Exam 1 (Course 096125 (095857))

Introduction of Green and Sustainable Chemistry

1. **Define sustainability (2 pts). What are three ways (with examples) that Triple Bottom Line companies promote sustainability (3 pts).**

2. **Describe the natural cycle of chemicals in the environment (3 pts) and how man has altered the cycle (2 pts).**

3. **What is biomimicry and how does it relate to green chemistry (5 pts). Name how two chemicals that are used in nature can have multiple uses for mankind (5 pts).**

4. **Name and briefly define 5 principle of green chemistry (5 pts). Exemplify what 5 items can green chemistry reduce if implemented (5 pts).**

5. **Describe the life cycle of a plastic bottle (5 pts). Describe two alternatives that can simplify and reduce the life cycle cost (5 pts).**

6. **Describe two ways the periodic table is organized (4 pts). Why does lithium behave differently than chlorine (2 pts)? Why is carbon the ideal element for life (4 pts)?***

7. **Name four functional groups in organic chemistry and what important molecules are they used to build (8 pts). Heavy metals react with what functional group (2 pts).***

8. **What is the defining principle of toxicology (3 pts) and what environmental parameters affect it (2 pts)?**

9. **What is the difference between acute and chronic toxicity (6 pts)? How do we express the potency of each one (2 pts)? Give an example of an acute and chronic effect (2 pts)**

10. **What are polymers made of (1 pts)? Name an example of a man made polymer and one made by nature (2 pts). What is the difference between the way chemists make polymers and what nature does (2 pts)?**

11. **What is an endocrine disruptor and how to these chemicals act (6 pts)? Name an example and why we should be concerned about them (4 pts)?**

12 - Background

The automobile instrument panel (IP) is a complex component that is fabricated of numerous parts and must fulfill a variety of requirements. As the engineering manager for one of the major automotive companies, your responsibility is to design and manufacture instrument panels for one of your company's most popular vehicles. For the current version of this vehicle, the structural parts of the IP are built primarily of steel. However, for the 1999 model, you and your staff are evaluating a design that is lighter and replaced much of the steel with magnesium.

Issue

Thus far, the new design appears to meet all of your company's safety, aesthetic, cost and other criteria. However, a recent technical report indicated that the material production energy of magnesium is much greater than that of any other materials used in current IP's. Since one of your company's objectives is to lower the life cycle energy of the instrument panel, you must now assess if the new design will achieve this objective. Does the new design lower the life cycle energy of the instrument panel? Please show your calculations and state assumptions.

Data

Material Production Data

Material	Material Production Energy (MJ/kg)	Current Design (kg)	New Design (kg)
Steel	40	10	4
Magnesium	285	0	3
Polyurethane Foam	72	3	3
PVC	65	2	2
Other Plastic	93	10	8
TOTAL		25	20

Manufacturing Phase Data

- Approximately 500 MJ/IP are required to produce either the current or new design.

Use Phase Data

- Average car last 180,000 km.
- For this model of car, 1.0 MJ of energy are consumed to move one kg of weight for a distance of 1,000 km, i.e. the efficiency factor is 1.0 MJ/(kg*1000 km).

End of Life Phase Data

- For either design, a total of 10 MJ/IP are consumed during the shredding and other end of life processes.

Key Assumption:

The mass of each material in the product is equal to the mass of each material required for manufacturing. This assumes no scrap is generated.