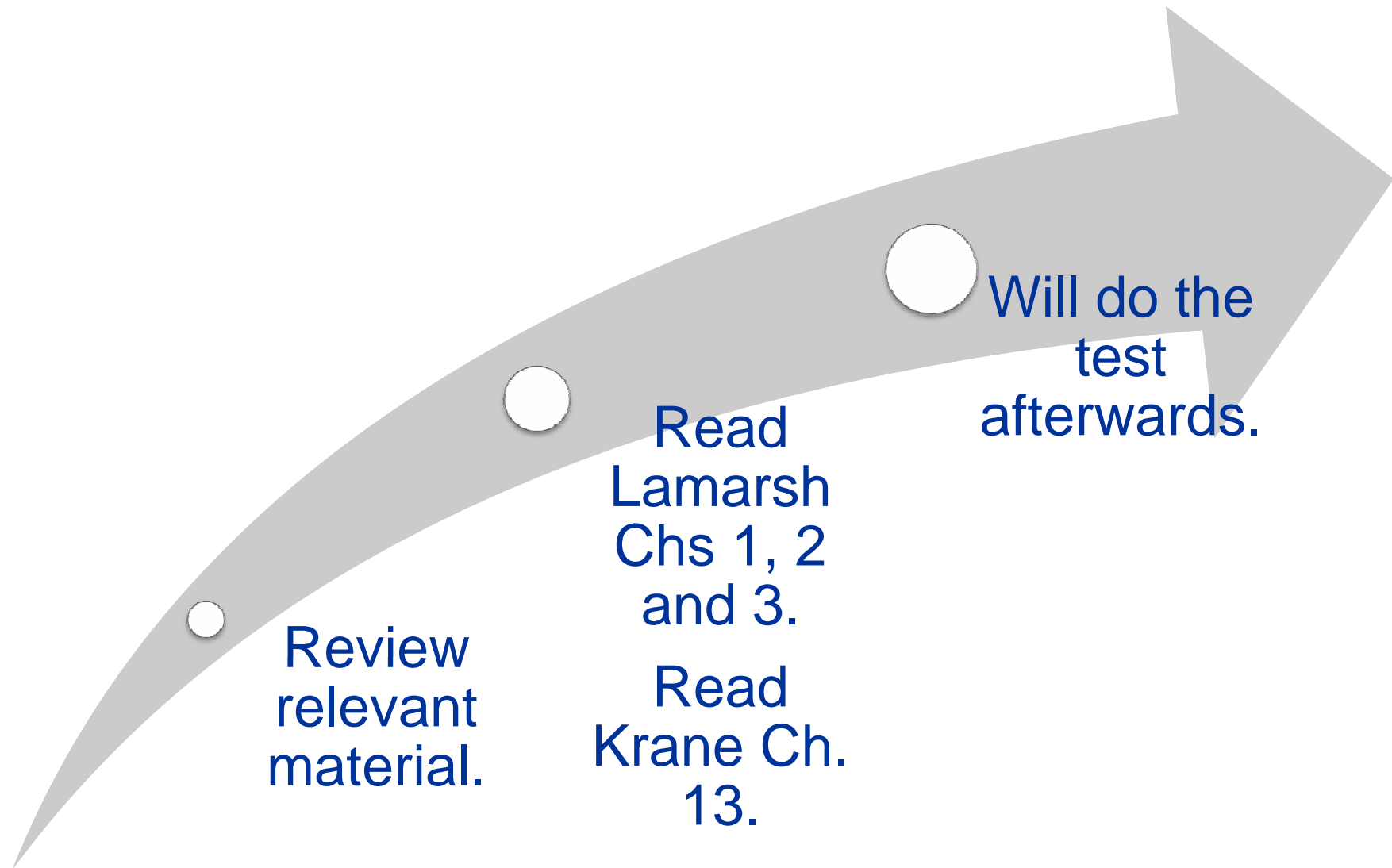
<http://nuclear.dababneh.com/ju-reactors>

