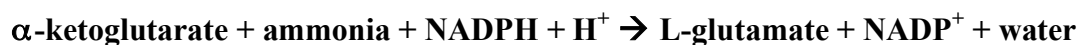


K) Are the Salmonella used in the Ames test mixotrophic, heterotrophic or autotrophic? (explain your answer, your answer should include why it is not the other two choices) (7pt)

You gaze back out at the field and muse about the myriad interactions that must occur for an ecosystem to be in balance. *Rhizobium* and soybeans live symbiotically.

L) What benefits does *Rhizobium* derive from this relationship? Be sure to consider the requirements of the nitrogenase reaction itself. (5pt)

You remember that the soybean plants benefit due to nitrogen fixation. After nitrogen gas is fixed it can then be used in the following reaction.



M) Is the forward reaction endergonic or exergonic? (Explain. Define endergonic and exergonic in your answer) (7pt)

N) In the reaction above, is α -ketoglutarate being oxidized or reduced? (Answer should be in the form of 'The α -ketoglutarate is being _____ because.....') (3pt)

O) Why would the plant benefit from this reaction? (3pt)

P) Why would an environmentalist applaud the farmer for alternating areas of legumes with areas of corn? What does it do to crop yield on those acres? (4pt)

BONUS: Draw the structure of L-glutamate (2pt)

All of this 'laboratory work', random musings, and five hours of driving, have left you hungry. You stop at a convenience store and fill up your gas tank. You glance at the prepared sandwiches but the slightly green tinge of the meat convinces you to avoid possible food poisoning and buy a chocolate bar. Munching on the chocolate while you continue driving car you return to your scientific ponderings.

Q) Where do glycolysis, the Krebs cycle and oxidative phosphorylation occur? (Be specific) (6pt)

R) Why does the compartmentalization you described in the previous question both help and hinder the production of ATP? (5pt)

S) Define the terms potential energy and kinetic energy. From your body's perspective, what type of energy is found in the chocolate bar you purchased? (Explain your answer). (8pt)

T) Compare and contrast the production of ATP by a bacterium like *Clostridium botulinum* (the food poisoning bacteria) and production of ATP in your liver cells. Be sure to mention any differences in the net amount of ATP produced per 'one candy bar's worth' of glucose. (Maximum of 400 words) (10pt)

You arrive at the Mayo Clinic and check in to find that you have been assigned to the oncology department. You head to your apartment to see what you can remember from section IV of Bio111, assured that your firm understanding of the basics will serve you well.

When a maximum word count is given you must provide the number of words in your answer. Word will determine this for you (Tools menu/ word count).

You have been hired as a summer research intern at the Mayo Clinic in Minnesota. After final exams you pack your bags and head out on the long drive to the Midwest. While driving through the farmlands of Ohio you happen to notice that the fields appear striped. Each field contains an alternating pattern of twenty yards of corn and twenty yards of soybeans. You also notice a crop duster (airplane) spraying the fields with pesticide. With plenty of time on your hands, you remember back to the bioenergetics section of Bio111 and the various ways that chemicals can poison plants and animals.

A) Define metabolism. (one sentence) (3pt)

B) Compare and contrast the way that paraquat kills plants with the way that cyanide kills animals. (250 words max- can be done in much less) (6pt)

C) If a plant could ingest cyanide would it die? Predict yes or no and explain your reasoning. (4pt)

BONUS: You want to test your prediction about plants and cyanide. You grow plant cells in a Petri dish with plant growth media. Your stock solution is 3M CN⁻, the Petri dish contains 20ml of growth media. What do you do to test the effect of 40mM CN⁻? (3pt)

D) Are plants alive? Provide your reasoning. (2pt)

It is a bright and sunny day and you realize that are billions of photosynthetic reactions occurring in the fields around you. You remember that the light reactions of photosynthesis include cyclic and non-cyclic photophosphorylation.

E) What is photophosphorylation? (3pt)

F) Photosynthesis and cellular respiration contain other reactions that are analogous to photophosphorylation. Give the name of one of those reactions and provide an example of where it occurs. (4pt)

BONUS: Draw the molecules involved in the reaction you described above (3pt)

G) Describe what occurs in each of the three stages of the Calvin Benson cycle. (100 word max) (6pt)

You imagine a laboratory setting in which Chlamydomonas is used as a model organism. You are studying two strains of Chlamydomonas. One strain is mixotrophic and the other is heterotrophic. You set up an experiment where you measure the ATP produced by cellular respiration continuously throughout the experiment. At the beginning of the experiment each strain is grown on normal growth media in the light for an hour. You then wrap each sample in tin foil for 3 hours. You write up a results section for your experimental data.

H) Draw (by hand) the figure describing the ATP data as it would appear in your results section. (ATP concentrations can be represented by 'arbitrary units'—interested in the trend of the graph rather than absolute numbers) (5pt)

I) Explain the figure that you drew above. (5pt)

J) If you repeated this experiment using a Salmonella strain from the Ames test lab, its normal growth media, light and tinfoil covered growth periods what would you expect the graph to look like? (your explanation may include a well-labeled graph but the text must stand alone) (4pt)

Biology 111: Unit 3

April 2006

This review must **be signed in at my office Watson289 before 5:00pm Friday, April 14th**. Refer to the syllabus for information about course policies regarding tests and other written assignments.

- There is no time limit for taking the review except for the final due time. It was designed to be completed in 2 hours and I suggest you use that as a guideline but do not wait until the last minute to begin. Leave time to print and deliver.
- This is a closed-book, closed-note review. Once you have seen any question your review period has begun.
- This page must be the first page of your answer packet. Fill out this page and attach it to the ones containing your answers. The top of each additional page in the packet should contain only your initials and the page number.
- All answers must be typed and in complete sentences unless otherwise indicated. Any accompanying *graphs or figures may be hand-drawn*.
- You may use a calculator for +,-,*,and / only. To receive full credit all calculations must be included. Calculations/equations may be hand written and do not need to be sentence form. The answer to the question requiring the calculation should be in sentence form.
- Be sure to completely answer the question asked. Brevity is encouraged.
- **There are 20 questions worth 100pt and 3 bonus questions worth 8pt.**

Write out the honor code: (On my honor.....)

Name: _____

(PRINT)

Signature: _____

This review was completed in _____ hours. I began it a _____ and completed it at _____ on _____.