

MedLab: Heart Disease—Exercise

AT A GLANCE

Students will learn about different types of exercise and the benefits of exercise.

OBJECTIVES

Students will:

- Describe how exercise benefits the heart and body
- List the three types of exercise and give examples of each
- Conduct an experiment that investigates variables that affect the efficiency of exercise
- Make suggestions on how to improve exercise habits

KEY VOCABULARY

exercise, lifestyle exercise, structural exercise, aerobic exercise, anaerobic exercise, FITT principle, heart rate, atherosclerosis, homeostasis

SUGGESTED GRADE

LEVELS: 7—12

ILLINOIS STATE LEARNING GOALS

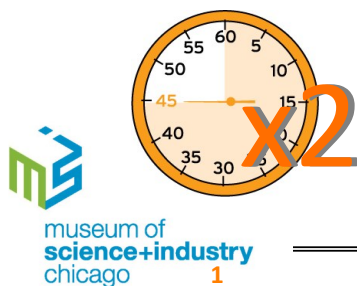
11.A, 12.A, 13.A, 13.B

NEXT GENERATION SCIENCE STANDARDS

LS1-1, LS1-2, LS1-3, LS1-5, LS1-7

PACE YOURSELF

TWO 45 MINUTE PERIODS



ADVANCE PREPARATION

1. Check with your school to determine its policies on student physical activity—you may need a parent release form.
2. Reserve a gymnasium/large space outside/hallway/etc.
3. Inform students in advance that they will do a lesson on exercise. They should wear appropriate clothes and footwear.
4. Make copies of the student worksheet packet for each student.
5. Divide students into groups of 4.
6. Label large sheets of paper (ie: 25" x 30" sheets of self-stick Post-It paper) with the title "Benefits of Exercise." Create one for each group. (Figure 1)
7. Create three columns on the large sheet of paper - "Aerobic", "Anaerobic" and "Stretching". (Figure 2)
8. Label another large sheet of paper with the title "Heart Rate", and draw a large line graph on it with Minutes (0-2) on the X-axis, and Heart Rate (0-150) on the Y-axis. (Figure 3)
9. Cut and construct Variable Exercise Dice on cardstock. Cut on the solid lines and fold on the dotted lines.



MATERIALS

Per Class

Large paper (or large Post-Its)
Tape
Cardstock dice (from templates)
Stopwatch (or clock with second hand)

Per Group:

2 sheets of prepared large (see above) paper and tape
2-3 different color magic markers

Per Student:

Student worksheet



WHAT YOU NEED TO KNOW

Exercise is any activity requiring physical effort that sustains or improves health and fitness. A common way to think about exercise is to differentiate it between lifestyle exercise and structural exer-

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cise. **Lifestyle exercise** is any physical activity done throughout one's daily routines. For example, raking leaves, walking your dog, washing your car by hand, walking to school and taking the stairs are simple opportunities to be active. **Structural exercise** involves formal exercise routines. I.e: playing sports or working out in a gym. Both lifestyle exercise and structural exercise can be further categorized as aerobic, anaerobic or stretching. Any exercise is good for our health. Studies have shown that increases in all types of exercise produce many physical and mental benefits—better cardiovascular (heart, lungs, and blood vessels) health; lower risk of, and improvements in the effects of, heart disease; lower risk of diabetes; weight loss; and improvements in mood and lower depression rates, among other benefits.

Aerobic exercise is exercise that raises your heart rate and increases your respiratory (breathing) rate. Aerobic means “with oxygen.” Exercise that increases your heart rate and respiratory rate will strengthen both your heart and lungs over time. Done on a regular basis, aerobic exercise improves one's cardiovascular endurance and makes your heart more efficient at delivering blood to the rest of your body. This leads to better heart health and can even reduce risk of developing **atherosclerosis**—the build up of fatty tissue between artery walls that can lead to blockages. Atherosclerosis in the arteries of the heart is often referred to as coronary artery disease and can cause chest pain, shortness of breath, heart attack, etc. Additionally, aerobic exercise has been found to reduce the severity of atherosclerosis in those who have already developed the disease. Examples of aerobic exercises include running, walking, biking, swimming, dancing, and playing tennis.

Anaerobic exercise involves strength training and moving your muscles against a resistance. Anaerobic means “without oxygen.” Exercises that provide resistance to your muscles and require large amounts of oxygen, build up lactic acid (lactate) and result in a burning sensation. This is normal/healthy for this type of exercise as long as one does not over-exert. These exercises may involve fitness rubber bands, free weights, weight lifting machines, and even your own body weight. Done a few days a week, anaerobic exercise can improve one's body weight, muscle tone, posture and strength.

