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**REMOTE LEARNING LESSON PLANS**

The Remote Learning Lesson Plans are adapted from the IQWST Teacher Edition to support continuous learning. Each plan condenses what is taught with specific teaching recommendations and identifies the digital resources, print resources, and materials needed to teach and learn IQWST remotely.

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| **UNIT TITLE** | **PS3** |
| **DRIVING QUESTION** | How will it move? |
| **UNIT STORYLINE** | [PS3 Storyline](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1571332403-ps3-3.0-storyline-with-appendix.pdf) |
| **IQWST OVERVIEW** | [IQWST 3.0 Overview](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1534960182-iqwst-3-0-overview.pdf) |
| **TEACHER EDITION** | [Teacher Edition (PDF)](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1533159852-san-ps3movev3-te.pdf) |
| **STUDENT EDITION** | [Student Edition (PDF)](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538757938-san-ps3movev3-se-color.pdf) |
| **LESSON PLAN OVERVIEW** | [Remote Learning Overview](http://activatelearning.com/wp-content/uploads/2020/05/remote-lesson-plans-overview.pdf) |

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| **STUDENT MATERIALS:** Each student will need the following materials. Teachers can modify lessons based on which materials the Ss have access to. For Blended Learning options, teachers may draw from a combination of digital and print resources. | | |
| **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS NEEDED** (FOR EACH STUDENT) |
| * Access to Interactive Student Edition * Access to teacher-led lesson or video * Access to IQWST lesson videos * Audio recordings of readings   **Access from any device with a web browser.**   * For PCs and Chromebooks, we recommend using **Chrome** as the browser * For Macs and iOS, we recommend using **Safari** as the browser * Internet Explorer is NOT supported * Read the full Technical Requirements [here](https://s3.amazonaws.com/al.general/website/pages/ALDP+Requirements.pdf)   **Login:** <http://activatelearning.com/digital-resources/>   * Select your program * Enter the Username and/or Password provided by your teacher | * PS3 Student Edition * Hard copies of selected Projected Images (PIs)   *Print student editions are necessary for Ss who do not have internet access (or reliable access).* | **IQWST Equipment (from kit)\***  Pad of sticky notes  2-balloons  1-straw  1-string (a few meters in length)  2-magnets,  1- tennis ball  1- rubber band  1-Spring,  2-3 masses to hang from spring, string, ruler  **Household Items**  1-straw  glue  small pieces of paper torn into tiny pieces  **Students may also need the following General Classroom Supplies (if not using the IDE):**  Pencils and sharpener  Colored pencils  Black marker and/or ink pen  Plain paper for drawing (10-20 sheets)  Glue stick or transparent tape  Pad of sticky notes  Scissors  *\* If kits have been purchased, they include enough equipment for 8 groups of 4 Ss. You will need additional equipment if you opt to provide materials to each student.* |

