Total Points in this Exam = # correct +3  MAX possible=49 (4 EXTRA POINT ADDED)
Average 80%  MAX=46  MIN=20
Exam #4 statistics:  Average =79%
# Above 100%       1
# between 99-90%   21
# between 89-80%   40
# between 79-70%   12
# below 69-60%     16
# below 60%        10

1. What is TRUE under the metabolic condition of anaerobic glycolysis?
A. One molecule of glucose is converted into one molecule of pyruvate
* B. There is a net synthesis of two molecules of ATP per molecule of glucose converted to pyruvate
C. NAD+ is recycled to NADH via Lactate dehydrogenase
D. The hexokinase reaction is readily reversible but not phosphofructokinase
E. Aldolase catalyzes the reversible isomerization of Glucose-3-phosphate and dihydroxyacetone
Correct Answer: B

2. The generation of CO2 through the reactions of the TCA cycle would be increased to the greatest extent by a genetic abnormality that resulted in what condition?
* A. A increase in the concentration of ADP in the mitochondrial matrix
B. A increase in the oxygen content of the cell
C. A decrease in the Vmax of alpha-ketoglutarate dehydrogenase
D. A increase in the Km of isocitrate dehydrogenase
Correct Answer: A
3. What statement below describes metabolic effects of an infant with an enlarged liver due to a deficiency in the the enzyme glucose-6-phosphatase?
* A. Cannot maintain blood glucose levels either by glycogenolysis or by gluconeogenesis
B. Cannot breakdown glucose to maintain energy levels.
C. Can only use glycogen to maintain blood glucose levels
D. Can convert pyruvate to glucose to maintain blood glucose

**Correct Answer: A**

4. A 36-year-old woman is training for her first marathon. Her coach has her keeping a pace that allows her to stay below her anaerobic threshold.

If she avoids anaerobic muscle glycolysis, pyruvate does not accumulate and is converted to what metabolite?
A. Ethanol
B. Lactic acid
C. Oxaloacetate
* D. Acetyl-CoA
E. Alanine

**Correct Answer: D**

5. Consider the following metabolic reaction:

\[ \text{Succinyl-CoA} + \text{Acetoacetate} \rightarrow \text{Acetoacetyl-CoA} + \text{Succinate} \ (\Delta G^\circ = -1.25 \text{ kJ/mol}) \]

The Keq for this reaction at 25°C is close to? \( R = 8.314 \text{ J K}^{-1} \text{mol}^{-1} \)
A. 1
B. 0.6
C. 422
* D. 1.6
E. 3.2

**Correct Answer: D**
CANCELLED

6. Question Name: free energy Type: MC Objective: 2008 Item Bank: Biochemistry (PHAR3316) EXAM4
Consider the following metabolic reaction:
Succinyl-CoA + Acetoacetate ==> Acetoacetyl-CoA + Succinate ($\Delta G^{\circ} = -1.25 \text{ kJ/mol}$). ($R=8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)
Which of the statements below is TRUE regarding this reaction at 25°C?
A. Highly favorable under metabolic conditions
B. Highly favorable under standard conditions
C. Always exergonic and can never proceed in the opposite direction
D. $K_{eq}=1$

7. Among the reactions in glycolysis that are coupled to ATP synthesis there is one that is catalyzed by two enzymes in gluconeogenesis. Which of the glycolysis metabolite conversions given below participate in this reaction?
A. Glyceraldehyde-3-phosphate --> 1,3-bisphosphoglycerate
* B. Phosphoenol pyruvate --> pyruvate
C. 2-phosphoglycerate --> phosphoenolpyruvate
D. 1,3-bisphosphoglycerate --> phosphoglycerate
Correct Answer: B

8. How many moles of ATP+GTP are required for the synthesis of 1 mole of glucose from pyruvate?
A. 2
B. 4
* C. 6
D. 8
E. 12
Correct Answer: C
9. What type of sugar is glucose?
A. D-aldose  
B. D-ketose  
C. L-aldose  
D. L-ketose  
**Correct Answer: A**

10. What would you predict to be the metabolic consequences of Fructose-1,6-biphosphatase deficiency?
A. Inability to carry out glycolysis  
B. Inability to mobilize glycogen stores for glycolysis  
C. Inability to generate glycogen stores  
D. Inability to generate free glucose from pyruvate  
**Correct Answer: D**

11. Which of the following statements is FALSE when considering the biosynthesis of pyruvate from glycogen?
A. One molecule of pyruvate is synthesized for every carbohydrate monomer of glycogen  
B. NADH is synthesized  
C. It is regulated by Phosphofructokinase and Pyruvate kinase are regulatory points  
D. The first step in glycolysis is not relevant  
**Correct Answer: A**