Stretching exercise is exercise that involves extending your muscles beyond their normal range of motion. It is important to stretch on a regular basis to keep your muscles and joints flexible and elastic. This will improve your posture, balance, flexibility, strength and circulation. Yoga and Pilates incorporate a lot of stretching activities.

There is a direct link between exercise and **homeostasis**—the body's internal system of maintaining relatively stable “normal” conditions. As the heart, lungs and muscles work harder during exercise, the body must undergo specific physiological responses in order to maintain its internal environment. During exercise, the heart beats faster and faster to deliver oxygen-rich blood to muscles. Muscles start to “burn”, because they require more oxygen and build up lactic acid, and the lungs work harder to deliver oxygen via the circulatory system. When all these systems work harder and faster, body temperature increases, which causes you to sweat in order to cool the system down.

The American Heart Association, the Centers for Disease Control and Prevention, and the World Health Organization recommend children get 60 minutes of physical activity each day. Exercise is good for both the body and mind.

Physical Benefits

- Lowers the risk of disease (diabetes, heart disease, osteoarthritis, etc.)
- Maintains healthy weight
- Improves cardiovascular health (circulation, blood pressure, heart rate, etc.)
- Keeps bones/muscles strong
- Reduces muscle soreness
- Improves/maintains mental health

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- Improves flexibility
- Increases metabolism
- Improves posture/balance

There are many factors that determine how efficient exercise may be. Variables include where you exercise, environmental conditions, individual mood, and more. Exercising at high elevation typically increases the need for oxygen, as fewer oxygen molecules are available in the “lighter” air than one would find at lower elevations. Exercising when you are not in the mood to, or when you have not gotten enough sleep may lead to shorter workouts or less effort expended. Even the humidity of the air can effect the efficiency of exercise. Other factors, such as, availability of equipment, age, weight, prior injuries, and personal enjoyment, are important too. In general, the **FITT Principle** is one way to judge your workout. FITT stands for frequency, intensity, time and type of exercise. This measure will vary depending upon the individual, but children should aim for 60 minutes (time) of moderate exercise (intensity), such as jogging (type), per day (frequency).

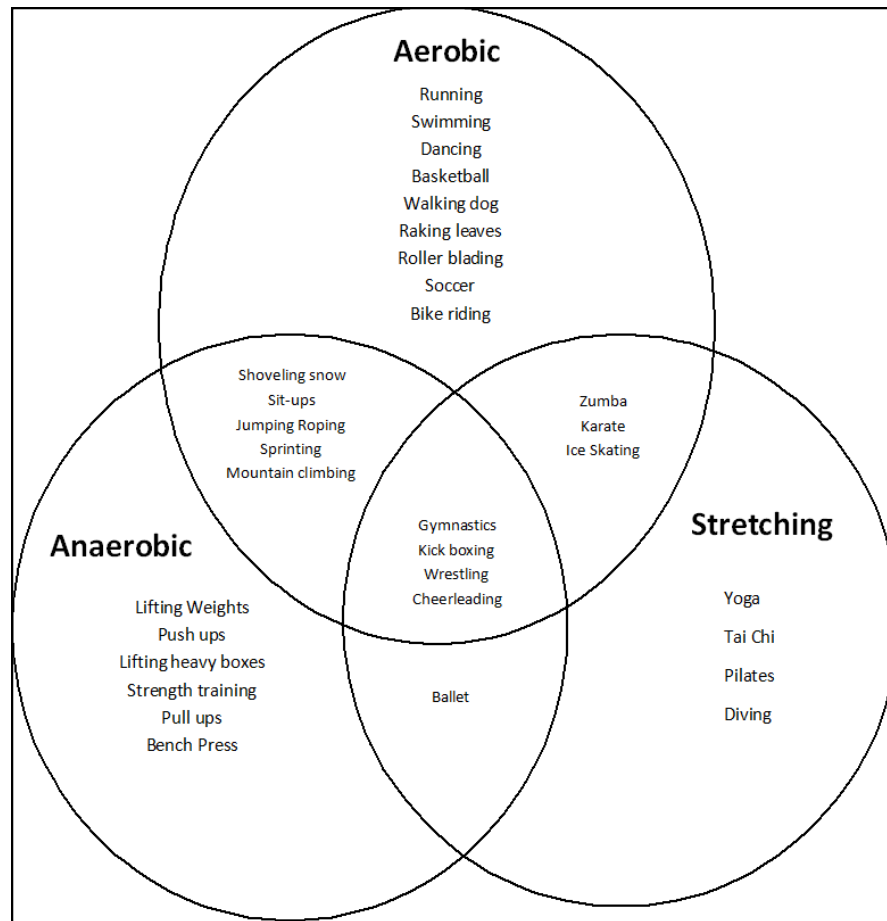
An effective way to measure exercise is through **heart rate**, the number of times the heart beats per minute (bpm). During exercise, heart rate increases to deliver glucose, fatty acids and oxygen to the muscles. According to the U.S. Centers for Disease Control and Prevention, resting heart rate for children over 10 years old can range anywhere from 60-100 bpm and still be considered normal or healthy. Any activity that increases heart rate is good. The more physically active one is, the lower their resting heart rate because exercise on a regular basis strengthens the heart, which allows it to pump blood more efficiently. Well-trained athletes may have a resting heart rate well below average.