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| **Learning Set 1: What Makes It Start and Stop?** | | | | |
| **Lesson 1**  **(1-2 sessions)** | **Anchoring Activity and Driving Question Board** | [Download Lesson 1 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918103-PS3%20Lesson%201.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 1.1 | **Anchoring Phenomenon:** The Magnetic Cannon moves in unexpected ways and kicks off the unit by prompting questions about force and motion. A second anchoring phenomenon--the predictable patterns in motion of Newton’s Cradle--is introduced in the TE and SE along with Reading One. Four apparatuses that are revisited throughout the unit are introduced in Lesson 2.  If possible, demo the anchoring activity for students (Ss). If not possible, share 1) Video: Magnetic Cannon first (live action), 2) the two slow-motion Activity Videos, and 3) the image of the magnetic cannon (in the TE and in the slide deck).  The Video: Magnetic Cannon does not have exactly the same set-up that the curriculum uses; however, it demonstrates clearly the unexpected action that the last ball appears to be discharged much faster than the incoming ball moved.  Teachers and Ss will need to track scientific principles through the unit to be used to write a final scientific explanation for the magnetic cannon.  Introduce the Driving Question Board (DQB): Throughout the unit, Ss record their own, original questions as they arise. See *IQWST Overview* for more information on how to use and manage the DQB.  Discussion Prompts: Throughout the unit, teachers should: 1) choose discussion prompts applicable to remote learning and ability to discuss with Ss, or 2) have Ss write answers to teacher-selected prompts that can be added to the slide deck, if discussion is not possible, or 3) choose questions in a format for Ss to discuss remotely, perhaps writing responses that are then submitted.  Questions in the SEs: Throughout the unit, teachers should decide on the method by which the lesson will be delivered, and then have Ss ignore any questions in their SEs that do not fit the way in which the lesson needed to be enacted remotely. Teachers may provide a handout for print-only Ss who cannot access the curriculum remotely, so that they know which questions in their SEs they should respond to.  Note: Given the likelihood of reduced time for remote learning, the teacher could demo (or share the videos associated with Activity 1.1), then demo a Newton’s cradle (or show/share the videos associated with Reading One), and then proceed with Activity 1.2 in a single session.  Key: The magnetic cannon behaves unexpectedly, and prompts questions about its behavior related to force and motion. | Access to Student Edition (SE) in Interactive Digital Edition (IDE)  [*Activity Video 1.1a*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--starter--8x-slow.mp4)  [*Activity Video 1.1b*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--end--8x-slow.mp4)  [*Video: Magnetic Cannon*](https://www.youtube.com/watch?v=Fog3mFN1eZ8)  Teacher-created DQB (e.g., jamboard, padlet) or physical DQB to share during virtual lessons.  Ss will post their own original questions in the “Questions” tab of the IDE | Hard copy of the Student Edition (SE) to be used for all activities,  readings, writing tasks.  Ss will write questions on sticky notes, and post at the front of their SEs on the *Driving Question Notes* pages. | Pad of sticky notes |
| Activity 1.2  *Driving Question Board (DQB)* | Share either a physical or digital DQB with Ss. Use a digital discussion board or another system for interacting with them, encouraging Ss to generate ideas and original questions that will drive learning throughout the unit.  Key: To generate questions about force and/or motion. | SE Act & 1.2 | SE Act 1.2 |  |
| Reading One | *Newton’s Cradle*  Review Gravitational (GE) and Kinetic Energy (KE) before Ss read.  After the reading, share the Activity Videos. The *Video:magnetic cannon* contains a more complex explanation than is required of middle school standards. However, it may be interesting to particular Ss who are ready to go beyond the curriculum.  Ask Ss to make observations, and to explain GE and KE at various points.  Key: As the balls in the Newton’s cradle are raised and released, gravitational and kinetic energy are transferred. | SE Reading One  [*Activity Video 1.1c*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-newton-cradle-1ball--8x-slow.mp4)  [*Activity Video 1.1d*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-newton-cradle-2ball--8x-slow.mp4)  [*Activity Video 1.1e*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-newton-cradle-3ball--8x-slow.mp4)  [*Video: magnetic cannon*](https://www.youtube.com/watch?v=kA2vjXHnySU) | SE Reading One |  |

