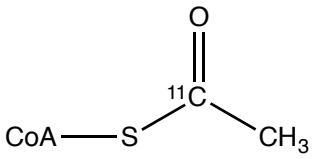
Name: _____ Exam 2

The following exam is based on information contained in:

A. Caron *et al.* Loss of UCP2 impairs cold-induced non-shivering thermogenesis by promoting a shift towards glucose utilization in brown adipose tissue. *Biochimie* (2017). [In press].

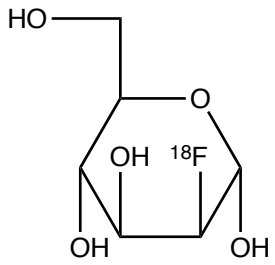
1. The authors fed immortalized mouse embryonic fibroblasts a solutions of 25 mM glucose with 1 mM pyruvate. Describe how to prepare 1 L of a solution containing 25 mM glucose and 1 mM pyruvate without wasting materials.

2. The authors use ^{11}C-acetate with PET/CT scanning to measure the rate of nutrient delivery to brown adipose tissue in mice. Eventually, the ^{11}C-acetate is converted to ^{11}C-acetyl-CoA and transported into the mitochondria. The generation of $^{11}CO_2$ allowed the authors to measure the rate of oxidative metabolism through the TCA cycle. List the order of enzymes that catalyze the ***minimum*** required steps to liberate ^{11}C of ^{11}C-acetyl-CoA as $^{11}CO_2$. [Not all the blanks have to be used.]



1. _____ 2. _____
3. _____ 4. _____
5. _____ 6. _____
7. _____ 8. _____
9. _____ 10. _____
11. _____ 12. _____
13. _____ 14. _____
15. _____ 16. _____
17. _____ 18. _____
19. _____ 20. _____

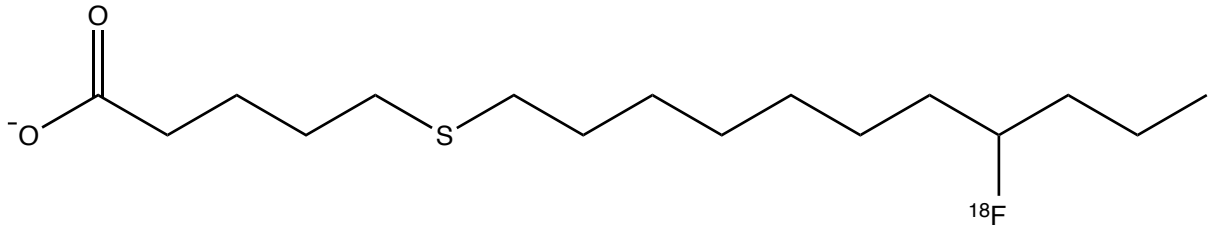
3. The authors monitor glucose uptake by brown adipose cells by monitoring the cellular levels of ^{18}F after feeding mice 2-deoxy-2-[^{18}F]-fluoro-glucose.



   a. Draw the terminal metabolic product that can be made by 2-deoxy-2-[^{18}F]-fluoro-glucose in brown adipose tissue. No pathway needed.

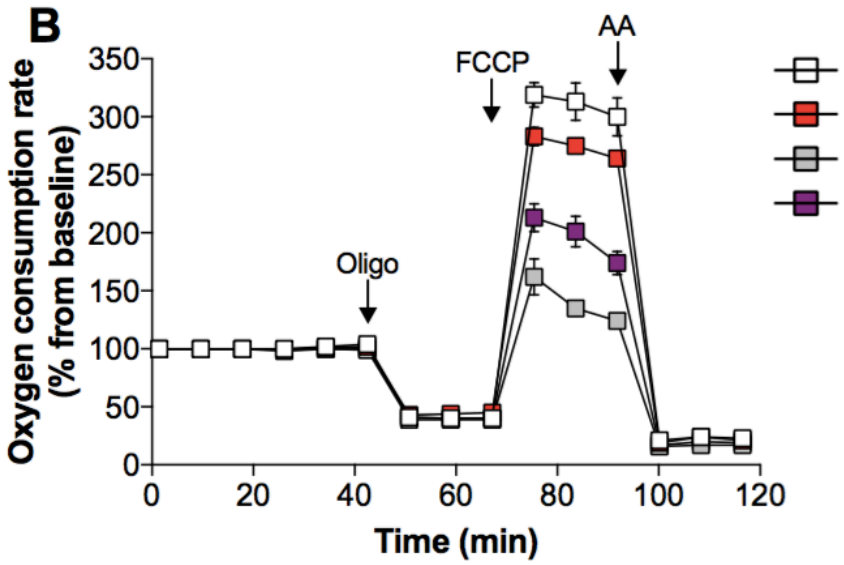
   b. Is the ^{18}F metabolically "stuck" in the brown adipocyte? Explain in two sentences or less.

4. The authors monitor fatty acid uptake by brown adipose cells by monitoring the cellular levels of ^{18}F after feeding mice 14-[^{18}F]-fluoro-6-thia-heptadecanoic acid.



   Draw the terminal metabolic product that can be made by 2-deoxy-2-[^{18}F]-fluoro-glucose in brown adipose tissue. No pathway needed.

5. The authors measure oxygen consumption of immortalized mouse embryonic fibroblasts and report the following.



a. Oligomycin (Oligo) is an ATP-synthase inhibitor. Explain the greater than 50% decrease in oxygen consumption upon administering oligomycin to the cells. Use two sentences or less.

b. Carbonyl cyanide 4-(trifluoromethoxy) phenylhydrazone (FCCP) shuttles protons across membranes. Explain the greater than 200% increase in oxygen consumption upon administering FCCP to the cells. Use two sentences or less.

c. Antimycin A (AA) is a Complex III inhibitor. Explain the 100% decrease in oxygen consumption upon administering antimycin A to the cells. Use two sentences or less.

6. Consider the title of the article:

   "*Loss of UCP2 impairs cold-induced non-shivering thermogenesis by promoting a shift towards glucose utilization in brown adipose tissue*"

   a. Imagine that the loss of UCP2 alters the regulation of the phosphorylation of regulated metabolic enzymes within adipocytes. To observe a shift to increased glucose utilization away from fatty acid use, would you expect to find increased or decreased levels of phosphorylation?

   b. Which adipocyte enzymes would be on or off?

ON	**Off**
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____