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PHYSICS MENTORING PROGRAMME | RHAGLEN FENTORA FFISEG

Mentor Resources Pack

Last updated: November 2024

INTRODUCTION

WHEN SHOULD I USE THE RESOURCES PACK?

You are strongly encouraged to come up with your own sessions based on what you learn about your mentees! However, if you are struggling for ideas or time, you can use the premade sessions in this resources pack. You may also find it useful to read this pack for session ideas you can adapt to better suit your mentees.

Before delivering any of the sessions, ensure you have read the entire session plan and you have everything you need. It is always a good idea to **try activities yourself beforehand** so that you are prepared.

TOP TIP: science teachers always practice experiments before they run them! It will help you to know what might go wrong, and how long activities will take

If you are charged for printing in your institution, talk to your university contact. They should be able to print any worksheets you require. If you purchase any items for activities, you can claim for these when you submit your expenses for the cycle.

HOW DO I GET THE EQUIPMENT?

The following universities will have at least one set of kit you can use for the activities in this pack: Aberystwyth, Bangor, Cardiff, Swansea. We are working to get kits in every university!

Please use the Resource Booker to book any resources, and get in touch with your university contact to arrange collection and return.

It is your responsibility as mentors to ensure the kits are kept tidy and not misused. **If anything is broken, used up, or missing, please speak to your university contact** as soon as possible so arrangements can be put in place to purchase replacement kit.

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CONTENTS

TOP TIP: click on the page number to jump to that session!

Session Name: My Physics Journey (Video)

Weekly Theme: [✓ MY PHYSICS JOURNEY] | THINKING LIKE A PHYSICIST | WHERE PHYSICS CAN TAKE ME | COLLABORATION, TEAMWORK, AND COMMUNICATION | THE WORLD AROUND ME

Aim

To explore the physics journeys of the mentors and mentees

Learning Objectives

By the end of this session, the mentee will be able to...

- Create the ground rules for the mentoring group
- State one hobby or interest each mentor has
- Identify one link between a chosen interest and physics

Equipment List

- My Physics Journey video
- Prepare a short talk on your own physics journey

Scaffolding

If mentees finish early:
- Encourage them to elaborate on their examples
- Challenge them to link an everyday mundane task to physics (e.g. chores, going to school, eating lunch, etc.)
- Ask what they think their physics journey will look like going into the future

If mentees are struggling:
- Encourage them to think about their own hobbies and interests.
- Ensure every mentee gets a chance to share their own hobby/interest

If they are struggling to link a hobby to physics, lead by example and choose a random hobby and link it to physics. Encourage them to use the same method you did for their own hobby.

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, introduction to the project and mentors • Brief overview of the session's objectives and activities
10 mins	**Ground Rules** • Create a short list of ground rules together with the mentees that must be adhered to in every session
20 mins	**Physics and My Hobbies** • Use the TikTok part of My Physics Journey video here • Facilitate discussion about linking hobbies to physics
20 mins	**My Physics Journey** • Each mentor gives a brief overview of their own physics journeys • Watch the interview part of My Physics Journey video
10 mins	**Reflection** • Allow time for mentees to complete their reflections

Science Capital Links

scientific literacy	[✓ science-related attitudes]	[✓ transferable science skills]	science media
[✓ out-of-school science]	family science skills	knowing someone in science	[✓ talking about science]

Session Name: My Physics Journey (Video)

SESSION NOTES

INTRODUCTIONS

- Make sure **you and your co-mentor introduce yourselves,** then go round and get each mentee to say their **name** and a **prompt** (e.g. a boring fact about themselves).
    - It's **okay to take notes of names** at this point as it's really important to remember names for building rapport!

GROUND RULES

- You can use a **Mentimeter** to encourage mentees to set the ground rules, then vote on **~5** to set as your rules.
- Make sure you then **display these rules** at the start of every following session!