12. Which of the following metabolic conversions is considered to be the major control point of glycolysis?
A. Fructose-1,6-bisphosphate ==&gt;dihydroxyacetone phosphate + glyceraldehyde-3-phosphate  
B. Fructose-6-phosphate ==&gt;fructose-1,6-bisphosphate  
C. pyruvate ==&gt; lactate  
D. Glucose ==&gt; glucose-6-phosphate  
**Correct Answer: B**
13. What is the net ATP generated by glycolysis from glycogen-derived glucose?
A. 1 ATP
B. 2 ATP
* C. 3 ATP
D. 4 ATP

**Correct Answer: C**

14. What is the name of the enzyme involved in the metabolic transformation depicted in panel A?
* A. Glyceraldehyde-3-phosphate dehydrogenase
B. Phosphoglycerate kinase
C. Pyruvate kinase
D. Phosphoglycerate phosphatase
E. Phosphofructokinase

**Correct Answer: A**

15. Which enzymatic step in Glycolysis involves a substrate level phosphorylation?
A. Aldolase
* B. Glyceraldehyde-3-phosphate dehydrogenase
C. Succinate dehydrogenase
D. Malate dehydrogenase
E. Isocitrate dehydrogenase

**Correct Answer: B**

16. Which of the enzymes or reactions listed below is MOST important in the reoxidation of NADH under anaerobic conditions?
A. Malate dehydrogenase
* B. Lactate dehydrogenase
C. Conversion of glucose-6-phosphate --&gt; fructose-6-phosphate
D. The conversion of isocitrate --&gt; alphaketoglutarate
E. The conversion of oxaloacetate --&gt; malate

**Correct Answer: B**
17. Which of the enzymes named below are NOT involved in glycolysis?
A. Aldolase
B. Enolase
C. Pyruvate kinase
D. Phosphoglycerate mutase
* E. Pyruvate dehydrogenase
Correct Answer: E

18. What happens in the metabolic steps between glucose and formation of the triose phosphates?
A. Two ADP and two NAD+ are produced
B. Two ATP and two NADH are produced
C. Two NADH molecules are consumed
* D. Two ATP molecules are consumed
Correct Answer: D

19. The reaction outlined in panel A is:
A. Part of gluconeogenesis
B. Part of stage I of glycolysis
* C. Part of stage II of glycolysis
D. Part of the TCA cycle
Correct Answer: C

20. In the process of glutaminolysis glutamine is converted to what carbon metabolite of the TCA cycle?
* A. alpha-ketoglutarate
B. Pyruvate
C. Citrate
D. Acetyl-CoA
Correct Answer: A
21. Red blood cells synthesize and degrade 2,3-bisphosglycerate (also known as BPG). The synthesis of BPG is as a detour pathway from glycolysis: 1,3-bisphosphoglycerate is used as a substrate in its synthesis. A deficiency in which glycolytic enzymes below would have the largest effect in increasing BPG concentration and thus decreasing oxygen binding affinity of hemoglobin?
A. Hexokinase
B. Isocitrate dehydrogenase
C. Triose phosphate isomerase
* D. Pyruvate kinase

**Correct Answer: D**

22. Which of the compounds listed below releases the highest amount of free energy upon phosphate hydrolysis?
A. ATP
* B. Phosphoenolpyruvate
C. 1,3-bisphosphoglycerate
D. Glyceraldehyde-3-phosphate

**Correct Answer: B**  **This was a difficult question for the class I ended up giving the point for this question and an extra point to those that got it correct**

23. Question Name: NADPH Type: MC Objective: 2008 Item Bank: Biochemistry (PHAR3316) EXAM4
What metabolic process or step given below is used in the biosynthesis of NADPH?
A. Glycolysis
B. Gluconeogenesis
C. TCA cycle
* D. Pentose phosphate pathway
E. Pyruvate ==> Lactate

**Correct Answer: D**
24. Which of the following statements best describes the flux of metabolites through a highly exergonic step?

A. The rate of the reverse step is much greater than that of the forward step
B. The rates of the forward and the reverse steps are approximately equal
*C. The rate of the forward step is much greater than that of the reverse step
D. The rates of the forward and reverse steps are both very high

**Correct Answer: C**

25. What is a characteristic of a rate-determining step of a metabolic pathway?

A. A step that functions near equilibrium and has a large positive free energy change
B. A step that functions near equilibrium and has a large negative free energy change
C. A step that functions far from equilibrium and has a large positive free energy change
*D. A step that functions far from equilibrium and has a large negative free energy change

**Correct Answer: D**

26. What is the essential function of the TCA cycle?

A. Dispose of excess pyruvate and acetyl-CoA
*B. Transfer electrons from the acetyl portion of acetyl-CoA to primarily NAD+
C. The oxidation of the acetyl portion of acetyl-CoA to oxaloacetate
D. Generate heat from the oxidation of the acetyl portion of acetyl-CoA
E. The final degradation of glucose to its most oxidized form

**Correct Answer: B**
27 - 30. Match the items in the alphabetic list to the numbered items.

A. Succinate dehydrogenase
B. Isocitrate dehydrogenase, alpha-ketoglutarate dehydrogenase, succinate dehydrogenase, malate dehydrogenase
C. Isocitrate dehydrogenase, alpha-keto-glutarate dehydrogenase
D. Isocitrate dehydrogenase