A qualitative way to measure exercise intensity is by rating how you *feel* while performing an activity. A person's perception of how hard they exercise can be measured as light, moderate or vigorous. Light aerobic exercise will not cause you to sweat or notice any difference in breathing. You can easily talk without pausing to breathe. Moderate aerobic exercise will cause you to sweat after several minutes of performing the activity and you will notice a change in your breathing pattern. Vigorous aerobic exercise will cause you to sweat after just a few minutes and your breathing pattern will be extremely fast and deep. One cannot speak more than a few words without pausing for a breath during vigorous aerobic exercise.

Describing aerobic, anaerobic, and stretching exercise as light, moderate, and vigorous can be done by determining how much physical energy you put into performing an activity. For example, when doing yoga you might consciously focus all your body's energy into holding a difficult position for several minutes rather than performing an easier position that does not require much energy or concentration. To fully maximize the benefits of exercise it should be challenging to *you*. Exercise that is easy for you might be hard for someone else, so it is important you continuously push your body so your “perceived effort” is high.

Because there are so many variables that determine how vigorous exercise may or may not be, strictly categorizing activities as aerobic, anaerobic or stretching can be challenging. There is a considerable amount of overlap when determining what type of exercise one is doing, because time, type and intensity can vary. Here are just a few possible examples of how to categorize exercises:

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WARM UP

Part One.

1. Tell each group to write *their* definition of exercise on page 1 of their student worksheet. They should also list as many examples of sports, physical activities and exercises as they can. Give them a few minutes to do this.
2. Facilitate a discussion about their answers and create a class definition of exercise. Discuss the difference between lifestyle exercise and structural exercise, and provide examples of each. Ask them what their heart, lungs, and muscles feel like when they exercise. What happens to their body when they exercise? Why should they exercise?
3. Ask students to brainstorm and to list as many mental and physical benefits of exercise as they can on page 1 of their students worksheet. They should write at least ten. Give them a few minutes to do this. Discuss their answers and talk about ones they did not think about. (Note: mental benefits may be subjective. ie—"I feel refreshed after exercising.")



ACTIVITY

1. This should be done in a gymnasium, outside, or any other large space.
2. Instruct students to stand in a large circle. (Depending on class size, age, and skill level of students, you can divide the class into two or three large groups.) Each student should stand arm's length

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apart. (Note: There should be no physical contact during this warm up.)

3. Ask the students what they do in their everyday lives that requires physical activity but is not done specifically for sports or to improve health, lose weight, etc.
4. After each answer have the students pantomime the activity in place (walking, brushing teeth, etc.) to demonstrate the physical exertion required to complete the task.
5. After a few student answers, ask the students what type of exercises these are (lifestyle). **Check for understanding**—ask students what the difference is between lifestyle exercise and structural exercise. Tell them they will be doing structural exercises next.
6. Have each group place their large post-it paper entitled “Benefits of Exercise” (figure 1) on the wall at one end of the gym (or hallway, or on a wall outside). Have them stand in line at the opposite end of the gym with their student worksheets on the ground next to them.

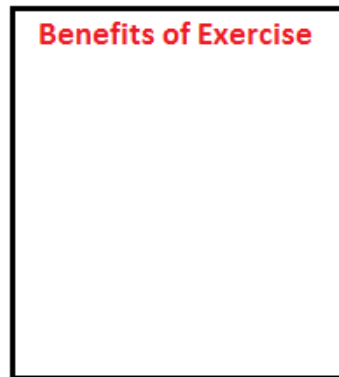


Figure 1

7. **Benefits race!** Instruct students to take turns running or briskly walking to the other end of the gym to write a benefit of exercise on their group's post-it paper. When they are finished writing they will run or briskly walk back to their group, and the next student in line will go. All students in the group (except the runner) should stay behind a line on the floor until the next runner receives the marker. They should repeat this until they have added a specific number of benefits (at least as many as are in largest group of students). Each student must go at least once.