USING THE VIDEO

- The YouTube video can be found here: https://youtu.be/f6gY0Nh9uXs
    - TikTok shorts for Physics and My Hobbies ends at **1:50**
    - Interviews start at 1:50 for My Physics Journey
- It's worth having a **back-up** way to play this in case internet doesn't work on the day!
    - e.g. send to the teacher ahead of time so they can play it (virtual mentoring)
    - e.g. have an alternative session planned if the video doesn't work (e.g. My Skilful Self)

PHYSICS AND MY HOBBIES

1. Show the mentees the **TikTok part of the video.** Ask them to note down **different hobbies/interests** of the mentors they see in the video.
2. Facilitate a **discussion** around this part of the video. You could use questions like:
    - Does anyone have the same hobbies?
    - Was anyone surprised or confused by any of the hobbies?
3. Explain that, while it may seem that the hobbies are unrelated to physics, **they all rely on physics or include physics.**
    - Choose **a couple of examples** from the video to illustrate and explain in some detail.
4. Challenge the mentees to **link one of their own hobbies/interests** to physics.
5. You could end this activity by listing some of the **physics skills** the mentees have just used (e.g. communication, creativity, etc.)

MY PHYSICS JOURNEY

1. Mentors can then briefly **explain your own physics journeys.** It doesn't have to be long, or even academic! Whatever your link is with physics, explain it in your own way.
2. Show the mentees the **second part of the video.** Ask them to note down:
    - 1 thing that **surprised** them
    - 1 thing they **have in common** with a mentor
    - What **their own answer** would be to one of the questions (they can pick the question)
3. Facilitate a **discussion** based around the three questions.

Session Name: My Physics Journey (My Skilful Self)

Weekly Theme: [✓ MY PHYSICS JOURNEY] | THINKING LIKE A PHYSICIST | WHERE PHYSICS CAN TAKE ME | COLLABORATION, TEAMWORK, AND COMMUNICATION | THE WORLD AROUND ME

Aim

To explore the physics journeys of the mentors and mentees

Learning Objectives

By the end of this session, the mentee will be able to...

- Create the ground rules for the mentoring group
- State one hobby or interest each mentor has
- Identify one link between a chosen interest and physics

Equipment List

- My Skilful Self worksheet
  - 1 per mentee
  - Bring your own completed sheet!
- Colouring pens/pencils

Scaffolding

If mentees finish early:

- Encourage them to elaborate on their examples
- Challenge them to complete a second My Skilful Self in a different way to their first
- Challenge them to link an everyday mundane task to physics (e.g. chores, going to school, eating lunch, etc.)

If mentees are struggling:

- Encourage them to think about their own hobbies and interests.
- Ensure every mentee gets a chance to share their own hobby/interest

If they are struggling to link a hobby to physics, lead by example and choose a random hobby and link it to physics. Encourage them to use the same method you did for their own hobby.

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, introduction to the project and mentors • Brief overview of the session's objectives and activities
10 mins	**Ground Rules** • Create a short list of ground rules together with the mentees that must be adhered to in every session
10 mins	**My Physics Journey** • Each mentor gives a brief overview of their own physics journeys
25 mins	**My Skilful Self** • Mentees complete the My Skilful Self worksheet ◦ You can show your own as an example • Each mentee presents their sheet to the group • Discuss how their hobbies/interests link to physics
10 mins	**Reflection** • Allow time for mentees to complete their reflections

Science Capital Links

scientific literacy	[✓ science-related attitudes]	[✓ transferable science skills]	science media
[✓ out-of-school science]	family science skills	knowing someone in science	[✓ talking about science]

Session Name: My Physics Journey (My Skilful Self)

SESSION NOTES

INTRODUCTIONS

- Make sure **you and your co-mentor introduce yourselves,** then go round and get each mentee to say their **name** and a **prompt** (e.g. a boring fact about themselves).
  - It's **okay to take notes of names** at this point as it's really important to remember names for building rapport!

GROUND RULES

- You can use a **Mentimeter** to encourage mentees to set the ground rules, then vote on **~5** to set as your rules.
- Make sure you then **display these rules** at the start of every following session!

