#### 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 – During race training, he expended more energy than during the marathon. He worked out constantly, joined a training program, and ate a balance diet.

***Amy –*** Amy was in a running program where she ran 4 days/week. She used more energy during the marathon than during her training.

***Mel –*** He worked out at a steady pace during training. He used more energy during the marathon than during training.

***John –*** He ran every day 5km to train and then upped it to 10km. He used more energy during training than during the marathon.

* 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 increased his intake of carbs (bread, pasta, etc.) in the weeks before the race. He ate a balanced diet.

***Amy –*** She increased her water intake along with lots of carbs.

***Mel –*** He decreased his amount of fats and ate a balanced diet.

***John –*** He ate balanced meals but ate desserts at night. He is also a smoker and reduced to a few per day.

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

### Neal – He joined a running/training program, ran often, and ate balanced meals.

***Amy –*** She initially ran many different courses, and then eventually kept a steady pace during training (16 km, 4 days a week).

***Mel –*** He ran four days/week and increased it the month before the race.

***John –*** He still smoked and ate desserts, but still trained every day without breaks to increase his stamina.

* 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 – He ate oatmeal with little milk and lots of juice in order to increase his energy for racing.

***Amy –*** She had oatmeal, milk, and orange juice.

***Mel –*** He stretched his upper and lower body before racing, and had French toast and juice.

***John –*** He ate a heavy breakfast with eggs, grits and coffee.

* 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 – He ran a steady pace without tiring due to proper training

***Amy –*** She ran smoothly at a comfortable pace.

***Mel –*** He started off at a good pace, and then started to cramp.

***John –*** He pushed himself during the start but then pretty quickly slowed down (“hit the wall”)

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

### Neal – He trained well and finished strong, but could have prepared a bit better to prevent cramping.

***Amy –*** She trained well and did well in the beginning, got tired towards the end, but still finished at a steady pace

***Mel –*** He started to cramp up because he did not eat the proper nutrition to finish strong.

***John –*** He under-trained (mileage) and smoked and did not have a balanced diet, so he was hurting during the race.

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

### Neal – He could have finished in a better position if he didn’t run so calmly

***Amy –*** If she had drank water or eaten gel packets during the race (or veggies/caffeine before), she might have improved her time

***Mel –*** If he had eaten more protein during training, and more carbs the morning of

***John –*** He could have found a smoking alternative, stopped eating desserts, and increased his training mileage while taking breaks to rest

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)

# 

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