#### Marathon Assignment

(adapted from *BSCS Biology: A Human Approach*)

#### One of the most difficult and demanding athletic contests is the Marathon, a 26.2-mile (41.9 kilometer) running race. Marathon runners need to be extremely fit in order to be successful. In this activity, you will analyze four individuals and their ability to successfully run a marathon. This will give you a chance to demonstrate your understanding of fitness and the biological conditions necessary for human fitness.

**Part I. In-Class Preparation with Groups**

1. Your teacher will count you off from 1-4.
   1. Each number is associated with a runner as follows: 1 = Neal, 2 = Amy, 3 = Mel, 4 = John
   2. All 1s, 2s, 3s, and 4s should get together to read the marathon story and discuss their assigned runner. You will eventually go back to your original group to share out answers.
2. As a group, read *The Race* on **pp. 392-395** in your textbook about four runners training for a marathon. Write the name of your assigned runner on the line below.

**My Runner:**

1. Look at Figures 7.35a-g and think about how these data will help you analyze your runner’s training strategies.
2. Read the essay, *Factors Influencing Performance* on pp. 401-405 of your textbook.
3. Use the information from *Exercise Energy Expenditure* (Figure 7.35c on pg. 398)and *The Race* (pp. 392-395) to calculate the values to complete the table below. **Refer to the back of this page for the steps for determining kcal usage for the remaining boxes in the table.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Runner** | Mass | **Normal Workout:**  **Kcals Used/Week (assume 5 min/km pace)** | **Race Training:** Kcals Used/Week **(assume 4.3 min/km pace)** | **Marathon:** Kcals Used **(see finish time)** |
| **Neal** | 68 kg (150 lb) | N.A. |  |  |
| **Amy** | 50 kg (110 lb) | N.A. |  |  |
| **Mel** | 82 kg (181 lb) | 2,624 |  |  |
| **John** | 75 kg (165 lb) |  | 2,709 |  |

A) If you are **Neal**, **Amy**, or **Mel,** you must calculate their Race Training kcal usage and their Marathon kcal usage.

B) If you are **John,** you must calculate his Normal Workout kcal usage and his Marathon kcal usage.

**Follow the steps on the next page to determine these numbers.**

You will need to use these resources:

a) “How the Runners Trained” on pg. 393 to find out their normal workout (within the first few months of training) vs. their race training workout (in the few months right before the race)

b) Figure 7.35 c the *Exercise and Energy Expenditure* table to determine kcals used/kg\*min based on their running rate (either 5 min/km or 4.3 min/km)

c) “The Scenario” on pg. 392 for the length of a marathon in km, and “The Race” for each runner’s end time

**Marathon Math Help**

**Follow these steps to determine the kcals used/week for a runner during his/her   
normal workout OR during race training (it’s the same formula for both, just with different #s):**

Runner’s name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Runner’s weight (kg): \_\_\_\_\_\_\_\_\_\_\_ kg (see figure 7.35a)

2. Distance run in 1 week of race training (km): \_\_\_\_\_\_\_\_\_\_km  
  
= *distance run each day \_\_\_\_\_\_\_\_(km) × number days trained per week \_\_\_\_\_\_\_(days) = \_\_\_\_\_\_\_\_ km*

3. Pace during race training (min/km): \_\_\_\_\_\_\_\_\_\_\_min/km (see figure 7.35a)

4. Time spent running in 1 week of race training (min): \_\_\_\_\_\_\_\_\_\_\_min  
 *= pace \_\_\_\_\_\_\_\_(min/km) × distance run in a week \_\_\_\_\_\_\_\_(km) = \_\_\_\_\_\_\_\_\_min*

5. Kilocalories burned every minute of race training (kcal/kg•min): \_\_\_\_\_\_\_\_\_\_\_ kcal/kg\*min  
(see figure 7.35c for kcals used/kg per minute for runner’s pace)

6. Total kilocalories used by runner in 1 week of training: \_\_\_\_\_\_\_\_\_\_\_ 🡨 Final answer

= *weight \_\_\_\_\_\_\_\_(kg) × time spent running/week \_\_\_\_\_\_\_\_\_\_(min) x   
kcal burned/min \_\_\_\_\_\_\_\_\_\_ (kcal/kg\*min) = \_\_\_\_\_\_\_\_\_\_ kcal (🡨 final answer)*

**Follow these steps to determine the kcals used/week for a runner during the marathon:**

1. Distance run in marathon (km): \_\_\_\_\_\_\_\_\_\_\_km (see *The Scenario* for marathon length)

2. Time spent running marathon (min): \_\_\_\_\_\_\_\_\_\_\_ min (see the end of *The Race* for marathon time)   
*NOTE: Convert the hours, minutes, and seconds into just minutes*