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| **Lesson 2**  **(3 sessions)** | **Which Forces Act on an Object?** | [Download Lesson 2 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918148-PS3%20Lesson%202.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 2.1 *Analyzing Apparatuses* | Demo the apparatuses, if possible--otherwise share the videos. Ss should answer the SE questions for each device.  If Ss are able to have the equipment, they could construct the balloon apparatus remotely so that at least one hands-on device is available to them. If that is possible, teachers could have Ss concentrate modeling activities, etc. on that one device for individual, remote work, and then focus on one more more of the *other* devices for virtual lessons.  Share images for devices (also in the slide deck).    Review the concept of *systems*, which is especially important for these phenomena and for modeling throughout the unit.  Key: Different types of force cause objects to behave in particular ways. Also, force and motion can be represented in 2D models. | SE Activity 2.1  [*Setup Video 2.1*](https://d16dnhlej6sizh.cloudfront.net/assets/portal/Teacher-Portal-Resources/PS3_se_v2_0_5_video-lesson_2-1115.mp4)  Balloon  [*Activity Video 2.1a*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--starter--8x-slow.mp4) *Magnetic Cannon*  [*Activity Video 2.1b*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-flying-balloon--8x-slow.mp4) *Balloon (slow motion)*  [Activity Video 2.1c](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-floating-magnet--regular-speed.mp4) Magnets  [Activity Video 2.1d](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-air-powered-car--regular-speed.mp4) Air-powered car  [Images: 4 devices](https://drive.google.com/file/d/1XJP0EfOWs8PRXcEvHPa2H8L6qqhh7-0-/view?usp=sharing) | SE Activity 2.1 | (1)balloon\*  (1)straw  glue  string (a few meters in length)  \*If there are no latex allergies in the household, Ss could do this activity remotely |
| Activity 2.2  *Systems and Contact Forces* | Share PI: Vehicle in Tow. Discuss components of the system and share the model of components (which can be used to explain *which* components interact and *how*).  Proceed to share and discuss all PIs:   * Two Hands (Ss can do this remotely with an adult or another child) * Pushing the Wall (Ss can do this remotely) * Leaning Ladder * Shoe on a Shelf (Ss can set a shoe on a shelf in any location, or teachers can instruct Ss to look around them for \*any\* object on a shelf. *Any object* can be used for reference.)   Key: Contact forces come in pairs, applying force in opposite directions. | SE Activity 2.2 | SE Activity 2.2  Print PIs:  •Vehicle in Tow  •Two Hands  •Pushing the Wall  •Leaning Ladder  •Shoe on a Shelf |  |
| Activity 2.3  *Forces that Act at a Distance* | If possible, demonstrate the phenomenon of electrical force (as a push and pull force) using the magnets. If Ss have access to the materials (a balloon and small pieces of paper), they could investigate at-a-distance force remotely.  Note: Teachers could make a sandwich--or--could use the extension activity image along with Activity 2.3 to illustrate at-a-distance forces in an everyday example.  Key: All forces come in pairs (contact *and* at-a-distance forces), applying force in opposite directions. | SE Activity 2.3 | SE Activity 2.3 | (2) magnets, (1) balloon\*, (1) small pieces of paper torn into tiny pieces  \*If there are no latex allergies in the household, Ss could do this activity remotely. |
| Extension Activity | [The World’s Greatest Sandwich](https://d16dnhlej6sizh.cloudfront.net/assets/images/san-ps3movev3/L2_Sandwich.jpg)  Key: Application of contact forces to an everyday example that Ss don’t think of as involving forces! |  |  |  |
| Reading One | *Balance and Force*  The two “try this at home” activities in the reading enable Ss to consider forces up close and in surprising ways, but in the interest of time for remote learning, teachers may wish to have Ss focus only on the sections of the reading that address those examples investigated in class (shoe, hands, ladder, Newton and the apples).  Key: Reinforces forces in pairs--both contact and at-a-distance forces. | SE Reading One | SE Reading One |  |
| Activity 2.4 | Provide images from the TE (and side deck) of each apparatus/device, and have Ss explain the forces acting on each component. Ss  Key: Application of force pairs to the devices from Lesson 1. | SE Activity 2.4  [Images: 4 devices](https://drive.google.com/file/d/1XJP0EfOWs8PRXcEvHPa2H8L6qqhh7-0-/view?usp=sharing) | SE Activity 2.4 |  |
| Checkpoint: Activity 2.4 is an opportunity to check Ss understanding of both contact and at-a-distance forces. Ss ability to draw diagrams, model force pairs, and complete the tables is less important than their ability to *explain* the forces involved in any of the scenarios (either the 4 devices or the shoes, hands, ladder, or sandwich). | | | | |

