# Sample virtual program: Stage 5 Science

## Considerations for programming virtual classrooms

Guiding questions for establishing learning expectations and communication processes

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| Guiding question |  |
| What are your students going to learn? (Objectives) | Itemise what you want your students to be able to do or know when completed. |
| How are they going to learn it? (Resources and Strategies) | What is required in order to meet each of the objectives defined? Will delivery be using one platform or be blended? |
| Completion date | When do you expect each task to be completed? |
| How are you going to know that they learned it? (Success criteria) | What is the specific task that students are to complete to demonstrate their learning? |
| Differentiation including HPGE | How can the classroom elements be differentiated to meet the learning needs of your students? Consider providing options for the content, process, product and learning environment. More information on differentiation can be found on the [teacher quality and accreditation](https://education.nsw.gov.au/teaching-and-learning/professional-learning/teacher-quality-and-accreditation/strong-start-great-teachers/refining-practice/differentiating-learning#Key0) website. |
| Collecting evidence of student learning (Verification) | What evidence of student learning will you collect and how will you evaluate it? |
| Feedback (Evaluation) | How well was the task completed? Provide an assessment decision. |
| Communication | How will student learning be oriented?  How will share and display information for your students to access?  How can you promote student-teacher interactions?  How can opportunities for learner-learner interactions be incorporated into activities?  How will the teacher monitor and support progress in student learning? |

### Supporting guided student inquiry

This sample uses an available pdf resource and demonstrates the modification of the content and activities to suit remote schooling. Students are guided in completing short online activities in either synchronous (live) or asynchronous formats. Teachers and schools should carefully consider the platform/s that will be used to deliver content.

#### Context: Stage 5 PW2

The motion of objects can be described and predicted using the laws of physics

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| Guiding question: | How can the motion of objects be described and predicted? |
| What are your students going to learn? (Objectives) | Students will develop working scientifically skills and demonstrate understanding of the relationship between force and motion:  Skills in processing and analysing data and information (WS7.7)  Skills in Communicating (WS9)  Knowledge and understanding of the qualitative relationship between distance, speed and time (PW2b)  Knowledge and understanding of the relationship between acceleration and a qualitative change in speed and/or direction as a result of a net force (PW2c) |
| How are they going to learn it? | Students engage in activities adapted from [Force and Motion](https://essl.leeds.ac.uk/download/downloads/id/349/force_and_motion.pdf)  Students investigate the relationship between speed, distance and time in the context of car crashes, by analysing and representing data and information.  Students make predictions, using data to communicate their justification.  Students represent and analyse speed time data to make conclusions about the relationship between speed, time and acceleration.  Students design and conduct a safe investigation to measure and analyse the motion of an object. |
| Target date for completion | 8 sessions (1 week). |
| How are you going to know that they learned it? (Success criteria) | Students will:   * represent data and information using appropriate scientific formats * analyse and describe trends and patterns in data * describe relationships between variables mathematically and graphically * plan and conduct experiments to collect, represent and analyse data * justify predictions * measure and analyse the motion of everyday objects |
| Differentiation including HPGE | Adaptive process: Students can use scaffolds provided by the teacher, which are available in the teacher resource [Force and Motion](https://essl.leeds.ac.uk/download/downloads/id/349/force_and_motion.pdf).  Adaptive process: diagnostic testing assists the teacher in identifying misconceptions and providing tailored support. The resources list contains online resources that could be employed to assist students requiring support or extension.  Adaptive process: the format of presentation is flexible and varied, such as submitting photographs and representing relationships graphically or mathematically |
| Collecting evidence of student learning (Verification) | Students will complete online activities:  Reflections  Quizzes  Charts or graphs  Worksheets  Investigations, including experimental method, data collection and analysis |
| Feedback (Evaluation) | Format to be communicated clearly by teacher, whether it is by emailing tracked documents, upload of media/audio via online platforms or a blended approach. For example, teacher recording oral feedback on Class OneNote and setting up quizzes to give automated feedback.  Teachers analyse the data from diagnostic testing, and feedback is dependent on the submission pathway (email, Google Classroom, MS Class OneNote or Teams, Google or MS forms or quizzes for example). |
| Communication | **Orientation** Teacher will post the activity description on an agreed virtual notice board, such as Teams. Students will be expected to independently complete a short activity before the online lesson. Video or audio conference, such as that on Teams will be used to guide students through learning activities.  **Sharing information:**  All relevant information can be included as links on the activity description. Initial orientation conference will be recorded and posted to Teams for students to access asynchronously.  **Promoting student-teacher interactions:**  Students may require clarification and assistance at various times in their investigation. Using an [asynchronous discussion](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/580#.XmbrZ3MkfVI.link) or chat or forum will make questions and answers visible to all students. The teacher communicates a deadline for student submission of activities along with a timeframe for the provision of feedback.  **Promoting student-student interactions:**  Students can use the chat/post function or forum to communicate between the class members whilst teachers facilitate collaboration, discuss questions and give informal feedback. Student groups can collaborate on documents in Google drive/One drive or on an activity in the collaboration space in Class OneNote.  **Monitoring and supporting progress in student learning**: Teachers provide feedback on student responses. |

