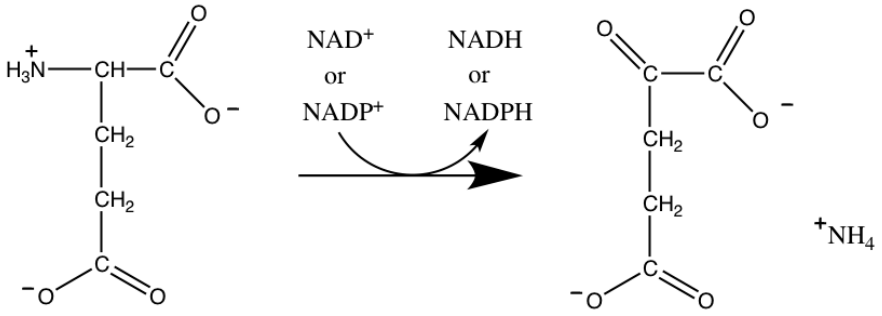
NAME:_____

One isoform of glutamate dehydrogenase is capable of using either NAD^+ or $NADP^+$ as a redox cofactor. The reaction catalyzed by glutamate dehydrogenase is as follows:



1. Ammonium ion is one product of the reaction catalyzed by glutamate dehydrogenase.

    a. **What is the metabolic fate of ammonium ions in humans?**

    b. **What is the significance of the removal of ammonium ions by glutamate dehydrogenase in the overall scheme of metabolism?** [Only two sentences are needed. Only your first two sentences will be graded]

2. During periods of fasting, this isoform of glutamate dehydrogenase may specifically use NAD^+ as its redox cofactor within hepatocytes. Under these conditions your hepatocytes release glucose, free fatty acids, and ketone bodies into the bloodstream to provide energy for other tissues.

    a. **What is the metabolic fate of NADH within a hepatocyte?**

    b. **What is the significance of NADH production by glutamate dehydrogenase in the overall scheme of metabolism in a fasting hepatocyte?** [Only two sentences are needed. Only your first two sentences will be graded]

c. Draw a schematic for the conversion of the α-ketoglutarate product of glutamate dehydrogenase to glucose within a fasting hepatocyte. Include the details of relevant, hormonally-regulated steps. [Include as much detail as you can. Unnecessary steps will be marked as incorrect.]

d. Draw a schematic for the conversion of the α-ketoglutarate product of glutamate dehydrogenase to ketone bodies within a fasting hepatocyte. Include the details of relevant, hormonally-regulated steps. [Include as much detail as you can. Unnecessary steps will be marked as incorrect]

e. Explain why the α-ketoglutarate product of glutamate dehydrogenase is not converted to free fatty acids within a fasting hepatocyte. [Only two sentences are needed. Only your first two sentences will be graded]

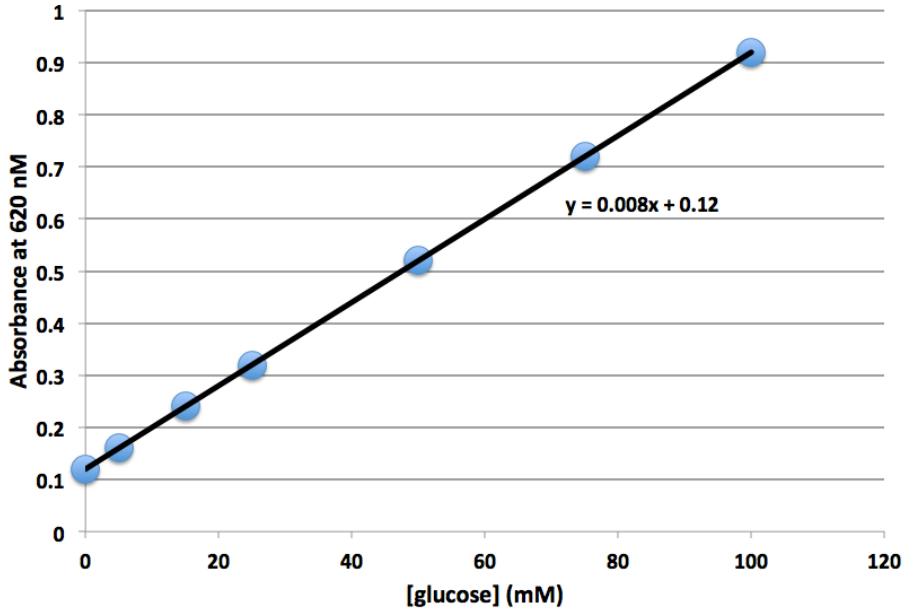
3. During periods of feeding, this isoform of glutamate dehydrogenase may specifically use $NADP^+$ as its redox cofactor within hepatocytes. Under these conditions your hepatocytes store energy as glycogen and fatty acids.

    a. **What is the metabolic use of NADPH within a fed hepatocyte?**

    b. **Draw a schematic for the conversion of the α-ketoglutarate product of glutamate dehydrogenase to a fatty acid within a fed hepatocyte. Include the details of relevant, hormonally-regulated steps.** [Include as much detail as you can. Unnecessary steps will be marked as incorrect]

c. **Explain why the α-ketoglutarate product of glutamate dehydrogenase is not converted to glycogen within a fed hepatocyte.** [Only two sentences are needed. Only your first two sentences will be graded]

4. The following graph is a standard curve for glucose concentration with 3 mL samples as we performed during the semester [You do not need to remember the lab to complete this question]. A 3 mL sample with an unknown concentration of glucose was prepared in an identical manner as the standards and had an absorbance at 620 nm of 0.378.



a. **What is the concentration of glucose in the unknown 3 mL prepared sample in units of mM?** [Show your work.]

b. How many mg of glucose are present in the 3 mL unknown sample? [Show your work.]

c. Imagine that the 3 mL unknown sample was originally prepared by diluting 120 µL of blood to the 3 mL sample volume. What is the concentration of glucose in the original blood sample? [Show your work. If you are unsure of your answers to parts "a" and "b", assume there was 100 mg of glucose in the 3 mL unknown sample.]