1. Which of the following about ATP is false?
   a) It has three phosphates
   b) It contains a ribose sugar
   c) When the terminal phosphate bond is broken it produces 5 kcal of useful energy
   d) All of the above are true

2. When activated by free ADP, Creatine Phosphokinase (CPK) converts ATP into more free ADP and inorganic phosphate.
   a) True
   b) False

3. Which of the following about Creatine supplementation is false?
   a) Creatine has a large osmotic load
   b) It has no known side-effects
   c) It increases PCr levels by 5-15% depending on the individual’s normal diet
   d) It definitely does not have anabolic effects
   e) None of the above are false
   f) All of the above are false

4. Does glucose consumption increase creatine absorption in the muscle? Why?
   a) Yes. Ingesting glucose decreases insulin levels, which increases amino acid absorption. Creatine absorption is thus increased since the amino acid receptors in the muscle do not specify.
   b) Yes. Ingesting glucose increases insulin levels, which increases amino acid absorption. Creatine absorption is thus increased since the amino acid receptors in the muscle do not specify.
   c) No. Ingesting glucose increases insulin levels, which decreases creatine absorption into the muscle.
   d) No. Ingesting glucose increases insulin levels, which increases amino acid absorption into the muscle. However, the amino acid receptors are highly specific, so creatine absorption is unaffected.
5. Which step in the glycolytic pathway is the rate-limiting step?
   a) Glucose to fructose-6-phosphate
   b) Fructose-6-phosphate to fructose 1,6 diphosphate
   c) Fructose 1,6 diphosphate to pyruvic acid
   d) None of the above is rate-limiting

6. Which of the following would increase the rate of glycolysis the most?
   a) Increasing free ADP; the activator of PFK
   b) Increasing the amount of glucose in the cell
   c) Increasing the total number of glycolytic enzymes in the cell
   d) A and B increase the rate of glycolysis equally
   e) A and C increase the rate of glycolysis equally
   f) All of the above increase the rate of glycolysis equally

7. Which is true about β-oxidation?
   a) It is the breakdown of lipids that enter the Kreb’s Cycle
   b) It cleaves 2 carbons at a time
   c) It produces less CO2 per molecule relative to glucose
   d) All of the above are true

8. The transport of electrons along the electron transport chain (ETC) is coupled with proton pumping from the intermembrane space into the matrix.
   a) True
   b) False

9. If an individual suffers from cyanide poisoning, what happens to aerobic energy production?
   a) Nothing; electrons will still flow through the ETC which ultimately will continue to produce ATP.
   b) Nothing; the electrons will stop flowing through the ETC, but that’s okay, the hydrogen ions will still be pumped from the matrix into the intermembrane space, thus eventually producing ATP.
   c) Aerobic ATP production will decrease; cyanide inhibits cytochrome oxidase (COX), so the electrons transported between complex IV and COX will no longer pump hydrogen ions, decreasing the total number of hydrogen ions contributing to the proton motive force.
   d) Aerobic ATP production will decrease; cyanide inhibits cytochrome oxidase, stopping electron flow through the ETC resulting in no pumping of hydrogen ions, and therefore no ATP production.
10. What is the final electron acceptor in the ETC?
   a) Oxygen
   b) Cytochrome Oxidase
   c) NADH dehydrogenase
   d) ATP Synthase

11. What are the two components to the Fick equation?
   a) i) Stroke Volume and ii) Heart Rate
   b) i) Stroke Volume and ii) muscle oxygen extraction
   c) i) Cardiovascular function and ii) muscle oxygen extraction
   d) None of the above

12. What is the cause of i) the fast component and ii) the slow component of excess post-exercise oxygen consumption (EPOC)?
   a) i) Increased body temperate and ii) excess mitochondrial oxygen consumption
   b) i) Excess mitochondrial oxygen consumption and ii) increased body temperate
   c) Excess mitochondrial oxygen consumption is responsible for both phases of EPOC
   d) Trick question. There is only 1 component to EPOC