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| **Lesson 3**  **(2 sessions)** | **Why Does an Object Start Moving?** | [Download Lesson 3 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918183-PS3%20Lesson%203.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 3.1  *Objects that Begin Moving* | If possible, demo the investigation of *starting* motion. Otherwise, share the videos. (3.1a shows the tennis ball; Setup Video 3.1 shows the rubber band activity, and 3.1b shows the rubber band and marble in slow motion.) If Ss are able to have a tennis ball, then they will be able to have direct experience with the phenomenon that motion only begins when a force is applied to an object.  Given the likelihood of reduced time for remote learning, teachers may wish to combine Activities 3.1 and 3.2 while with Ss either virtually or in person.  Key: The beginning of motion is always caused by forces. | SE Activity 3.1  [*Activity Video 3.1a*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-3.1-objects-begin-moving.mp4)  [*Activity Video 3.1b*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-3.1-slow-motion-marble-shot.mp4)  [*Setup Video 3.1*](https://d16dnhlej6sizh.cloudfront.net/assets/portal/Teacher-Portal-Resources/PS3_se_v2_0_5_video-lesson_3-1116.mp4) | SE Activity 3.1 | (1) tennis ball  (1) rubber band |
| Activity 3.2  *More Objects that Begin Moving* | Ss can do the procedure if they have access to a ball and a family member to help them.  If Ss do not have access to the materials, they can watch the video, Tennis Ball Forces, and then answer the questions. Or the teacher can demonstrate the investigation.  Ss can then do the dropped ball activity if they have access to a tennis ball.  If possible, have a synthesizing discussion with Ss about forces counteracting and reinforcing each other.  Key: The beginning of motion is always caused by unbalanced forces.  Key: Forces acting in an opposite direction counteract each other.  Key: Forces that are applied to an object in the same direction reinforce one another. | SE Activity 3.2  [*Activity Video 3.2 Tennis Ball Forces*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-3.2-more-objects-begin-moving.mp4) | SE Activity 3.2 | (1) tennis ball, a partner |
| Extension Activity | Heavy-Duty Shopping  Key: An opportunity to apply understanding to an everyday situation: lifting a bag of groceries | Lesson 3 Extension Activity | Lesson 3 Extension Activity |  |
| Activity 3.3  *Complex Systems that Begin Moving* | Ss will revisit the four devices from the beginning of the module: Floating Magnets, Magnetic Cannon, Air-Powered Car and the Flying Balloon to determine the forces that made the systems begin to move. They may want to watch the videos of the devices again. The teacher can assign different devices to different Ss or have them choose. If possible, have Ss share and discuss.    Key: Understanding *why* each of the 4 devices begins to move and in a particular direction--using the language of *balanced* and *unbalanced* forces that either reinforce or counteract one another.   * The beginning of motion is always caused by unbalanced forces. * Forces acting in an opposite direction counteract each other. * Forces applied to an object in the same direction reinforce one another. | SE Activity 3.3  [*Setup Video 2.1*](https://d16dnhlej6sizh.cloudfront.net/assets/portal/Teacher-Portal-Resources/PS3_se_v2_0_5_video-lesson_2-1115.mp4)  Balloon  [*Activity Video 2.1a*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--starter--8x-slow.mp4) *Magnetic Cannon*  [*Activity Video 2.1b*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-flying-balloon--8x-slow.mp4) *Balloon (slow motion)*  [Activity Video 2.1c](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-floating-magnet--regular-speed.mp4) Magnets  [Activity Video 2.1d](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-air-powered-car--regular-speed.mp4) Air-powered car  [Images: 4 devices](https://drive.google.com/file/d/1XJP0EfOWs8PRXcEvHPa2H8L6qqhh7-0-/view?usp=sharing) | SE Activity 3.3 |  |
| Reading One | *Why Does an Object Start Moving?*  Key: An object doesn’t move when forces are balanced; an object moves only when forces are unbalanced. | SE Reading One | SE Reading One |  |
| Checkpoint: Models in Activity 3.3 can be used to assess Ss understanding of why an object begins to move in a specific direction. | | | | |

