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Georgia academic support program asp

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Introduction

The *Georgia Academic Support Program* (*ASP) for High School Science* is a complete, turnkey solution for improving educational performance. Topics are built around accessible core curriculum ensuring that the *ASP* is useful for striving students and diverse classrooms.

This program recognizes that many struggling students aren't reached by traditional "skill and drill" or strict test-prep approaches.

The *ASP* includes components that review, instruct as needed, provide practice, and assess students' skills. Instructional tools and strategies are embedded throughout. The scope and sequence addresses the needs of students who require additional support in topics included in the Georgia's Performance Standards and the National Science Education Standards.

This 3-ring binder includes:

- Over 100 hours of lessons with reproducible activity sheets
- Daily warm-ups or openers—to begin a class or to make a transition
- Embedded assessment to inform instruction and document achievement
- Application activities to provide hands-on experiences
- A collection of inquiry-based lab activities
- A supportive teacher's guide that:
    - describes the purpose of the materials and options for using the package
    - provides pacing guide options
    - references relevant Georgia Performance Standards
    - recommends an assortment of graphic organizers for instructional use

Purpose of Materials

The *Georgia Academic Support Program for High School Science* is a flexible program that has been organized to fit your students' needs in evening or summer school.

Each day's schedule includes activities beginning with direct instruction and guided practice, and moving on to opportunities for developing and applying new skills and concepts in application and lab situations.

The program addresses the five domains of the Georgia High School Graduation Test for Science. These include the following:

- Domain 1: Cells and Heredity
- Domain 2: Ecology
- Domain 3: Structure and Properties of Matter
- Domain 4: Energy Transformations
- Domain 5: Forces, Waves, and Electricity

The Characteristics of Science: Habits of Mind, the Nature of Science, and Scientific Inquiry are infused throughout.

Structure of the Binder

The *ASP* is provided for your convenience in a binder format. The materials are completely reproducible, allowing you to make as few or as many copies as you need. If students lose an activity sheet, just make a new one. Tabs allow you to access the sections of the binder quickly and easily.

The Teacher's Guide is the first section. Written for you, this section helps you navigate the materials with the pacing guides, offers 19 graphic organizers and suggested strategies for their use, and shows how the lessons correlate to the Georgia Performance Standards and Georgia High School Graduation Test specifications.

The next five sections focus on content and knowledge of the following: Biology; Ecology; Chemistry; Motion, Forces, and Energy; and Waves, Light, Electricity, Magnetism, and Modern Physics. The units in the *ASP* can be implemented as outlined in the pacing guide, yet the design is flexible so that you can mix and match sections and units as the needs of your students and your instructional style dictate.

Part 7 contains a collection of application activities, referenced throughout the pacing guide. These suggested activities provide students with additional hands-on and real-life experiences.

The final section includes pre- and post-tests to be used with each instructional unit. The pre-tests will allow you to identify relative strengths and weakness in prior knowledge and conceptual understanding, and to plan instruction and differentiation accordingly. The post-tests will serve as documentation of improved achievement and learning.

Structure of Units

Nearly all of the instructional units in Parts 2 through 6 have some common features.

In each class session, you will present a topic. Some topics may be a review for students. Other topics may be completely new to them. After some instruction, you will provide students with practice activities to try. Students will have a chance to talk about how they completed their work. There are additional materials to use if you are confident that students are ready to extend their learning. If students need more practice or further explanation, you can provide them with that, too!

1. The Goal Statement

Each unit begins with a brief objective of what students should know, understand, or be able do at the end of the unit.

2. Words to Know

Vocabulary terms are provided as background information for instruction or to review key concepts that are addressed in the unit.

3. Direct Instruction

This section is a guide for a teacher-led activity to review and/or instruct students on a specific concept or topic (activities are 15 to 45 minutes in length). Instructional strategies include lecture, modeling, discussion, group facilitation, and more. The activities may include the use of one or more of the graphic organizers found in the Teacher's Guide. This section includes many illustrations/diagrams that can be presented to students on the board, via an overhead projector, or in a photocopied handout. Each lesson includes diagrams and sample problems to be presented to the class in this manner.

4. Student Activity Sheets

Each unit includes three or more lesson tasks and activities to support students' achievement of learning objectives. These sheets are written for the student. They can be used in any combination of teacher-led instruction, cooperative learning, or independent application of knowledge.