3. Pace during marathon (min/km): \_\_\_\_\_\_\_\_\_\_\_ min/km

= *time spent running marathon \_\_\_\_\_\_(min) ÷ distance run in marathon \_\_\_\_\_\_(km) = \_\_\_\_\_\_min/km*

4. Kilocalories burned every minute during marathon (kcal/kg•min): \_\_\_\_\_\_\_\_\_\_\_

(see figure 7.35c for kcals used/kg per minute for runner’s pace as determined above)

5. Total kilocalories burned by runner during marathon: \_\_\_\_\_\_\_\_\_\_\_ 🡨 Final answer

= *weight \_\_\_\_\_\_\_\_ (kg) × time spent running \_\_\_\_\_\_\_(min) x kcal burned/min \_\_\_\_\_\_\_\_\_ (kcal/kg\*min) = \_\_\_\_\_\_\_\_\_\_\_ kcal (🡨 final answer)*

Record your two “final answers” (one for normal/training workout and one for marathon) in the table.

1. Using your understanding of biology, the reading *Physiologic Data Related to Physical Performance*, and the completed table above, analyze your runner’s training and performance on race day.
   1. Examine your runner’s training schedule. In what ways did the schedule prepare him or her to finish the race? How did your runner’s energy expenditure per week of race training compare with the amount of energy he or she expended during the marathon?

### Neal – Neal’s training schedule allowed him to maintain a comfortable rate. During the marathon he actually used less energy than during training.

***Amy –*** She trained well by running 10 miles a day and 40 in a week. She used more energy training than she did in the race, which means she pushed herself hard during training.

***Mel –*** His training helped him be comfortable with running because he wasn’t used to it. During the marathon he expended more energy than during training.

***John –*** His training schedule helped him lose weight and endure running. He used more energy during the marathon than while training.

* 1. Examine the diet of your runner in the weeks preceding the race. Did your runner appear to be increasing or decreasing his or her intake of any particular class of nutrients during training?

### Neal – He ate a balanced diet and ate large amounts of whole grains (bread, cereal, and pasta)- aka more carbs.

***Amy –*** She ate a balanced diet the entire time, not increasing or decrease any type of nutrient.

***Mel –*** He ate balanced meals with carbs and proteins, and low amounts of fats.

***John –*** He also ate balanced meals and felt like it was fine to eat desserts after training.

* 1. Summarize the strategy you think your runner was using during training.

### Neal – His goal was to increase his stamina and finish without getting sore or cramps.

***Amy –*** Her strategy was to build up a resistance to running and slowly get better.

***Mel –*** He wanted to start small but increase his mileage over time.

***John –*** He wanted to lose weight so he increased his energy levels incrementally each week.

* 1. Examine your runner’s behavior on the race day before the race began. What strategies do you think he or she was using to prepare for the race?

### Neal – Neal ate oatmeal and plenty of juice to give him energy and water to stay hydrated.

***Amy –*** Eat lots of calories and vitamins for nutrition

***Mel –*** He was relaxed and ate a lot of protein

***John –*** He was confident and ate steak and eggs (omlette) and French toast because he thought he’d get more energy

* 1. Examine your runner’s performance during the marathon (for example, his or her pace, fluid intake, and apparent stamina and success). What strategies did he or she seem to be using?

### Neal – Was able to run a steady/comfortable pace without cramping, due to his proper training

***Amy –*** She had a steady pace to make sure she didn’t tire out

***Mel –*** He ran at a steady rate though his leg cramped up #forcingit

***John –*** His legs failed him (knees heavy and cramping); he came in last

* 1. Propose reasons why your runner’s body behaved as it did.

### Neal – Neal ate the right amount of nutrients during training AND on race day and properly trained

***Amy –*** She pushed herself towards the end very hard and because nauseous

***Mel –*** He didn’t stretch or do leg work so his legs cramped

***John –*** HE wasn’t prepared because of his proper training, smoking habits, and bad eating

* 1. Propose ways your runner could have improved his or her performance.

### Neal – He could have trained a bit more and increased his speed/frequency; he could have drank some calorie gel during the race

***Amy –*** She could have raced more miles when training, and you can always eat healthier

***Mel –*** He could have stretched and done more leg work, plus increased his training and improved his eating habits

***John –*** He could have increased his training mileage, started training earlier, and improved his eating habits

1. All members in the same group (who are working on the same runner as you) should have the same information in his/her packet. You all need to be equally prepared to share the information with your original group. Check yours and others packets for completion, now.
2. Go back to your original group and share the information you recorded for each runner.   
   All group members should have a full set of information for all the runners. Having a complete set of information for all runners is very important for completing Part II of this activity, as described on the next page.