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| **Lesson 4**  **(1-2 sessions)** | **How Strong Is That Force?** | [Download Lesson 4 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918224-PS3%20Lesson%204.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| **Activity 4.1**  *Measuring Forces (Optional)* | If possible, teachers could demo Activities 4.1 and 4.2 in one session. Given the likelihood of reduced time for remote learning, and that Activity 4.1 is considered optional, teachers may choose to skip the Lesson 4 activities and only use the readings and the data in 4.2.  If Ss are able to have the equipment, they can observe the phenomenon that the greater the mass, the greater the force--using a spring, string, and masses of varied size. A ruler would enable Ss to collect quantitative data in addition to qualitative data. | SE Activity 4.1  [Activity Video 4.1 - Sponge Ball](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-4.1-sponge-ball.mp4)  [Activity Video 4.1 Measuring Forces - Spring Scale](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/PS3+-+4.1+-+Measuring+Forces.mp4) | SE Activity 4.1 | (1)Spring, (2-3)masses to hang from spring, string, ruler |
| **Activity 4.2**  *Measuring Force with Probes* | Introduce the concepts of weight and mass, and the difference between them by having Ss read the first part of the procedure. Share the Video: Measuring Different Masses with Push-Pull Balance. Ss should fill in the data table as they watch the video, and then answer the SE questions.    Share the Video: ,Push-Pull Balances Pulling on Each Other again having Ss fill in the data table as they watch the video and answer the Making Sense questions.  Key: For every force, there is an equal and opposite force.  Key: Forces can either counteract or reinforce each other, depending on their direction. | SE Activity 4.2  [Activity 4.2 Setup Video](https://d16dnhlej6sizh.cloudfront.net/assets/portal/Teacher-Portal-Resources/PS3_se_v2_0_5_video-lesson_4-1114.mp4)  [Activity Video 4.2 - Push Pull Balances Pulling on Each Other](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/PS3+-+4.2+-+Measuring+Force.mp4) | SE Activity 4.2 |  |
| **Activity 4.3**  *Revisiting Familiar Apparatuses* | Ss revisit the four devices to determine which forces made the systems begin moving.  Key: The motion of an object is determined by the sum of the forces acting on it. | SE Activity 4.3  [*Activity Video 2.1a Magnetic Cannon*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--starter--8x-slow.mp4)  [*Activity Video 2.1b Ballon : Slow Motion*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-flying-balloon--8x-slow.mp4)  [Activity Video 2.1c Magnets](https://iat.wistia.com/medias/s5ivlouemu)  [Activity Video 2.1 Air Powered Car](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-air-powered-car--regular-speed.mp4) | SE Activity 4.3 |  |
| Reading One | *What Keeps Things from Moving?*    Key: Ss read about the need to overcome friction to begin the movement of an object. | SE Reading One | SE Reading One |  |
| Reading Two | *Who Will Win a Tug-of-War?*  Key: Friction is important in tug-of-war where there are two sets of friction forces-between the player’s feet and the ground and between the players’ hands and the rope. | SE Reading Two | SE Reading Two |  |

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| **Lesson 5**  **(1-2 sessions)** | **Why Does an Object Stop Moving** | [Download Lesson 5 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918262-PS3%20Lesson%205.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 5.1  *A Book that Stops Moving* | Given the likelihood of reduced time for remote learning, teachers may choose to combine the Activities in Lesson 5 into a single session with Ss, whether in-person or virtual.  Teachers can demo and/or can have Ss gently shove a book across a table, but not so hard that it falls. Ss then draw two free-body diagrams, one before it starts moving and the other when it is moving but a hand is no longer touching it.    Key: Friction acts on an object against the direction in which the object moves.  Key: The start and end of motion is always caused by unbalanced forces. | SE Activity 5.1 | SE Activity 5.1 | (1) book |
| Activity 5.2  *Recoil in the Magnetic Cannon* | Share the video and have Ss answer the questions. The teacher may want to share the free-body diagram in the TE.  Key: The start **and end** of motion is always caused by unbalanced forces. (Revision from Lesson 3 adding that the end of motion is also caused by unbalanced forces.) | SE Activity 5.1  [Video: Magnetic Cannon](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--starter--8x-slow.mp4)  [Video: Magnetic Cannon (32X slow)](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--end--8x-slow.mp4) | SE Activity 5.1 |  |
| Reading One | *What Affects How Quickly Something Stops Moving?*  Key: Common examples of the relationship between the magnitude of a force and the rate at which something stops: When the stopping force is greater, the object stops more suddenly. | SE Reading One | SE Reading One |  |
| Checkpoint: The conclusion question in Activity 5.1 can be used to assess Ss understanding of why objects stop moving. The teacher can also ask Ss to consider jumping off a high step. In which case is the overall vertical force your body feels when it hits the ground greater: when you bend your knees or when the teacher keeps them straight? | | | | |

