Comparing human and cow diets

Focus question	Why do humans' and animals' dietary needs change throughout their lifetimes?
Vocabulary	Total mixed ration, forage, energy concentrate, lactating

Human diets are made up of the three major nutrients, carbohydrates, fats/lipids and proteins. Water, vitamins and minerals complement the major nutrients to give humans the energy they need for daily living. Athletes need nutrients in different proportions to provide quick energy, muscle repair and growth, sustained energy, hydration and muscle function, oxygen transport, bone health and strength, antioxidants for recovery and inflammation. At different stages of life, energy reuirements change (i.e. adolescence, pregnancy, aging) for both humans and animals. This activity asks you to create a ration (snack mix) that is in the same proportion to the energy that an active human or a lactating cow needs.

Materials
- List of nutrients and amounts for an athlete or hiker
- Various snacks provided

Procedure
1. Design a nutrient mixture (using amounts of carbohydrates, fats and protein) for an athlete or hiker to eat prior to an event or to take along on a hike.
2. Combine a snack mix using the snacks provided for an athlete/hiker using your amounts determined in #1 or use the percentages given below for a lactating dairy cow (one that is actively producing milk) based on the sample total mixed ration (TMR) of percentages of protein, carbohydrates, and fats given.
3. Once you have listed your ingredients, determine costs and volumes as if this ration was being fed to an individual by calculating the amounts used and scaling up to what an athlete or lactating cow would require in a day.
4. Create a graph to show your percentages in your chosen TMR.

Sample ration
The ration below is taken from an actual dairy farmer with a high-performance herd and should be used as a guide when designing your own ration.
- **For a 2-year old, high-producing cow, the total ration is 50 lbs/day**
- Forage: 47%
  - Hay: 2.5 lbs or 5%
  - Haylage: 7 lbs or 14%
  - Corn silage: 14 lbs or 28%

- Energy concentrate: 33%
  - High moisture corn: 10.64 lbs or 20%
  - Cottonseed: 3.92 lbs or 8%
  - Wet distillers grains: 2.6 lbs or 5%
- Protein: 20%
  - Protein mix (canola, soy, etc.): 10 lbs or 20%

Ingredients and costs

Design a 1 lb (or 16 oz) ration using the following ingredients:
- Forages
  - Pretzels ($2.99 per lb) = hay
  - Corn Chips ($10.18 per lb) = corn silage
- Energy concentrate
  - Skittles ($4.50 per lb) = high-moisture corn
- Protein
  - Cashews ($9.98 per lb) = soybeans
  - Sunflower seeds ($4.75 per lb) = dried distillers grain

Rules

1. No single ingredient can exceed 3 oz.
2. The total ration must not exceed 8 oz or be below 7 oz.
3. You must receive instructor approval before creating your TMR, as well as before consuming it.
4. Use a balance or scale to measure out your ingredients. Be sure to use a paper plate or bowl to hold your items—remember to subtract the weight of the plate or bowl.
5. Create a pie chart to show the relative amounts of each ingredient.
6. You must complete all questions and receive instructor approval before eating your ration.

In the table below, include your ingredient, the amount used in ounces (oz) and what percent that ingredient makes of the total ration. Note: there are 16 oz in a pound (lb).

Ingredient	% in ration	Cost per pound	Total cost of ingredient
Pretzels		$2.99 per lb	
Corn Chips		$10.18 per lb	
Skittles		$4.50 per lb	
Cashews		$9.98 per lb	
Sunflower seeds		$4.75 per lb	

Reflection

1. Why did you formulate your ration the way you did? Provide reasons for why you think this would be effective for an athlete's performance or the production of the dairy cow and profitability of the farm.

2. How much would your ration cost to feed per pound? To determine this, take the percentage of each ingredient and multiply it by its cost per pound. Fill in the table above.

3. How does your cost compare to the other groups? List costs of other groups below.

4. Do you think the cheapest group's ration is also the most profitable ration? Explain.

5. Do you think your ration is the best ration? Explain.

6. If you chose to follow the TMR for a cow, explain the connection between the quality of feed in the TMR and milk production.

7. What is the difference between the types of foods that a human eats and the types of foods that cows eat? Could humans live on a cow's diet? Why or why not?

8. Create a chart to show the percentages of each ingredient and the category it represents.

Rubric for self-assessment

Skill	Yes	No	Unsure
I used math to determine the TMR using proper percentages.			
I used math to create a graph to show TMR components.			
I understand the relationship of different dietary needs based on different energy needs of an individual person or animal.			

Extension: Creating a protein percentage using the Pearson square

Using the following grains (canola, soy, barley, oats), choose two. Of those two, what percentage of each is needed to achieve the 20% crude protein requirement? Use the Pearson square below to figure it out.

Canola (20%), barley (12%), soy (46%) oats (15%)

1. Place the desired crude protein percentage in the center box. (In this example, the desired crude protein is 15.)
2. Place the protein percentages of the two grains you chose on the left corners of the square. (i.e., two grains that have 30% and 12% protein.)
3. Calculate the difference between the desired crude protein and each grain, then place the answer by following the arrows to the opposite corner. (i.e., the center number is 15 and the top number in the left corner is 30; the difference between 30 and 15 is 15; so 15 goes in the bottom right corner of the square). The difference between the bottom left number and the center is 3, which then goes in the top left corner following the arrows—do not worry about negative signs.
4. Add the two numbers on the right together to get the total, then calculate each feed as a percentage:

   15 + 3 = 18
   Grain 1: **3 / 18 = 0.167 × 100 = 16.7%** of grain 1 is needed to make the correct ration.
   Grain 2: **15 / 18 = 0.833 × 100 = 83.3%** of grain 2 is needed to make the correct ration.