1. Describe the following as they refer to skeletal muscles:
   a. Excitability - (responsiveness)  The ability to receive and to respond to a stimulus.
   b. Contractility -  The ability to shorten (forcibly) when stimulated.
   c. Extensibility -  The ability of muscle cells to be stretched.
   d. Elasticity -  The ability of the muscle cell to recoil and resume resting length after being stretched.

2. What makes up one motor unit?  
   One neuron and all the skeletal muscle cells it stimulates.

3. What is the location called where an axon terminal forms a junction with the sarcolemma of a muscle cell?  
   Neuromuscular junction (contain vesicles filled with neurotransmitters).

4. Name the specific neurotransmitter that stimulates skeletal muscle cells.  
   Acetylcholine (ACh)

5. Nerve endings and muscle cell membranes never touch but are very close together. What is the name of the gap between the two?  
   Synaptic cleft

6. After a nerve impulse reaches the axon terminal a series of events occur leading up to the contraction of a muscle cell. Describe the SIX events below.
   1. Action reaches axon terminal & 
   2. Calcium channels open and Ca$^{2+}$ enters the axon terminal.
   3. Ca$^{2+}$ entry causes some vesicles to release Ach.
   4. Ach then diffuses across the synaptic cleft and attaches to receptors that are located in the sarcolemma.
   5. Sarcolemma becomes perm. to (Na$^+$) ions which rush in to the cell. Potassium ions (K$^+$) diffuse out.
   6. When muscle fibers are activated by the nervous as described above, the myosin heads attach to binding sites on the thin filaments and the sliding begins.

7. What happens to a sarcomere during muscle contraction?  
   The sarcomere shortens.

8. Explain how the "walking" of the myosin cross bridges, or heads, along the thin filaments during muscle shortening is like a centipede's gait.
   Some myosin heads are always in contact with actin (some legs are always on the ground) so the thin filaments do not slide backward.
10. Calcium ions are necessary for the attachment of myosin to actin. Which muscle cell organelle stores calcium until it is ready to be released? **Sarcoplasmic Reticulum**

11. Define the following:
   a. Graded response: Different degrees of shortening
   b. Muscle twitches: Single, brief, jerky contractions, not normal
   c. Tetanus: When the muscle is stimulated so rapidly that no evidence of relaxation is seen; contractions are smooth and sustained.

12. Describe the three pathways that working muscles use in order to regenerate ATP (be general, no need to go into great detail).

   1. **Direct phosphorylation** of ADP by creatine phosphate:
      * CP is found only in muscle cells (fibers) - As ATP is being depleted to ADP interactions between CP + ADP = more ATP CP supplies exhausted within 1-2 sec.

   2. **Aerobic respiration**: Occurs in mitochondria uses oxygen. During: Glucose is broken down completely to CO₂ + Water, and some energy released and captured in the bonds of ATP (32 ATP per glucose).

   3. **Anaerobic glycolysis**
      * Lactic acid formation
      * Glycolysis = breakdown of glucose w/o O₂
      * Glucose broken down to pyruvic acid and small energy goes to ATP (2 ATP = glucose)
      * O₂ + glucose are not there ⇒ pyruvic acid converts to lactic acid.

13. Explain muscle fatigue, a result of:
   A muscle is fatigued when it is unable to contract even though it is still being stimulated.

   The person is not able to take in O₂ fast enough to keep the muscles supplied with what they need.

15. What happens to the muscle when it is deprived of oxygen?
   Lactic acid begins to accumulate in muscle via anaerobic pathway.

16. Define the following:
   a. Isotonic contraction: Movement occurs. (Bending knee, smiling)
   b. Isometric contraction: Contraction in which the muscles do not shorten.
   c. Muscle tone: The state of continuous partial contractions
17. What do the terms flaccid and atrophy mean in regards to skeletal muscles?

**FLACCID**: Flabby or Soft  
**ATROPHY**: Wear away

18. Describe aerobic or endurance exercise and explain how it impacts the body's muscles.

**AEROBIC**: Result in stronger, more flexible muscles with greater resist to fatigue. Blood supply to muscles ↑ form more mitochondria & store more O₂ => more ATP.

19. Describe resistance or isometric exercises and explain how they impact muscles.

- Muscles try to move against an immovable object.  
- Due to enlargement of muscle cells. Not amnt.

20. If your goal is to have large, beautiful skeletal muscles, should you focus on aerobic or resistance type exercise? **Resistance**

21. After a running a marathon, Marie found herself breathing heavily and sweating profusely. She also complained that her legs ached and felt weak. She grabbed a sports drink from the finish line stand and waited to "catch her breath." Using what you have learned about muscle energy metabolism, respond to the following questions:

a. Why is Marie breathing heavily?

b. What ATP-harvesting pathway have her working muscles been using that leads to such a breathing pattern. **Aerobic Resp.**

c. What metabolic product(s) might account for his sore muscles and his feeling of muscle weakness? **Lactic acid promotes muscle soreness**

**Anaerobic Glycolysis**  
(intense muscle activity or inadeq. glucose or O₂, aerobic cannot keep up)  
- Pyruvic acid => lactic acid

**O₂ needed to break down into more ATP + Creatine phos. reserves.**