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| **2: Learning Set What Makes It Change Its Motion?** | | | | |
| **Lesson 6**  **(1-3 sessions)** | **How Can We Describe How an Object Moves?** | [Download Lesson 6 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918297-PS3%20Lesson%206.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 6.1  *Graphs that Show When a Ball Moves* | Share PIs   * Newton’s Cradle * Balls in Motion 1 * Balls in Motion 2   Share the Activity Video.  Share the Newton’s Cradle video(mute the video).  Teachers may choose to provide graphs for Ss and talk through them rather than have Ss construct the graphs; otherwise, Lesson 6 might need to be skipped.  Note: The graphic representations are designed to support Ss in understanding key concepts. For some Ss, the representations are very helpful. Other Ss struggle to draw these representations, although they may be supported by seeing one that is drawn by someone else (or constructive “live”) and then walked through by the teacher. Most important here is that Ss understand the concept that unbalanced forces mean that an object will move. The representations are less important than the concept(s). Focus on conceptual understanding --especially in a remote-learning context where drawing and discussing as a class may not work as well as they do in a classroom setting.  Key: When an object is subjected to unbalanced forces, it is moving. | SE Activity 6.1  [*Activity Video 6.1*](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-newton-cradle-1ball--8x-slow.mp4)  [*Video: Newton's Cradle*](https://www.youtube.com/watch?v=kA2vjXHnySU) | SE Activity 6.1  Print PIs  •Newton’s Cradle  •Balls in Motion 1  •Balls in Motion 2 |  |
| Activity 6.2  *Graphs that Show How a Ball Moves* | Explain that Ss will now draw a graph to explain *how* a ball moves and not just *when* it moves. The teacher may want to share the video, Newton’s Cradle once more.  Share PIs   * Newton’s Cradle Drawing * Balls in Motion 3 * Balls in Motion 4   Share PI: Newton’s Cradle Drawing. If possible, explain to Ss how to draw a graph for Ball A as discussed in the TE.    Share PI: Balls in Motion 3 which shows the old and new graphs. Ss will then draw a similar kind of graph for Ball E at the other end of the cradle. They will use their graph from Activity 7.1 and the axes of the new graph.    Show PI: Balls in Motion 4 which is the final result. Discuss this with Ss if possible.  Key: When an object is subjected to unbalanced forces it can move. A model of this movement can be shown in a graph. | SE Activity 6.2 | SE Activity 6.2  Print PIs  •Newton’s Cradle Drawing  •Ball in Motion 3  •Balls in Motion 4 |  |
| Activity 6.3  *Motion Graphs for the Magnetic Cannon* | Share the Video: Magnetic Cannon.    Share PI: Magnetic Cannon. This will provide the measurements Ss need to know where to place the graph on the axes. Tell Ss they should assume that they start counting time from the moment that the entering ball (Ball A) is released and that it takes this ball one second to reach the magnets. Ss should draw a graph that includes data for the ball that activates the cannon and also for the ball that shoots out.  If possible, have Ss share graphs and discuss them. The teacher may want to share the final graphs that are included in the TE.  Have Ss answer the Making Sense questions.  Key: When objects are subjected to unbalanced forces they can move at different speeds. A model of this movement can be shown in a graph. | SE Activity 6.3  [Video: Magnetic Cannon](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--starter--8x-slow.mp4)  [Video: Magnetic Cannon (32X slow)](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--end--8x-slow.mp4) | SE Activity 6.3  Print PI:  Magnetic Cannon |  |