Grading

Review Test	10%
Mid-term Exam	30%
Projects, quizzes and HWs	20%
Final Exam	40%

- Homeworks and small projects are due after one week unless otherwise announced.
- Remarks or questions marked in red without being announced as homeworks should be also seriously considered!
- Some tasks can (or should) be sent by email:
saed@dababneh.com

Review Test



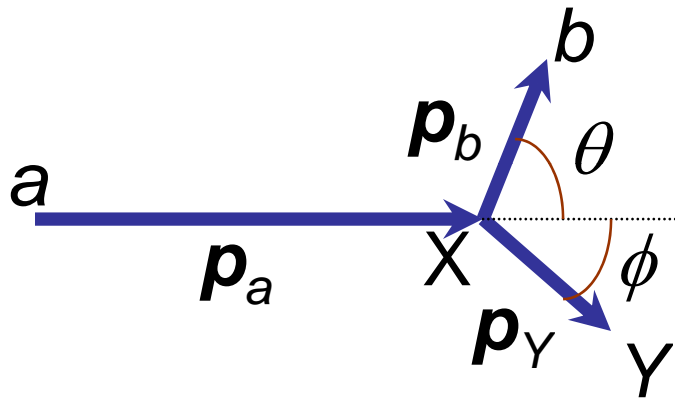
Projects

- Radiation protection and shielding (Due May 10th).
- Nuclear fuel cycles with emphasis on front ends (Due May 10th).
 - Work as a team. Divide and organize the job among you.
 - Try to explore local applicability.
 - Presentation: Will be scheduled later.
- Other small projects will be announced in class.

Nuclear Reaction Energetics (revisited)

Conservation Laws

- Charge, **Baryon number**, total energy, linear momentum, angular momentum, parity, (**isospin??**)



$$m_i c^2 - m_f c^2 = T_f - T_i = Q_{gs}$$

+ve Q-value ► exoergic reaction.

-ve Q-value ► endoergic reaction.

Stationary X ??

$$T_b + T_Y = Q + T_a$$

+ve Q-value ► reaction possible if $T_a \rightarrow 0$.

-ve Q-value ► reaction not possible if $T_a \rightarrow 0$. (Is $T_a > |Q|$ sufficient?).

Conservation of momentum

Nuclear Reaction Energetics (revisited)

- Conservation of momentum.
- We usually do not detect Y.

HW 1

Show that:

double valued !?

solve for Q

$$\sqrt{T_b} = \frac{\sqrt{m_a m_b T_a} \cos \theta \pm \sqrt{m_a m_b T_a \cos^2 \theta + (m_Y + m_b)[m_Y Q + (m_Y - m_a)T_a]}}{m_Y + m_b}$$

- The threshold energy (for T_a): (the condition occurs for $\theta = 0^\circ$).

$$T_{Th} = -Q \frac{m_Y + m_b}{m_Y + m_b - m_a}$$

Q < 0

- +ve Q-value ► reaction **possible** if $T_a \rightarrow 0$.
- -ve Q-value ► reaction **possible** if $T_a > T_{Th}$.
- **Coulomb and other barriers.....!!!**
- **Neutrons vs. charged particles.**



Nuclear Reaction Energetics (revisited)

HW 1 (continued)

- The double valued situation occurs between T_{Th} and the upper limit T_a^{\backslash} .

$$T_a^{\backslash} = -Q \frac{m_Y}{m_Y - m_a} \quad Q < 0$$

- Double-valued in a forward cone.

$$\cos^2 \theta_{\max} = - \frac{(m_Y + m_b)[m_Y Q + (m_Y - m_a)T_a]}{m_a m_b T_a}$$

Nuclear Reaction Energetics (revisited)

HW 1 (continued)

- Discuss thoroughly the ${}^7\text{Li}(p,n)$ reaction.
- During the discussion emphasize on the case when the incident proton beam is 30 keV above the threshold.
- Use your computing skills.

• Discuss the **elastic** and **inelastic scattering** of **neutrons** using these relations.