5. Assessments

Each unit includes pre- and post-tests to inform instructional decisions and to document the extent to which students grasped the concepts and skills addressed during the unit.

Teacher-to-Teacher Introduction

As a high-school science teacher with 15 years of experience, I have taught students with a wide variety of ability levels. I have taught everything from struggling ninth graders with special education needs in a general science class, to seniors in honors physics. Across the entire range of students, I've found that they generally perform better at all levels when they know the goals that they must reach to be successful. I developed this *Academic Support Program (ASP)* with a Pacing Guide to help you help your students understand the goals they need to reach. Your students are in a position in which they need to review a large amount of material in a relatively short amount of time. This *ASP* has condensed within it the core concepts of general science, biology, chemistry, and physics.

I envision a typical day consisting of some review time in which students are given the opportunity to recall information about the day's topics that they already know or might be able to remember. After this introductory warm-up, there will be a component of direct instruction in which you cover the highlights of the material that will be used that day. There will be labs and hands-on activities (although not every day) that will help reinforce some of the key concepts without requiring a large amount of expensive and complicated equipment. Review activities that help reinforce the material are available for every section, and will afford students the opportunity to determine whether or not they understand the key concepts. There is generally more material available for a single day than students will be able to do; some of these materials are high-priority, while others can be utilized where there is extra time in class, or as extra material to help struggling students.

Here is a summary of the materials that are available in the *ASP:*

The **Pacing Guide** has suggestions for content that should be covered each day, and a review of those suggestions will help you plan what materials you think are best suited to the needs of your students.

The **Pre-Tests** are simple tools that generally consist of 10 multiple-choice questions that will allow you to do a quick survey of the topics that need to be covered in a given unit. This will also be a good place to ask students what they remember about the material you'll be covering in that unit. If most students in your class seem to be familiar with a topic or concept, you can skip it or review lightly during instruction. If individual students seem to be missing something that others are familiar with, you can provide individual attention. If the whole class misses one or more of the questions, you'll know that the planned instruction is right on target.

The **Warm-Up** is meant to be a 5-minute activity that asks students to consider a concept that they have probably been exposed to before, but may not remember in its entirety. This will give students an opportunity to recall information they have seen before. This will help you determine the topics that students are well-prepared to discuss and which ones they struggle with.

The **Direct Instruction** section is a collection of core material that covers the key ideas from a major science area. This is a simplified and somewhat abbreviated lesson that can serve as a guide for the materials you will want to cover each day. Some parts may need to be photocopied and shared with students, while other parts, such as charts and diagrams, might need to be shown on an overhead during your instruction or drawn on a board for students to view. The direct instruction has a lot of material and is designed to allow you to pick and choose sections that seem to best fit the needs of your students. You might choose to photocopy and hand out sections of the direct instruction for "jigsawing." Instead of the teacher delivering all of the information verbally, on the board, or via an overhead projector, groups of students can each get a part of the lesson, and then summarize and present what they have learned to other students.

In Real Life notes appear occasionally in the direct instruction. These are short narratives you can share with students to help jog their memories about concepts and events they have seen outside of class. They can they share their experiences with their classmates, and help all students connect to the material.

Labs are designed to cover a variety of concepts without requiring a large amount of equipment and to give students more hands-on opportunities.

Application Activities are short, hands-on labs that give students another way to connect to the material. They are meant to be shorter than a full lab and require very little in the way of lab equipment, while still covering important topics. Application activities are not scheduled for each day; they are sometimes used as a prep for the next day's material or as a review of the previous day's material.

Think About It activities are used to give students another direction from which to approach the material. They are similar to the warm-ups, but appear at the end of some lessons as a very brief review of a major topic.

Practices are an immediate opportunity for students to answer questions about the material they have covered in that class. They are generally short-answer, true/false, multiple-choice, fill-in-the-blank, and short-answer questions designed to test student knowledge about the many concepts in the section.

Reinforcement Activities are more detailed worksheets about the material covered in each section. While there may occasionally be time to use them in class, it is more likely that students will use them as homework or review outside of class. If you wish to incorporate some time during class to go over the answers or to answer questions about the reinforcement activities, you may, but you might also consider posting answer keys so students can check their work without cutting into class time.

Post-Tests occur at the end of each unit. The units cover anywhere from 2 to 5 days' worth of instruction, but are generally broken up so that a post-test will be used every 2 or 3 days. Some class time might also be spent going over the answers to these post-tests to give students an opportunity to reflect on what they have learned in each unit.