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| **Lesson 7**  **(2 sessions)** | **Why Do Things Change Their Speed or Direction?** | [Download Lesson 7 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918335-PS3%20Lesson%207.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 7.1  *Changing Speed* | Share videos with Ss. If possible, lead a discussion using questions in the TE. Focus Ss attention on the “types of motion change”: beginning to move, stopping, slowing down, and speeding up.  Key: If a moving object is subjected to unbalanced forces acting in the direction of its motion, it will speed up. If an object is subjected to unbalanced forces acting against the direction of its motion, it will slow down. If an object is not subjected to an unbalanced force in the opposite direction, it will move at a constant speed. | SE Activity 7.1  [*Video: basketball*](https://d16dnhlej6sizh.cloudfront.net/assets/portal/Teacher-Portal-Resources/PS3_se_v2_0_5_video-lesson_7_video_7-1113.mp4)  [*Video: soccer ball*](https://d16dnhlej6sizh.cloudfront.net/assets/portal/Teacher-Portal-Resources/PS3_se_v2_0_5_video-lesson_7_video_7-1118.mp4)  [*Video: bow & arrow*](https://d16dnhlej6sizh.cloudfront.net/assets/portal/Teacher-Portal-Resources/PS3_se_v2_0_5_video-lesson_7_video_7-1117.mp4) | SE Activity 7.1 |  |
| Activity 7.2  *Changing Direction* | Share Activity Video.  Share the table from Activity 7.1, but with a row for changing direction at the bottom. Share the activity video. Ss should then answer the questions and fill in the bottom row of the table.  Add another row, Change in speed and distance, to the bottom of the table. If possible, have a synthesizing discussion to put together what Ss have learned from the scenarios in the video.  Key: An object’s mass affects how the energy transferred to it changes the object’s movement. When the amount of energy transferred to two objects is the same, the motion of an object with smaller mass changes more (with greater acceleration) than the change in motion of larger mass. | SE Activity 7.2  [Activity Video 7.2](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-7.2-changing-direction.mp4) | SE Activity 7.2 |  |
| Activity 7.3  *Newton’s First Law* | Demo the spiral if possible; otherwise, share the video and the PI: Spiral Example. Ss will then answer the questions in the Procedure.  The teacher can refer to the table from Activity 7.1 and 7.2.  Key: An object will continue to remain at rest or move at a constant speed in a straight line unless it is subjected to unbalanced forces. | SE Activity 7.3  Video: Metal Spiral  PI: Spiral Example | SE Activity 7.3 |  |
| Checkpoint: Ss should be able to answer the Learning Set subquestion, “What Makes [an object] Change Its Motion?” in terms of the forces applied to it. | | | | |

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| **Learning Set 3: Forces and Energy: What is the Difference?** | | | | |
| **Lesson 8**  **(1 session)** | **Using Forces and Energy to Understand the Magnetic Cannon** | [Download Lesson 8 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918379-PS3%20Lesson%208.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 8.1  *Revisiting and Summarizing the Scientific Principles* | Provide Ss with a list of the Scientific Principles that have been developed to facilitate their summarization of activities and readings that have helped them to construct understanding over time. Use the list of scientific principles identified in the TE, as needed, to support Ss learning.  Key: All scientific principles will be used in this lesson. | SE Activity 8.1 | SE Activity 8.1 |  |
| Activity 8.2  *Can We Explain the Behavior of the Magnetic Cannon?* | Share PI: Motion Graph and Magnetic Cannon.  Demo the Magnetic Cannon or show the video. Share PI: Forces (Newton’s third law of motion). Share the bottom diagram of PI: Forces and have Ss draw free-body diagrams for each of the two balls. Share PI: Magnetic Attraction.  Show/share: Magnetic Attraction -Image B and discuss if possible.  Key: At the moment of impact, Balls A and E were subjected to unbalanced forces, Ball A to the left, and Ball E to the right. This is why Ball A stopped moving to the right, while Ball E started moving to the right. Also at the moment of impact, the magnetic force applied to Ball A was greater than that applied to Ball E. | SE Activity 8.2  [Video: Magnetic Cannon](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--starter--8x-slow.mp4)  [Video: Magnetic Cannon (32X slow)](https://s3.amazonaws.com/s3-static.iwqst.com/assets/media/iqwstv3/remote-lesson-videos/ps3/ps3-magnetic-cannon--end--8x-slow.mp4)  PI: Motion Graph and Magnetic Cannon  PI: Forces  PI: Magnetic Attraction | SE Activity 8.2 |  |
| Lesson 8: Homework One | *Motion Graph*  Ss will use the motion graph for the Magnetic Cannon to help explain how the Magnetic Cannon works. Ss should answer the questions.  Key: The balls acted differently at different times because of the forces that they were subjected to. | SE Lesson 8 Homework One | SE Lesson 8 Homework One |  |
| Activity 8.3  *Concluding the Activity* | Have Ss fill in the table in the SE. If possible, have a discussion about the differences between energy and forces and why Ball E shoots out of the Cannon.  Key: There is a lot of energy at the start because both balls have high magnetic energy (because they are both far from the magnet). At the end, only Ball E has significant energy, because it is both moving and is far from the magnet. Ball A, on the other hand, has almost no energy because it is motionless and next to the magnet. Since the energy at the start has to be the same as the energy at the end, all the energy that was at the start is equal to all the energy at the end. Since there is more magnetic energy at the start than at the end, the missing energy has been transformed into Ball E’s kinetic energy. | SE Activity 8.3  PI: Kinetic and Magnetic Energy | SE Activity 8.3  PI: Kinetic and Magnetic Energy |  |