#### Resources:

* [Force and Motion](https://essl.leeds.ac.uk/download/downloads/id/349/force_and_motion.pdf) is a resource that contains a range of student diagnostic assessments, learner activities and explicit instructions for teachers.
* [RiAus low level speeding notes-Years 10-11](https://issuu.com/riaus/docs/riaus_pdplus_low_level_speeding_notes_-_years_10-1) contains articles, media and activities on force and motion related to car crashes.
* [BBC bitesize](https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zkcpfcw) is a useful resource for students requiring additional support and/or revision.
* Microsoft [excel-for-windows-training](https://support.office.com/en-us/article/excel-for-windows-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb?wt.mc_id=otc_home&ui=en-US&rs=en-US&ad=US&clearCache=fdfd1f08-cf92-8faf-5d81-296545276cd1) has a quick start guide for using excel and a guide on charts.
* [Quizizz – distance-time graph practice](https://quizizz.com/admin/quiz/57fb00464d72f0c932b60729/distance-time-graph-practice) includes a range of multiple-choice questions, most of which are at a suitable level for Stage 5 Science students. Teachers can share the link for students to complete as a self-assessment. Alternatively, by logging in with their Google account, teachers can set the quiz as homework or host a live quiz.
* [ABCD cards](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/560#.XmgQPJ3-1OI.link) in the Learning Activities selector, from the DoE portal, provides details of quiz and polling software, such as kahoot, mentimeter, Microsoft forms, Google forms, Plickers, and Socrative.
* [Asynchronous discussion](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/580#.XmbrZ3MkfVI.link) is a template from the digital learning selector in a format in which students can respond to the lesson at times where synchronous lessons are not possible.
* [Desmos](https://www.desmos.com/) is an online graphing calculator that can be used by students and teachers to create, explore and interact with graphs. It is accessed through a web browser and activities can be easily shared with students online. It can be used simply as a graphics calculator, but the [Activity Builder](https://teacher.desmos.com/custom) function allows teachers to develop interactive activities for their students.

### Lesson Sequence:

This sequence of activities uses the resource [Force and Motion](https://essl.leeds.ac.uk/download/downloads/id/349/force_and_motion.pdf) , The National Strategies Secondary. © Crown copyright 2008.

This is a teacher resource. Although it contains student worksheets it is not advisable to send the entire document to students.

While it may not be possible to run lessons synchronously it may be beneficial to provide a weekly 30 minute session where students can join a video conference/live chat and undertake discussion and ask questions.