27. Regulated allosterically by ADP
28. Liberates CO2
29. Reduces a cofactor that transfers electrons to the electron transport chain
30. Utilizes coenzyme Q as a cofactor

Correct Answer: 27:D 28:C 29:B 30:A

31. In what form does carbon enter the TCA cycle?
A. CO2
B. Pyruvate
C. Acetyl-CoA
D. Glucose

Correct Answer: C

32. Which of the following conditions decreases the oxidation of acetyl-CoA by the citric acid cycle?
A. A low ATP/ADP ratio
B. A low NADH due to rapid oxidation to NAD+ through respiratory chain
C. A low NAD+/NADH ratio
D. A high concentration of AMP
E. A low GTP/GDP ratio

Correct Answer: C
33. Which of the statements listed DOES NOT describe a possible fate for pyruvate?
A. Conversion to Lactate with the corresponding generation of NAD+
B. Decarboxylation by pyruvate dehydrogenase
C. Conversion to Alanine
* D. Conversion to alpha-ketoglutarate

Correct Answer: D

34. Question Name: TCA5 Type: MC Objective: 2008 Item Bank: Biochemistry (PHAR3316) EXAM4
Under standard state conditions, which enzyme of the citric acid cycle has the largest positive free energy change?
A. Citrate synthase
* B. Malate dehydrogenase
C. Aconitase
D. Isocitrate dehydrogenase

Correct Answer: B

35. Which of the statements below DOES NOT describe a possible metabolic fate for glucose?
A. Conversion to ribose-5-phosphate via pentose phosphate pathway (PPP)
* B. Conversion to Glycogen via Glycogenolysis
C. Conversion to pyruvate Glycolysis
D. Conversion to Lactate via Glycolysis and Lactate dehydrogenase

Correct Answer: B

36. The conversion of pyruvate to glucose requires the participation of a number of essential enzymes EXCEPT:
A. Pyruvate carboxylase
* B. Triose phosphate isomerase
C. Phosphoenolpyruvate carboxykinase
D. Fructose bisphosphatase
E. Glucose-6-phosphatase

Correct Answer: B
37. Which one of the following statements concerning glycolysis is TRUE?
A. The conversion of glucose to lactate requires the presence of oxygen
B. Hexokinase is important in liver glucose metabolism
C. Fructose-2,6-bisphosphate is a potent inhibitor of Phosphofructokinase
D. The regulated reactions are the one with largest change in free energy
E. The conversion of glucose to lactate yields two ATP and two NADH molecules

**Correct Answer: D**

38. Glutamine can be used as source of energy through what metabolic process?
A. Glycogenolysis
B. Glycolysis
C. Glutaminolysis
D. Pentose Phosphate Pathway
E. Lipid catabolism

**Correct Answer: C**

39. Which of the metabolites listed below takes part in the reaction depicted in panel A?
A. 1,3-bisphosphoglycerate
B. 3-phosphoglycerate
C. 2-phosphoglycerate
D. Dihydroxyacetone phosphate

**Correct Answer: D**

40. Human fibroblast cells are not able to utilize galactose as effectively as glucose. If we feed galactose to human fibroblasts what is a potential alternative metabolic pathway that these cells can utilize for synthesis of ATP?
A. Gluconeogenesis
B. Glycolysis
C. Glutaminolysis
D. Alaninolysis

**Correct Answer: C**

*This was a difficult question for the class I ended up giving the point for this question and an extra point to those that got it correct*
41. Which one of the metabolites in the TCA cycle is a precursor to fatty acid biosynthesis?
A. Alpha-ketoglutarate
B. Oxaloacetate
* C. Citrate
D. Succinyl-coA
Correct Answer: C

This was a difficult question for the class I ended up giving the point for this question and an extra point to those that got it correct

42. Question Name: hypoxic Type: MC Objective: 2008 Item Bank: Biochemistry (PHAR3316) EXAM4
What metabolic process is used to generate ATP under hypoxic conditions?
A. Oxidative Phosphorylation
B. Gluconeogenesis
* C. Glycolysis
D. Glutaminolysis
Correct Answer: C

43. What is the site of fatty acid catabolism?
A. Cytoplasm
* B. Mitochondria
C. Peroxisome
D. Plasma membrane
Correct Answer: B

44. Which of the following is correct concerning the metabolic reaction shown in panel A?
A. This reaction is an oxidative decarboxylation
B. This reaction connects glycolysis to the TCA cycle
C. The enzyme carrying out this reaction is called a dehydrogenase
* D. This reaction is an example of a transferase
Correct Answer: D
45. What is name of the type of transferase reaction important in linking amino acid metabolism to glycolytic and to TCA metabolites?

A. Phosphotransfer reactions

* B. Aminotransferase reactions

C. Carboxyltransfer reactions

D. Acetyltransferase reactions

**Correct Answer: B**