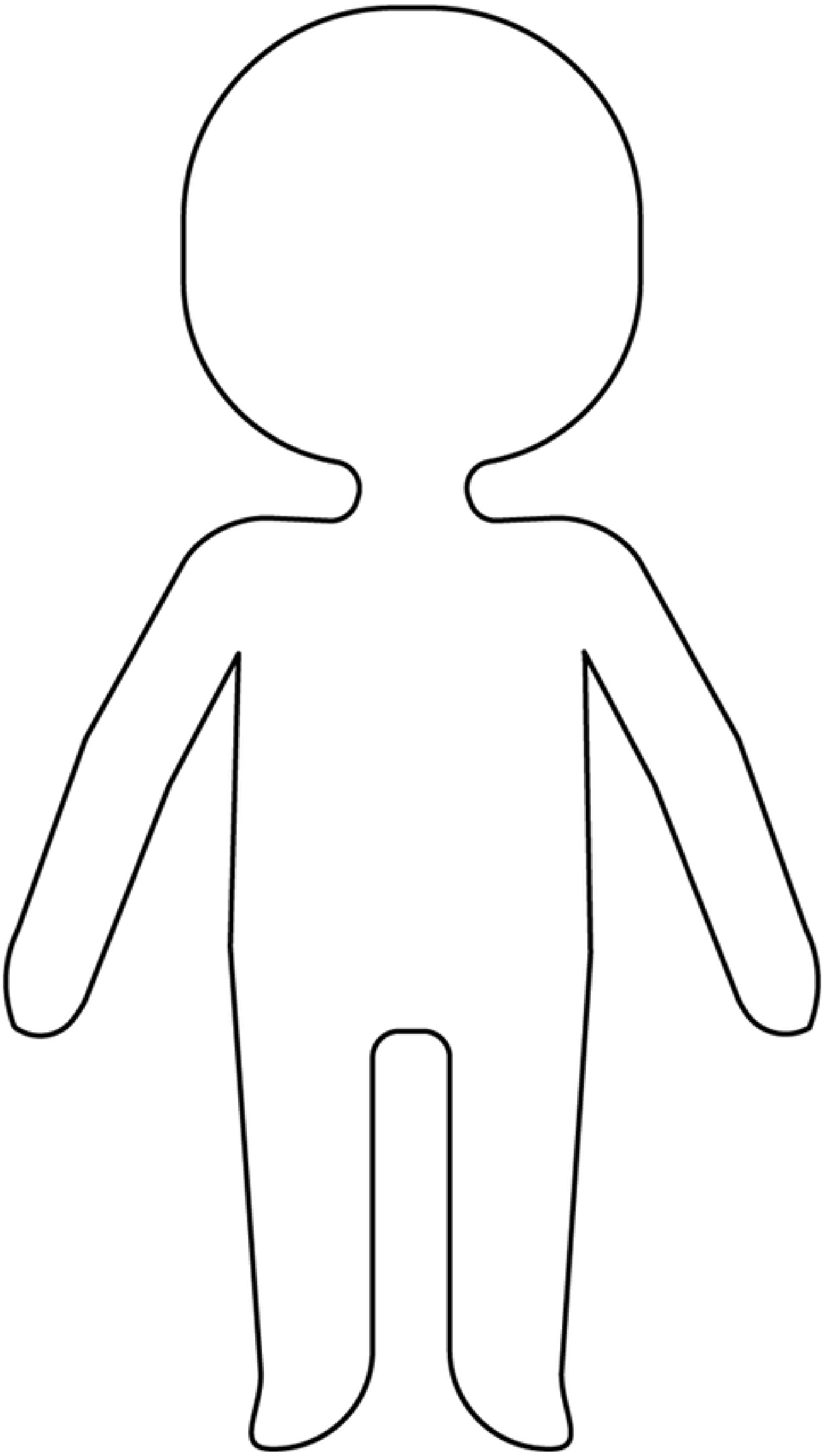
MY PHYSICS JOURNEY

- Mentors briefly **explain your own physics journeys.** It doesn't have to be long, or even academic! Whatever your link is with physics, explain it in your own way.
- If you have time, you could ask the mentees afterwards if anything surprised them about your journeys.