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| **Appendix** | | | | |
| **Appendix 1**  **(1 session)** | **Designing the Best Electromagnet** | [Download Appendix 1 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918422-PS3%20Appendix%20Lesson%201.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 1.1  *Designing the Best Electromagnet* | Ss will not be able to do this activity remotely. You may still want to have them do the Reading One. |  |  |  |
| Reading One | *How Do Electromagnets Work?*  Key: Electromagnets are magnets that run on electricity and can be used in scrap metal junkyards, electric alarm bells and headphones. | SE Reading One | SE Reading One |  |

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| **Appendix 2**  **(1 session)** | **The Universe** | [Download Appendix 2 Teaching Slides](https://d16dnhlej6sizh.cloudfront.net/assets/portal/1589918481-PS3%20Appendix%20Lesson%202.pptx) | | |
| **ACTIVITY** | **TEACHING RECOMMENDATIONS** | **DIGITAL RESOURCES** | **PRINT RESOURCES** | **MATERIALS**  **FOR EACH STUDENT** |
| Activity 2.1  *Organization and Formation of the Universe* | No analogy is perfect, but teachers can use one with which they are familiar or can Share PI: Distribution Center, relating its structure to that of the solar system or universe. Have Ss (Ss) do the actions in the Demonstrating Gravity on their own activity so that they see that gravity is a force of attraction between objects and since the Earth is so massive, it has more gravitational force.  Ss will not be able to do the phenomenon since it involves a large group of Ss simulating accretion. Instead, teachers can have Ss view online simulations of accretion. Use search terms such as disk accretion simulation gravitational accretion simulation or modeling accretion disks. Show PI: Formation of the Solar System.  Key: Galaxies, stars and the solar system formed by gravity from a disk of dust and gas. | Activity 2.1  PI: Distribution Center  PI: Formation of the Solar System | Activity 2.1  PI: Distribution Center  PI: Formation of the Solar System |  |
| Reading One | *Studying the Universe (reading only)*  Key: The universe is a vast system made up of many galaxies, star systems, and planets that interact with one another. | SE Reading One | SE Reading One |  |
| Activity 2.2  *Motions of the Solar System* | Demonstrate the hoop and marble, if possible; otherwise, share the video. If Ss were provided with the materials, they could investigate this phenomenon remotely. For any of these options, Ss can record data and answer the Making Sense questions.    Key: Gravitational force is always attractive. Gravitational forces caused matter (a disk of dust) to coalesce into stars, planets, and other bodies within the universe. | SE Activity 2.2  video coming  Video: Hoop and Marble | SE Activity 2.2 | (1)Hoop  (1)Marble  (1)large sheet of paper  (4)colored pencils |
| Activity 2.3  *Apparent Motions of Stars* | Have Ss do the Modeling “appearance” activity remotely using a lamp or light.  Share PI: Projectable Sky Maps (Set of 6). Ss use these to do Part 1 of Activity 1.3.  Key: As the Earth moves around the sun through the year, different stars and constellations are visible, and their relative positions change throughout the year. |  | PI: Projectable Sky Maps (Set of 6) |  |

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| **SUMMATIVE ASSESSMENT:** Ss can construct a complete, evidence-based explanation of the behavior of the Magnetic Cannon and/or answer the Driving Question “How will it move?” based on a scenario teachers adapt to the local context or experience of their own Ss. |

***Teachers might choose to emphasize only a portion of this as a final assessment, given what teachers are able to teach and what Ss are actually able to do during this remotely taught unit.***