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| Session | Learning Sequence | Evidence of learning |
| Session 1 | Stimulus material: [force and motion](https://essl.leeds.ac.uk/download/downloads/id/349/force_and_motion.pdf): (Lesson 2, Activity 2.1 representing motion-distance/time/speed. pp 24-25)  Students use the communicated platform to post or answer via other communication such as padlet, google or MS form or email. | Students reflect on the media:  2 things they notice and  1 thing they wonder about |
| Session 2 | Discussion of pre-reading and reflections:  An online forum or live discussion with teacher facilitation can be conducted. The live session can be recorded and viewed. | Students participate in a discussion (synchronous or asynchronous) |
|  | Stimulus material: [force and motion](https://essl.leeds.ac.uk/download/downloads/id/349/force_and_motion.pdf)  (Lesson 2, Activity 2.2 Supply students with data on p 20)  Teachers may need to provide students with support to construct line graphs, such as explicit instructions for using [excel](https://support.office.com/en-us/article/excel-for-windows-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb?wt.mc_id=otc_home&ui=en-US&rs=en-US&ad=US&clearCache=fdfd1f08-cf92-8faf-5d81-296545276cd1) and how to upload to a digital notebook or other platform such as email.  If students have access to the internet, they could use Desmos to plot the data and share their completed graphs. [This desmos graph has been set up specifically for this exercise](https://www.desmos.com/calculator/9w1wizvsx2). | Students use Desmos to plot distance-time graphs for each vehicle on the same set of axes.  Alternatively, students can use excel or hand-draw graphs which can be photographed and uploaded. |
|  | Teachers prepare a quiz/form or alternatively plan and conduct a synchronous discussion to formatively assess student learning with the following questions:   * On a distance-time graph: * What does a straight-line plot indicate? * What does the slope indicate? * What does a zero slope (flat line) indicate? * What does a curved line indicate? * Outline the major events in the tunnel   If a synchronous discussion cannot take place, a quiz or form should be employed to collect information about student learning | Students to compare graphs and explain motion of each car and then respond to questions/form/quiz, to enable teachers to formatively assess their understanding |
| Session 3 | Teachers can use the plenary on p 22 to guide student understanding.  Students use this to make a prediction of what happened in the tunnel and justify their prediction.  Teachers send students the Official CSI account. | Prediction demonstrates students abilito to interpret distance time graphs to describe the motion of an object. |
| Session 4 | Teachers read through Lesson 3: Representing motion-speed and acceleration, p 27.  Teachers share diagnostic quiz/form or copy handout from pp 30-39 ([available as a Google form](https://docs.google.com/forms/d/1PN6D05FeV2_dyF8cZ7EgJlCofEPT5FdPdfSenul5g3I/edit?usp=sharing)) or use Quizizz link in the resources below  Teachers analyse the data (answers on p 28) and provide differentiated activities on representing data. Teachers may need to send selected students additional verbal/written feedback and additional support activities. Feedback can be via email, recorded on OneNote, etc. | Students complete quiz or worksheet on distance-time graphs and submit. |
| Session 5 | Activity 3.2 Speed-time graph activities on p 43. Teachers to copy worksheet or upload to learning platform.  Teachers prepare questions, reflections or quiz. | Students complete activity to sketch and plot speed-time graphs.  Students to respond to open and closed questions via quiz or other means (synchronous discussion, online forum, recorded session or written task):   * What does a straight line plot indicate? * What does a positive slope indicate? * What does a negative slope indicate? * What does a zero (flat) slope indicate? |
|  |  | HPGE Students investigate the difference between speed and velocity by designing an activity to measure the distance travelled in 2 orthogonal (at right angles) directions and compare to the displacement from the origin. Calculate the average speed from distance/time data and velocity from displacement/time data.  Mathematical models can provide extension to students. Teachers can supply F=ma worksheets or quizzes.  Worksheets on graphs, pp 70-73 |
| Session 6 | Teachers prepare diagnostic quiz/form or copy handout from pp 57-64. Teachers analyse the data (answers on p 50) and provide differentiated activities on representing data. Teachers may need to send selected students additional verbal/written feedback and additional support activities. Feedback can be via email, recorded on OneNote, etc. | Students complete quiz or worksheet on speed-time graphs and submit. |
| Session 7 | Review of unbalanced and balanced forces. Complete worksheet on pp 9-11 OR complete variation of Activity 1.2, p 16 | For Activity 1.2 students photograph a common situation (for example, a cup on a table, a mass hanging on a spring, a wooden block floating in water, a block of foam under a heavy book, a toy car rolling down a slope, a ball thrown up into the air) and annotate the photo with the forces acting on it. The annotation should indicate the size of the forces and whether they are balanced or not balanced. Upload of a photo can be to a Notebook, posted to the forum or emailed to the teacher. |
|  | Activity 4.2 Linking force and motion, pp 54-55. Information from these pages can be presented in a worksheet or through a recorded or live teacher exposition session. | Students respond to posed questions, either in live session or via feedback via quiz, learning platform or email.  Students to give examples of the relationship between balanced/unbalanced forces and motion in an assessment, such as an online quiz. |
| Session 8 | Activity 5.1: open ended investigation, p 66. Teachers will need to change woodlice to slaters. Mealworms, a small pet or a moving toy could also be used. | Students design and conduct an ethical and safe investigation to measure and analyse the motion of an object such as a moving toy, invertebrate or pet. The analysis will include a distance/time plot for the moving animal/object, qualitative descriptions of motion, average speed calculations and calculations of acceleration (as assigned). |

### Student handout for distribution

**Inquiry question: What is the relationship between speed, distance and time?**

Orientation/introduction – do this before our lesson <date/time>

Scenario: Imagine you are part of a CSI team that has been called to a fatal accident which occurred in the Queensway Tunnel in the early hours of the morning.

The challenge for the CSI Team is to use the available data to reconstruct what happened inside the tunnel and to identify the person responsible for the hit-and-run fatality.