Best of luck!

Brian Pressley

Mechanical Energy

Georgia academic support program asp

Direct Instruction

Goal: To understand work and mechanical energy; to apply the principle of the conservation of energy

WORDS TO KNOW

conservation of energy	the principle that the amount of energy in any system remains the same, even if the form of the energy changes
conservation of matter	he principle that the amount of matter in any system remains the same, even though it may have gone through physical or chemical change
elastic potential energy	potential energy that is created by tension in an object such as a stretched rubber band
energy	the ability to do work
gravitational potential energy	potential energy due to an object's position relative to Earth or some other gravitational field
joules	units of energy or work
kinetic energy	energy of a body in motion
mechanical advantage	the ratio of output force to input force for a simple machine
potential energy	stored energy because of its position or tension
simple machine	any of the devices, including the inclined plane, the lever, the pulley, the screw, the wedge, and the wheel and axle
work	the transfer of energy, measured as the product of the force applied to an object and the distance moved by that object in the direction of the force applied

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The quantity *work* is defined as the product of the force applied to an object multiplied by the distance through which the force is applied. This means that if no displacement of the object occurs, no work is done on the object even though the force applied may be quite large.

Reference to the work we do is a large part of our daily conversation. We all have opinions as to which jobs require more or less work. However, this common usage of the word *work* does not always match up with the physics definition. Use the column on the left to arrange the list of jobs in order of hardest work to easiest in your opinion. Use the column on the right to arrange them in order of most work to least work according to physics.

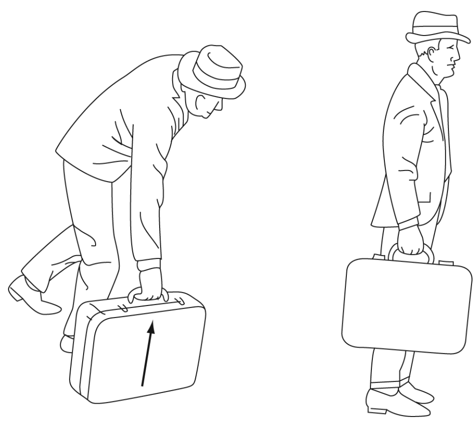
Opinion	Jobs	Physics
(hardest)	store clerk	(most)
	accountant	
	package delivery driver	
(easiest)	furniture mover	(least)

Work and Energy

Energy is one of the most important principles in science. It is also one of the most difficult to define or measure. Every object has energy. Any motion or change requires energy. But you cannot see energy itself.

What you can observe is the effect of energy. In physics, the effect of energy is known as *work.* The scientific meaning of work is somewhat different from the everyday meaning of work. For example, people often say that studying is hard work, or holding up a heavy box is hard work. However, physicists use the term *work* to describe how much effect a force has in causing an object to move.

For instance, in the diagram below, the man is only doing work as he lifts up the suitcase. Here, his force is causing the object to move. When he is holding the suitcase still, he is doing no work.



Similarly, if you push against a wall and it does not budge, you did not do any work. This is because the force was not effective in causing the wall to move.

The amount of work achieved by a force depends on two things: the amount of force applied and the distance the object moves. For example, in the diagram above, the man would do more work if he lifted the suitcase up over his head because the force would cause the object to move a greater distance. Likewise, if the suitcase was filled with bricks, more work would be done in lifting it because a greater force must be applied.

You can calculate the amount of work done by multiplying the force and the distance, as in the following formula:

$$W = Fd$$

Here, W is work, F is force, and d is the distance the object moves.

Now, suppose the suitcase weighs 200 N, and the man lifts it up 1.5 meters. The force required to lift the suitcase is 200 N, since the man must overcome gravity to lift it.

$W = Fd$

$W = 200\text{ N} \bullet 1.5\text{ m}$

$W = 300\text{ N-m}$

When you multiply newtons and meters, the unit is known as **joules** (J). Joules are used to measure work. So, the work done is 300 joules.

If the man lifted the suitcase 2.5 meters, then the work done would be

$W = Fd$

$W = 200\text{ N} \bullet 2.5\text{ m}$

$W = 500\text{ J}$

Now, the work done is 500 J.

Although you cannot see **energy,** energy is the ability to do work. The more energy an object has, the more work it can do. In other words, more energy generates a greater force. Or, more energy applies a given force over a greater distance.

