1. (10 points) Explain briefly the difference in the undergraduate education of Mechanical and Aerospace engineers. Enter your answer in the space below.

The two curricula are very similar

AA majors take more courses on fluid dynamics

2. (10 points) Briefly describe the primary ethics failures on the part of NASA that led to the Challenger disaster: How much was known to NASA about the O-ring problem before the disaster?

**Ethics Failure:** NASA placing meeting the schedule before safety of the crew

**Knowledge:** NASA managers had apparently not been aware of the temperature constraints on the O-rings, and were surprised when the issue was brought up → Communications failure.

3. (10 points) What are the benefits of earning an advanced degree (M.Sc. or Ph.D.) as compared to a mechanical engineer (BS)?

Answer: Higher Income, more job satisfaction and responsibility.

4. (10 points) You are in charge of selecting highly insulated windows for a new building development. In order to meet building codes, you find that expensive triple pane windows will be required. The builder wants to avoid the added expense and suggests that you fudge the numbers a little so that it appears he is meeting code with double-pane windows. How should you respond?

**Answer Question 4:** It is both unprofessional and illegal to circumvent building codes. The answer should be no.

5. (10 points) Briefly explain the value of a patent search for new designs.

Answer: A patent search will reveal the state of the art. It will also show potential pitfalls, such as patent infringement.
6. **(10 points)** Consider the Kansas City disaster. As a rule, how should an engineer respond when a design change is requested?

For any design change, the underlying engineering analysis must be repeated so as to establish the safety of the new design.

7. **(10 points)** You are in charge of designing an air conditioner for residential use. List the three most relevant decision criteria for selecting the best design, and assign a weight (as percentage of total) to each criterion.

<table>
<thead>
<tr>
<th>Multiple choices are possible, e.g. Cost</th>
<th>30%</th>
</tr>
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<tbody>
<tr>
<td>Thermal efficiency</td>
<td>30%</td>
</tr>
<tr>
<td>Maintenance Costs</td>
<td>20%</td>
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<tr>
<td>Durability</td>
<td>20%</td>
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8. **(20 points)** List the requirements for professional licensing as an engineer in the state of Nevada.

Applicants must have passed EIT exam, graduated from 4-year engineering program, record of 10 years or more of active experience in engineering work

Pass PE exam

9. **(10 points)** The figure below shows the graph pertaining to O-ring erosion at various temperatures which was presented at the Challenger pre-launch conference.

(a) What argument were the engineers trying to make?

(b) Suggest one or more ways to make the graph itself convey the message more clearly, rather than having the engineers argue the merits of the presented data orally. You may add to the graph at left, or draw additional graph(s) below.

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**Answer 9(a)**

Dangerous loss of O-ring sealing capacity seemed more severe at low temperatures

**Answer 9(b)**: Add a trend line by connecting the points. This will visualize the risk associated with low temperatures. Alternately, the failure probability graph presented in the lecture would be a good visual aid.