MY SKILFUL SELF

- It's up to you whether you **prepare** your own My Skilful Self beforehand and bring it as an example, or do yours **alongside** the mentees.
- Encourage mentees to complete this **however they see fit!** Whether they want to write, draw, make the figure look like themselves (or not), whichever way they want to express themselves.
  - It could be fun to source some **extra resources** to really encourage creativity, e.g. tissue paper, glue, stickers, etc.
- Make sure you **allow enough time** for each mentee to **describe** their Skilful Self (30 secs per mentee should be a good estimate)
- Once mentees have presented their Skilful Self sheets, facilitate a discussion on how their hobbies/interests **link to physics.** Some prompts could include:
  - Do you have any hobbies in common with each other?
  - What skills do you need to do this hobby? How can that be used in physics?
  - What physics concepts are involved in this hobby? (e.g. sport = mechanics and motion, cooking = heat, knitting = tension, etc.)
- You could **collect the Skilful Self** sheets in at the end and keep them to reference throughout your sessions!

My Skilful Self | Myfi Medrus



Session Name: Mystery Boxes

Weekly Theme: MY PHYSICS JOURNEY | [✓ THINKING LIKE A PHYSICIST] | WHERE PHYSICS CAN TAKE ME | COLLABORATION, TEAMWORK, AND COMMUNICATION | THE WORLD AROUND ME

Aim

To exercise science skills and explore the scientific process

Learning Objectives

By the end of this session, the mentee will be able to...

- Estimate what is inside the mystery boxes using science skills
- Employ teamwork and communication
- Justify their scientific conclusions

Equipment List

- Mystery boxes
  - 3 sets of boxes
- Mystery box worksheets

Scaffolding

If mentees finish early, you can ask them to think about the following questions:

- What are the benefits of an experiment being done multiple times?
- What skills have you used in this experiment?

You could also discuss the importance of being critical of science you might see in media. Science could be published that isn't true or based on poor experiment techniques.

If mentees are struggling:

- Encourage them to think about what they could test - could they shake the box? Weigh it? What sounds does it make?
- Have another mentee in their group explain what they think is in the box and why to them.

Ensure all mentees get to contribute to the discussion - don't just ask for volunteers

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, review of ground rules • Brief overview of the session's objectives and activities
20 mins	**Mystery Box Investigations** • Split mentees into 3 groups and give each group a set of mystery boxes and a worksheet • Each team has to figure out what's in each box **without opening them** and write this on their worksheet ◦ Teams should keep their decisions secret from each other
20 mins	**Mystery Box Discussion** • Once testing is done, each team presents what they think is in each box **and why** ◦ Mentees will want to know what's in the boxes - in the real world, scientists never get to see what's in the box! • Discuss similarities/differences in answers - does anyone change their mind about what's in a box?
10 mins	**Reflection** • Allow time for mentees to complete their reflections

Science Capital Links

[✓ scientific literacy]	[✓ science-related attitudes]	[✓ transferable science skills]	science media
out-of-school science	family science skills	knowing someone in science	talking about science

MYSTERY BOXES: WORKSHEET

BOX 1	BOX 2	BOX 3
What’s in it? Why?	What’s in it? Why?	What’s in it? Why?

BOX 4	BOX 5	BOX 6
What’s in it? Why?	What’s in it? Why?	What’s in it? Why?

Session Name: Electromagnetic Spectrum

Weekly Theme: MY PHYSICS JOURNEY | [✓ THINKING LIKE A PHYSICIST] | WHERE PHYSICS CAN TAKE ME | COLLABORATION, TEAMWORK, AND COMMUNICATION | THE WORLD AROUND ME

Aim

To use scientific skills in the context of the electromagnetic spectrum

Learning Objectives

By the end of this session, the mentee will be able to...