Optional: While students are waiting for their turn in line they can do jumping jacks or march in place until it is their turn to go. When they are finished, ask them how they feel physiologically and mentally.

8. When each group has finished writing their list of benefits on their post-it paper have them discuss their answers and provide additional examples and information about the mental and physical benefits of exercising.
9. Next, have students turn to page 2 in their student worksheet. Discuss the definition of aerobic, anaerobic and stretch exercise. Demonstrate the differences and provide examples of each.
10. Have students categorize as many examples of each type of exercise they can think of on page 2 of their student worksheet. Give them a few minutes to do this. While they are working, call out examples and have them write them in whichever column they think is correct.

Optional: Have students stand on the opposite side of their post-it paper with three columns, “Aerobic”, “Anaerobic” and “Stretching”. This time you will call out examples of exercises and sports and they must write it under the one column on their post-it paper. Each student, whether it is their turn or if they are

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standing in line, must mimic the sport or activity you call out. For example, if you call out “swimming”, each student must mimic the act of swimming. If you call out “raking leaves”, they must mimic the act of raking leaves.

Aerobic	Anaerobic	Stretching

Figure 2

10. When each student has categorized a few activities, have them discuss each sport/exercise and have them explain their answers. Discuss why their answers may vary and why there is a considerable amount of overlap when categorizing exercise.

Part Two

1. Remind your students that categorizing exercises can be difficult, because there are a lot of variables that determine how vigorous it may or may not be. Explain the FITT Principle.
2. Explain that heart rate is a fairly accurate way of determining how efficient a particular exercise may be. Review page 3 of the student worksheet with students. Demonstrate how to check heart rate and have them calculate their resting heart rate and record it on their student worksheet. You may want to call out “start” and “stop” to standardize the sample and allow the students to concentrate on counting rather than watching the clock for a minute to pass.
3. Next, inform students that they will check their heart rate and record it in their student worksheet immediately after doing jumping jacks at a moderate intensity level for 1 minute and again after doing jumping jacks for 2 minutes. Explain and/or demonstrate the difference between a light, moderate and vigorous intensity level for jumping jacks. Remind them that intensity is based on their perceived effort, which will be different for everyone.
4. Keep track of time while students are doing jumping jacks. After 1 minute, have them stop and check their heart rate. After everyone has recorded it on their student worksheet, have 5 or 6 students plot their heart rate on the large sheet of post-it paper you created with the title “Heart Rate”.
5. Now have them do jumping jacks for 2 minutes. Again, have them check their heart rate immediately after exercising, and have them record it in their student worksheet. Have the same 5 or 6 students plot their heart rate on the class graph. (See figure 3 below for example.)
6. Have students discuss why their heart rate increased between 1 minute and 2 minutes of exercise. Refer to the graph.
7. Instruct students to turn to page 4 of their student worksheet. Introduce the Exercise Variable Dice by

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briefly explaining and have a student demonstrate each type of exercise on the dice and how they vary with light, moderate and vigorous intensity levels. Remind the students to exercise safely—if they are in pain or feel it is too much, they should stop.

8. Inform the class that 2-3 students from each group will exercise at one time, while the other students rest. They will alternate between exercising and resting each time the dice are rolled.
9. Roll the dice. The students in each group who will be exercising first will record the results of the dice (time, type, intensity) on their graph on page 4 of their student worksheet. (The two students resting can leave these spaces blank) When the exercisers are ready, verbally tell them to begin doing the exercise and stop them when the time is up. Keep track of time with a stopwatch or clock.
10. When the time is up, *all* students will *immediately* calculate their heart rate and record it on their student worksheet. Keep track of time with the stopwatch while students check their heart rate by verbally starting and stopping them.
11. Roll the dice again. This time the students that were resting will perform the exercise on the dice, while the other students rest. Have the exercisers record the results of the dice in their student worksheet. Again, verbally start and stop them and keep track of time with the stopwatch. When time is up, have everyone calculate their heart rate and record it.
12. Repeat this until everyone has done several exercises.
13. Have them answer the questions on page 5 of their student worksheet. Debrief with a discussion about their results.