13. Which organism will have the highest VO2 max?
   a) An elephant
   b) A morbidly obese person
   c) An incredibly muscular person
   d) There is not enough information to determine the correct answer

14. The anaerobic system is invoked every time you increase intensity during exercise.
   a) True
   b) False

15. What is the concentration of lactic acid at rest?
   a) 5mM
   b) 30mM
   c) 15mM
   d) 1mM
   e) None of the above
16. A 20-year-old University student weighs 150 lbs and is 175 cm tall. Determine their BMI.
   a) 22
   b) 28
   c) 19
   d) 26

17. What role does Myosin ATPase play in Energy metabolism?
   a) Builds up ATP (anabolism) for use in cells
   b) Breaks down (catabolism) ATP for use in cells
   c) Causes vasodilatation in blood vessels
   d) None of the above
   e) All of the above

18. True or False: the amount of ATP produced depends on the level of the intensity of the exercise.
   a) True
   b) False

19. Which Energy system plays the biggest role in the beginning of exercise?
   a) Aerobic system
   b) Anaerobic Glycolysis
   c) ATP-PC
   d) None of the above
   e) A and C
   f) A and B

20. Why is there a difference in lactate threshold's between untrained and trained (Endurance-Athletes) people?
   a) Endurance athletes have more mitochondrial content, which allows more ATP to be produced, and less dependency on anaerobic systems.
   b) Untrained people have more mitochondrial content, which allows more ATP to be produced, and less dependency on anaerobic systems
   c) Endurance athletes have less mitochondrial content, which allows less ATP to be produced, and more dependency on anaerobic systems.
   d) None of the above
21. During incremental exercise, individuals who are PFK deficient have low blood-lactate concentrations. What is the reason?
   a) Those individuals suffer from mitochondrial disease
   b) Those individuals have trouble metabolizing glucose
c) False: PFK deficient people do not have low blood-lactate concentrations
d) A and B

22. During high intensity exercise, the lactic acid concentration in the blood is highest at 25-30mM. What is the main reason for this?
   a) The Aerobic system is occurring
   b) Anaerobic glycolysis is occurring, which leads to acidosis
c) The muscles are beginning to break down, which is causing high lactic acid in the blood
d) None of the above

23. What is the main difference between a 15,000-meter run Marathon runner and a 100-meter dash runner?
   a) The 15,000-meter marathon runner primarily uses the anaerobic system, while the 100-meter dash runner primarily uses the aerobic system.
b) The 100-meter dash runner primarily uses the anaerobic system, while the 15,000-meter marathon runner uses primarily aerobic system.
c) There is no difference between the two runners

24. True or False: Creatine concentration increases during exercise and decreases during recovery.
   a) True
   b) False

25. What is the main role of the NADH dehydrogenase?
   a) Serves as a potential energy in making ATP
   b) It causes COX deficiency
c) It is the first enzyme in the aerobic system pathway
d) All of the above
26. During sarcomere contraction:
   a) H zone becomes shorter
   b) I band stays the same
   c) A band becomes longer
   d) Two of the above
   e) All of the above
   f) None of the above

27. During exercise, the ATP-Phosphocreatine system starts up before aerobic glycolysis and the aerobic system.
   a) True
   b) False

28. What about PCr is true?
   a) [PCr] is 3-4 times higher than ATP
   b) PCr is used rapidly, but restored slowly
   c) PCr restoration depends on blood flow
   d) a and b
   e) a and c
   f) b and c

29. What is the role of free ADP (ADP_f) in energy production?
   a) Substrate for Creatine Phosphokinase
   b) Activator of PFK in glycolysis
   c) Rate-limiting step for the aerobic system
   d) a and c
   e) All of the above

30. Where in the cell do the ATP-PC pathway (i) and glycolysis (ii) occur?
   a) (i) Cytosol, (ii) mitochondrial matrix
   b) (i) Mitochondrial matrix (ii) intermembrane space
   c) (i) Mitochondrial matrix (ii) mitochondrial matrix
   d) (i) Cytosol (ii) cytosol
31. What does the Michaelis constant (K_m) represent?
   a) The maximum velocity of the reaction
   b) 50% of the maximum velocity of the reaction
   c) The substrate concentration that gives you the maximum velocity of the reaction
   d) The substrate concentration that gives you 50% of the maximum velocity of the reaction
   e) None of the above