- Construct a spectroscope
- Create a hypothesis using information they know/learn
- Recall the physics of the electromagnetic spectrum

Equipment List

- EM Spectrum activity kit (1 per mentee)
  - Spectrometer sheets
  - CDs
- UV activity kit
  - UV torch
  - Suncream + laundry liquid

Scaffolding

If mentees finish early:

- More mentees can try writing secret messages under UV light!
- Discuss advantages of different wavelengths for different applications *(e.g. infrared on TV remotes)*
- What careers are different wavelengths used in? *(e.g. x-rays in medicine, radar in aviation, night vision in security/military, the whole spectrum in astronomy, etc.)*

If mentees are struggling:

- Have them research the different EM wavelengths and make a diagram
- Show them this (incredible) video: https://www.youtube.com/watch?v=bjOGNVH3D4Y

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, review of ground rules • Brief overview of the session's objectives and activities
20 mins	**Making Spectrometers** *(see next page for details)* • Start by seeing what the mentees know/remember about the EM spectrum • Mentees create spectrometers • Insert a CD into the slit and look through the eyehole at a range of objects ◦ What do they see? What do they think is happening?
20 mins	**UV Activity** *(see next page for details)* • Use the UV torch to demonstrate UV light • Write some secret messages and explain the science
10 mins	**Reflection** • Allow time for mentees to complete their reflections

Science Capital Links

[✓ scientific literacy]	science-related attitudes	transferable science skills	science media
[✓ out-of-school science]	family science skills	knowing someone in science	[✓ talking about science]

Session Name: Electromagnetic Spectrum

SESSION NOTES

Don’t let mentees point their spectroscopes directly at the Sun!

MAKING SPECTROMETERS

1. Each mentee will need a spectroscope sheet, a CD, scissors, and tape/glue
    - You can ask your teacher to provide scissors and tape/glue
    - Bring extra sheets just in case someone messes theirs up!
2. Mentees **cut along the solid lines** and **fold along the dotted lines**

THE SCIENCE

- The tiny pits on the CD **diffract light,** splitting it into the full spectrum of colours (think rainbow).
- Different light sources and objects either **reflect, absorb, or emit** different wavelengths of light by different amounts, creating **bright or dark stripes** in the spectrum.

Why is this useful?

- If we know what lines on the spectrum each chemical element makes, we can estimate what elements are in objects from far away. Can they think of examples where this might be useful?
    - *Examples could include: celestial objects like the sun, stars, galaxies; the atmosphere*
- The spectrometer was invented in the 19th century by Robert Bunsen.
    - Do mentees recognise that name?
        - *Answer: Bunsen burners!*
    - What do they think it allowed scientists to do that they couldn’t before?
        - *e.g. estimate the composition of celestial objects that we will never be able to measure in-person*

UV ACTIVITY

1. Lower the lights and **look at different things under the UV torch** (don’t aim it at eyes!!)
    - *Things that work well: bank notes, teeth, hi-vis, white or dark clothing*
2. Turn the lights back on. **Ask for 2 volunteers.** They will each dip a finger into one of the “mystery” liquids and write a secret message on a piece of paper.
    - *Don’t tell them what the liquids are! One is suncream and one is laundry detergent. Make sure to ask about any skin allergies first.*
3. Turn the lights back off and inspect each piece of paper. Can the mentees guess which liquids were used? Why? Encourage the use of science to explain their reasoning.

THE SCIENCE

- Under a UV light, white clothes, paper, teeth, fluorescent items etc. glow in the dark. What they have in common is that they all contain **phosphors.**
    - *A phosphor is any substance that absorbs energy and re-emits it as visible light.*
- Teeth and fingernails contain phosphors naturally, and many laundry detergents contain phosphor-based optical brighteners designed to make your white clothes brighter. That’s why the laundry detergent message will **glow!**
- Suncream protects you from UV light from the Sun. So it should look **dark** under UV light.

Session Name: Modelling Radioactive Decay

Weekly Theme: MY PHYSICS JOURNEY | [✓ THINKING LIKE A PHYSICIST] | WHERE PHYSICS CAN TAKE ME | COLLABORATION, TEAMWORK, AND COMMUNICATION | THE WORLD AROUND ME

Aim

To explore scientific modelling using coding in Python

Learning Objectives

By the end of this session, the mentee will be able to...