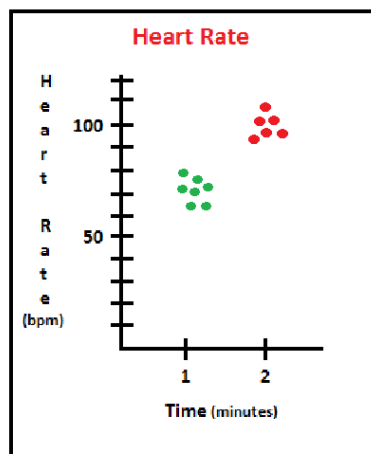


Figure 3



CHECK FOR UNDERSTANDING

Throughout the lesson have students share answers to the following questions:

1. What is exercise? What are the different categories of exercise? *Exercise is physical activity that sustains and improves health. Both lifestyle and structural exercise can be categorized into aerobic, anaerobic, and stretching exercise.*
2. What are some examples of structural exercise and lifestyle exercises? *Examples of lifestyle exercise include raking leaves, walking your dog, and walking to school. Structural exercise includes playing sports and formal exercise workouts.*
3. What do your heart, lungs, and muscles feel like when you exercise? *When you exercise your heart beats faster, your lungs work harder, you begin to sweat, your muscles fatigue and start to “burn”.*

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4. What are some benefits of exercise? *There is a wide range of the mental and physical benefits of exercising. It reduces the risk of disease, lowers blood pressure, helps one maintain healthy weight, etc.. It also improves one's mood and self-esteem.*



DIFFERENTIATED INSTRUCTION

- Adapt exercises to the age and abilities of your students. You may increase or decrease the amount of time students rest between activities. Also, try increasing or decreasing the distance students have to travel to write on their post-it paper during part 1 of the lesson.
- Try letting students determine their own variables on the Exercise Variable Dice template with blank spaces. They can determine their own type, time and intensity.
- If you do not have a gymnasium or large space outside, try this activity in a large hallway or cafeteria. If your space does not have a wall or somewhere to hang the sheets post-it paper you may lay them on the ground.
- Have students brainstorm dependent and independent variables in this experiment. Independent variables are the aspects of the experiment that you choose and manipulate—time, number of repetitions, type of exercise, etc. Dependent variables are the aspects of your experiment that change because of those manipulations—heart rate, respiratory rate, etc. The table below gives a few ideas:

INDEPENDENT VARIABLES <i>How does the. . .</i>	DEPENDENT VARIABLES <i>Affect the. . .</i>
Frequency	Resting Heart Rate Blood Pressure
Intensity	Heart Rate Breathing Rate
Time	Heart Rate Breathing Rate
Type	Heart Rate Breathing Rate

Remember to only change one independent variable at a time. For example, if you want to measure what independent variables affect heart rate, change only the amount of time you are exercising. If you change more than one independent variables, you will not be able to discern whether the results are due to time or something else.

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WHAT'S HAPPENING

The amount of time, type, and intensity are all variables that affect the efficiency of exercise. Comparing your resting heart rate to your heart rate immediately after exercising gives you an accurate way to measure how hard you are exercising. Any activity that increases your heart rate is good, but the higher you increase it during exercise the better (within a safe range of course).



EXTENTIONS

LANGUAGE ARTS

- Give students an opportunity to write about their attitude before and after exercising. The goal is to help students become consciously aware of their feelings about exercise and to encourage a positive attitude towards it.
1. Immediately *before* doing this lesson, tell students they will be doing a lesson where they will be exercising. They will begin by writing down how they *feel* when they are told they are getting ready to exercise. Are they happy, sad or indifferent about it? Do they believe it will be boring, fun, competitive, easy, hard, etc.? Students do not have to share their essay if they do not wish.
 2. Immediately *after* exercising, have students write another journal entry/essay about how they felt during and after exercising. Did they have fun? Did they laugh? Was it harder or easier than they thought? Did their mood change? Are they more or less likely to exercise again? Have them compare both journal entries/essays to identify differences in their feelings. Did their attitude change? Is it less intimidating now? Are they motivated to exercise again?
- Have students research exercise routines of their favorite athlete. Have them write a description of the types of exercises they do, how often they do it and why it is important for them to do it.

MATH

- Give each student a copy of the Exercise Log. Instruct them to keep track of how long they exercise and how long they spend with electronics each day for five days. After five days, discuss their findings. Have them determine the class average and total time exercising. Do this activity for five more days, but this time encourage them to exercise more to increase their class total.

PHYSICAL EDUCATION

- Talk to a physical education teacher/coach about partnering for this activity. Perhaps the exercises can be done in P.E. and the discussion can be done in your classroom.



DIGITAL RESOURCES

American Heart Association's physical activity site:

http://www.heart.org/HEARTORG/GettingHealthy/PhysicalActivity/Physical-Activity_UCM_001080_SubHomePage.jsp

Great site for exercise content from the National Institutes of Health:

<http://www.nlm.nih.gov/medlineplus/exerciseandphysicalfitness.html>



RELATED EXHIBITS

YOU! The Experience

- Hamster Wheel
- Choose Your Exercise
- Giant Heart