#### Session1

1. Read the information about the accident provided on p.24-25 in [force and motion](https://essl.leeds.ac.uk/download/downloads/id/349/force_and_motion.pdf).
2. Join the class <insert link to platform, such as padlet>
3. Join the class Team using this link **<insert link to Microsoft Team site>**.
4. Post your completed response to 2 things you notice and 1 thing you wonder about <insert link to platform, such as padlet or (a posting could be on Google classroom, Microsoft Teams or Edmodo>)

#### Session 2

Getting Started:

1. On <date/time>, join the class in Microsoft Teams for a discussion and introduction to your task this week. Discussion: < link to platform, such as a live online audio or video chat with teacher facilitation in Microsoft Teams or Google Hangouts or a collaborative document, such as a google doc, or sharing the collaboration space in OneNote>
2. Refer to the data on page 24 and plot a distance verse time graph for each vehicle on the same grid using [Desmos](https://www.desmos.com/calculator/0r3b5nxqof). Alternatively, students can use excel or hand-draw graphs which can be photographed and uploaded for your teacher to view.
3. Answer the questions that your teacher has provided on distance time graphs using the information about distance time graphs to describe the motion about each of the cars in the tunnel

#### Session 3

1. Predict which car was responsible for the accident
2. Justify your prediction

#### Session 4-7

Developing skills in representing and analysing data:

Complete the following tasks. If you have any questions or require assistance, contact your teacher **<select Teams/Google classroom/email>**

1. Complete the set of diagnostic questions <attach questions p 30-39 or link to online Google form quiz>.
2. Complete the speed time graph activities on pages 43-48 and answer the questions provided by your teacher
3. Answer questions on Acceleration on pages 57-64 and submit to your teacher
4. Complete Forces worksheet, pages 9-11 or undertake activity 1.2 on page16
5. Complete activity 4.2 Linking Force and Motion, either by answering the questions your teacher has set or through a live chat

#### Session 8

Putting it all together: Planning and conducting an investigation and representing and analysing data:

1. Conduct an investigation on the motion of an object such and a moving object, invertebrate or pet following the instruction given by your teacher

### Crime scene investigation (CSI) report: The Queensway Tunnel

**Date of incident:** Sunday January 20th

**Time of incident:** 1.30am

#### Summary

In the early hours of Sunday 20 January, a 25-year-old man was killed in the Queensway Tunnel after having been hit by another car. It appears that the victim’s car broke down, that he got out of the car and was then hit by another car in a ‘hit-and-run’ incident. There are CCTV cameras at 500m intervals throughout the tunnel, but the incident took place in a ‘blind spot’ and was not recorded on camera.

However, pictures are available of the victim’s car (V) and three other cars (A, B,C) which were travelling through the tunnel at about the same time. These pictures have been used to produce the following table which records the time at which each of the cars went through each of the 8 cameras in the tunnel.

All times are taken from the moment at which the first car (victim Car V) entered the tunnel. Hence Car A entered the tunnel (camera 1) 10 seconds after Car V, and Car C entered the tunnel 150 seconds after Car V.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Cam 1 | Cam 2 | Cam 3 | Cam 4 | Cam 5 | Cam 6 | Cam 7 | Cam 8 |
|  | 0 m | 500 m | 1000 m | 1500 m | 2000 m | 2500 m | 3000 m | 3500 m |
| Car V | 0 | 40 | 80 | 120 |  |  |  |  |
| Car A | 10 | 40 | 70 | 100 | 130 | 160 | 190 | 220 |
| Car B | 60 | 90 | 120 | 150 | 210 | 240 | 270 | 300 |
| Car C | 150 | 170 | 190 | 210 | 275 | 310 | 340 | 360 |

#### Further information

Two sets of tyre skid-marks were found in the tunnel alongside the victim’s car. One set of skid-marks was significantly longer than the other. By coincidence, cars B and C were the same model.

#### Brief

To use these recorded times and distances to help reconstruct what happened in the tunnel and to identify which of the cars A, B, C was responsible for the ‘hit-and-run’ crime.

#### Queensway Tunnel

The Queensway tunnel is 2 miles long (3240 m). There are CCTV cameras along the tunnel at intervals of 500m (the last camera is situated in the road 260m after the tunnel exit).

Two images of the Queensway tunnel show the view from the last CCTV camera located outside the tunnel exit and the view from one of the CCTV cameras inside the tunnel.
The diagram below shows the placement of CCTV cameras along the tunnel. the cameras are located at 500 m intervals along the length of the tunnel with the final camera 3500 m from the start of the tunnel. The diagram is not to scale.