Energy and work are both measured in the same units, joules. So, if an object has 300 J of energy, it can do 300 J of work.

An object can have many kinds of energy: heat energy, electrical energy, chemical energy, mechanical energy, and so on. The same unit of measurement can be used for all of these types of energy.

TIP

In many calculations, you will use distances, masses, forces, and energy together. In the metric system, the measurements will all be in meters, kilograms, and seconds. Your answer for force will be in newtons, and the answer for energy will be in joules.

Practice 99: Kinetic and Potential Energy

Decide if each sentence below describes kinetic energy (**K**), gravitational potential energy (**G**), or elastic potential energy (**E**). Write the correct letter on each line.

______ **1.** A car is driving at 30 km/hr.

______ **2.** A book is resting on the top of a bookshelf.

______ **3.** A ball rolls across a pool table.

______ **4.** A man stretches his suspenders to put them on.

Decide if each statement that follows is true (**T**) or false (**F**). Write the correct letter on each line.

______ **5.** A golf ball and a bowling ball rolling at the same speed have the same amount of kinetic energy.

______ **6.** The amount of potential energy in an object is equal to the amount of work done to store the energy.

______ **7.** There is only one type of potential energy.

______ **8.** Once energy is stored in an object, the energy cannot be released.

Circle the correct answer to each of the following questions.

9. If a boy has a mass of 40 kg, and he is running at 5 m/s, how much kinetic energy does he have? (*Hint:* Remember the equation $K = \frac{1}{2} m \bullet v^2$.)

- **a.** 400 J
- **b.** 500 J
- **c.** 5,000 J

10. In stretching a rubber band, a person applies 20 N of force over a distance of 0.1 meters. How much potential energy is stored in the rubber band?

- **a.** 2 J
- **b.** 10 J
- **c.** 20 J

Reinforcement Activity 104: Work, Force, and Distance

Remember the equation for work? It is W (work) = F (force) • d (distance). Usually, it is written like this: $W = Fd$.

Answer the questions below. Record all your answers in joules (1 newton • 1 meter = 1 joule). In each box, draw a force diagram to show all the forces working on the object. Remember to include every force acting on the object, including friction and gravity.

1. How much work is done by a person who pushes a 20-newton crate across an icy pond (almost frictionless) a distance of 20 meters? The person pushes the crate at a constant speed.

____

2. How much work is done when a 1-newton ball falls a distance of 2 meters from a window to the ground below?

____

3. How much work is done when a child pulls a 4-newton cart around in a complete circle?

____

4. How much work is done when a 500-newton rocket is pushed horizontally by its engine gases a total of 1,000 kilometers in outer space? The rocket is moving at a constant speed.

____

Lab 6: How Much Power Do You Have in Your Legs?

Instructional Objectives

Students will be able to:

- calculate the work done in climbing a flight of stairs.
- calculate the power generated by their legs in climbing stairs.
- demonstrate use of scientific instruments: stopwatch and metric ruler.

Helpful Hints and Discussion

Time frame: 40 minutes

Structure: groups of 2 or 3 students

Location: in class

In this activity, students will be calculating the power produced by their legs in running up a flight of stairs. In order to do this, they must first calculate the work done and time how long it takes them to do it. Have your students do this by multiplying their body weight by the vertical distance traveled. If they have completed other activities in this book, students should know by now that this is the work they would do if they had in fact traveled vertically. The mechanical advantage of the stairs does not enter into this activity.

Be sure the students use only MKS (meter-kilogram-second) units in their calculations, otherwise their numbers will not come out right.

Be aware of safety in this activity, since students can get competitive. Do not allow more than one team to run up the stairs at a time. Parents should be made aware that students will be running up flights of stairs. They should be asked to sign a permission slip and to indicate if there are physical limitations on their child's activities. Some students may be reluctant to have their weight measured—try to have these students act as timekeepers or data recorders. Demonstrate use of the stopwatch.

Adaptations for High and Low Achievers

High achievers: These students should be encouraged to do the Follow-up Activity.

Low achievers: Review the relevant concepts of force and work. These students can be paired with high achievers for the activity. Review with them how to do the calculations.

Scoring Rubric

Full credit should be given to students whose data recorded in the Data Collection and Analysis section look reasonable, who correctly do the calculations, and who answer the questions correctly and in complete sentences. Extra credit should be awarded to students who do the Follow-up Activity. The quiz can be scored from 1 to 3 correct.