32. What does ADP act as, in relation to PFK?
   a) Allosteric inhibitor
   b) Allosteric activator
   c) Competitive inhibitor
   d) Competitive activator

33. Beta Oxidation of fatty acids contributes to which part of the Kreb's cycle?
   a) Acetyl CoA
   b) Citric Acid
   c) Pyruvate dehydrogenase
   d) Oxaloacetic acid (OAA)

34. What about Type IIx fibres is FALSE?
   a) Classified as oxidative-glycolytic
   b) Generates the most force
   c) Slow to fatigue
   d) a and b
   e) a and c
   f) b and c

35. Creatine is a type of protein.
   a) True
   b) False

36. How does endurance training affect O_2 deficit during sub-maximal exercise?
   a) Faster rise in oxygen uptake
   b) Increased level of steady state oxygen uptake
   c) More lactate formation
   d) More PC depletion
   e) All of the above
   f) None of the above
37. What is the reason for having excess post-exercise O₂ consumption?
   a) O₂ is used by mitochondria to make ATP, which is used to restore Cr
   b) O₂ is used by mitochondria to make ATP, which is used to restore PCr
   c) O₂ is used by mitochondria to make ATP, which is used to restore creatine phosphokinase
   d) None of the above

38. VO₂ max is proportional to:
   a) Heart rate
   b) Stroke volume
   c) Arterio-venous oxygen difference
   d) Two of the above
   e) All of the above
   f) None of the above

39. Someone with a PFK deficiency will reach their lactate threshold:
   a) Well before an untrained individual
   b) After an untrained individual, but before a trained individual
   c) After a trained individual
   d) Will not have a lactate threshold

40. Women tend to have a lower VO₂ max than their male counterparts because:
   a) Women have less haemoglobin
   b) Women have lower muscle mass in relation to their body weight
   c) Women have fewer mitochondria in each muscle cell
   d) A and B
   e) A and C
   f) B and C
   g) All of the above

41. Which of the following sets the energy demand during exercise?
   a) Creatine Phosphokinase (CPK)
   b) ATP Concentration
   c) Myosin ATPase
   d) Creatine concentration
42. Which of the following is true regarding PCr restoration post exercise?
   a) It is dependent on aerobic ATP production
   b) It is dependent on anaerobic ATP production
   c) It is dependent on the conversion of ATP to ADP and inorganic phosphate via myosin ATPase
   d) Occluded blood flow will not interfere with PCr recovery

43. Which of the following is false?
   a) A small decline in level of ATP is evident with short bursts of moderate exercise
   b) The level of PCr in the muscle can drop below the level of ATP during maximum exercise
   c) A small decline in level of ATP is evident with short bursts of maximum exercise
   d) The ATP-PCr system is important for all exercise types and intensities

44. In mild exercise:
   a) Anaerobic respiration contributes to matching the ATP demand
   b) The aerobic respiration matches the ATP demand
   c) Steady state is reached immediately
   d) The oxygen debt is the same as severe exercise

45. Which is false during aerobic training?
   a) It decreases the anaerobic contribution during exercise
   b) It enables to reach steady state faster than non-aerobically trained individuals
   c) It eliminates EPOC
   d) It decreases PCr utilization

46. An individual lacking which of the following would not produce lactic acid during incremental exercise?
   a) COX
   b) Myosin ATPase
   c) PFK
   d) CPK

47. VO\textsubscript{2}max is measured:
   a) Directly using the FICK equation
   b) Directly using open circuit spirometry
   c) Indirectly using FICK equation
   d) Cannot be measured directly
48. Which of the following are adaptations to exercise training?
   a) An increase in CPK activity
   b) A decrease in the amount of pyruvate entering the mitochondria
   c) An increase in the size of each individual mitochondria in the muscle
   d) An increase in the concentration of mitochondria in the muscle