**DO NOT LOSE THIS PACKET!!!**

**You will be using this packet daily over the next two weeks. Put it in a SAFE place in your backpack where it will not get crumpled and will be easy to find.   
Take care of your belongings!**

**Part II Written Analysis**

Now that you have collected data on these runners and thought about their training and racing strategies from a biological perspective, you need to synthesize the information into a written piece. In your writing you will also revisit earlier biological concepts and explore a new topic in fitness.

**In an essay of 2-3 pages in length**, respond to the following questions. The **suggested length** for each response is in parentheses after each question.

Explain how humans obtain energy. You should discuss digestion and biosynthesis in your answer. Then explain how physical fitness is related to the release of energy from matter. (1+ paragraphs)

Compare and contrast the training strategies and fitness of each runner. Which runner was most

prepared? Which runner was least prepared? Which runner expended the most energy during their training? Which runner expended the most energy during the race? Give reasons for your response. (2 + paragraphs)

Compare the training schedules and diets of the four runners before the race: list one

training and one dietary strategy and explain the physiological changes that result from those strategies. (1+ paragraphs)

Explain how the process of energy release from matter is more efficient in highly

trained athletes than in most other people. (1+ paragraph)

Explain how digestion, breakdown, and biosynthesis relate to the repair of a torn

muscle in a marathon racer. (1+ paragraphs)

**Logistics:**

* This assignment is due in its entirety on **Friday, January 23, 2015.** If you are absent on Friday, it is still due. Email me your essay and hand in the written packet when you return first thing on Monday.
* The written part of your analysis should be typed, double-spaced with 12-point font and 1” margins.   
  It should be approximately 3 pages.
* On January 23rd, you should turn in your essay with your group work from Part I stapled to the back.
* This assignment is worth 100 points
  + 40 point classwork grade (written packet)
  + 60 point project grade (2-3 page essay)
* If you have questions at any point while you are working on this assignment, first ask a friend and then come ask me. We are working on building our independence. Seek out the information within your notes, textbook, or the Internet. If you come ask me a question, make sure it is very specific and not, “I don’t get it; help me!”
* You should plan to spend between 30 min and 1 hour per day on this assignment from now until it is due on Friday the 23rd. I will not accept late “Marathon Assignments” and you will get 0 points for this assignment. You HAVE TWO WEEKS- plenty of time to make it happen.
* Plan ahead for your work on this assignment. If you don’t have access to a computer at home, you have options: office hours, library, pen & paper then computer, etc. There is no excuse when you are given two weeks to complete an assignment.
* Make SURE to read the attached rubric **before,** **during**, and **after** completing your assignment. Follow the components carefully. DO NOT turn in work that is only half done. Get it done and do it well. Good luck ☺

**Marathon Assignment Rubric  
Grading Sheet 2015**

**Part I will count towards for a 40 point classwork grade.**

Calculations and analysis of own runner (20 points)

Recorded and understood analysis of other runners (20 points)

**Comments**

# Part I Total: \_\_\_\_\_\_/40 points

# Part II Essay

# How Humans Obtain Energy (\_\_\_\_\_\_/9 points)

Digestion (2 points)

Biosynthesis (2 points)

Physical fitness (2 points)

Completeness and use of examples (3 point)

# Runners’ Training Strategies (\_\_\_\_\_\_/12 points)

Most prepared runner (1 points)

Least prepared runner (1 point)

Most energy during training (1 point)

Effectiveness of training strategies (4 points)

Discussion of runners’ fitness (2 points)

Completeness and effective reasoning (3 points)

# Training Schedules and Diets (\_\_\_\_\_\_/6 points)

1 training strategy (1 point)

Physiological changes from training strategy

(2 points)

1 diet strategy (1 point)

Physiological changes from the diet strategy

(2 points)

# Efficiency of Energy Release (\_\_\_\_\_\_/5 points)

# Why trained athletes = more efficient energy use

# (3 points)

Explanation of how training causes physiological

advantages (2 points)

**Muscle Repair (\_\_\_\_\_\_/8 points)**

Explanation using digestion, breakdown, and

biosynthesis (6 points)

Effect of marathon training (2 points)

**Presentation (\_\_\_\_\_\_/20 points)**

Proper grammar and punctuation; Evidence of

proofreading (15 points)

Typed. (5 points)

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# Part II Total: \_\_\_\_\_\_/60 points