- Create a Python code to model radioactive decay
- Discuss the advantages of using computers to simulate experiments
- Explain the careers that coding skills can lead to

Equipment List

- Mentor laptop with Python capabilities
- Computers/laptops for mentees
    - *Ask your School Lead if this is possible, and make sure they can access Google Colab*

Scaffolding

If mentees finish early:

- You could explain that radioactive decay is *exponential*- ask them to investigate exponentials/logarithms on the internet
- Mentees could find the half-life of different substances and run the code to see what changes

If mentees are struggling:

- Walk them through changing the code on your screen *(if you can connect to the projector in the classroom this will help)*
- Challenge them to explain/research why programming is an important skill in today's world

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, review of ground rules • Brief overview of the session's objectives and activities
30 mins	**Python Coding Activity** *(see next page for details)* • Start by seeing what the mentees know/remember about radioactive decay and computer modelling • Mentees access Python code and investigate how half-life changes when they change variables
10 mins	**Half-life Activity** *(see next page for details)* • Discuss the half-lives of different materials and how this affects the disposal of radioactive waste
10 mins	**Reflection** • Allow time for mentees to complete their reflections • You can complete yours at the same time!

Science Capital Links

[✓ scientific literacy]	science-related attitudes	[✓ transferable science skills]	science media
out-of-school science	family science skills	knowing someone in science	[✓ talking about science]

Session Name: Modelling Radioactive Decay

SESSION NOTES (1)

PYTHON ACTIVITY

1. If they haven't already, the mentees need to create a Google account to access Colab
    - They should be able to to use their school email addresses
    - There are instructions on how to access Google Colab on the PPT for this session

EXPLAINING THE CODE

1. **Experiment Set-up:**
    - Choose the **number of atoms** in the experiment, and the **decay constant** (conventionally denoted with λ).
    - Mentees can pick from one of the example isotopes shown in the list, or make up their own. For decay constants $\lambda \ll 1$, this number is the probability that an atom will decay in one second.
2. **Data Recording Set-up:**
    - Decides **how long** the experiment will be, and what the **time interval** between "readings" will be. Both are in **seconds.**
    - Also sets out some blank arrays to be used later, such as an array for all the atoms (ones for atoms yet to decay, and zeros for decayed atoms) which updates at every timestep.
3. **Running the Experiment:**
    - This **simulates** the block of atoms over the time period set.
    - If your mentees have experience with coding previously, you could explain the nature of for loops (if you are comfortable with them yourself) and how they work. You don't need to explain the maths in the loop unless they ask specifically.
4. **Presenting the Raw Data:**
    - Using pyplot, this shows the **numbers of active radioactive atoms at each timestep.**
    - Plotting the data shows a curve matching a **half-life distribution.**
5. **Creating a Model:**
    - This section defines a number of functions to provide models of decay, which the students can choose between. **Allow the students to choose a model and a half life.**
    - They are all parameterised by the half life. For example, "ExponentialDecay" uses the equation for an exponential decay to model what we have seen from our experiment, while "LinearDecay" has a constant decay rate.
6. **Comparing the Model to the Raw Data:**
    - This takes the chosen model and plots a line over the raw data, to **see if they match.**
7. **Fitting the Best Model:**
    - Uses the **"curve_fit" function** to find the best-fit value for the half life. This can be used to find the decay constant and half-life.

TOP TIPS

- The code will take too long to run if mentees put in **high numbers of atoms or readings**
- The for loop (Section 3) will say **"In [*]"** to the left of the cell if the mentees choose **too many atoms or too many time steps**
- Several models may appear to give a good fit if mentees choose **too short a time**

Session Name: Modelling Radioactive Decay

SESSION NOTES (2)

PYTHON ACTIVITY

RUNNING THE CODE

1. Ask the mentees to investigate how the **half-life changes** as the total number of atoms is changed.
    - Keep the **decay constant fixed** for this part!
2. Discuss the mentees' decay curves. **Are they what we expect?** Can they **describe what is happening?** Be sure to mention the importance of accuracy when collecting data.
3. Try **another isotope,** perhaps with a **different decay constant,** and see how the half life changes.
4. You may wish to discuss the details of radioactive decay, but be aware that **they likely haven't studied logarithms yet.**

HALF-LIFE ACTIVITY

OPTION 1: RADON

Radon has a half-life of **3.8 days. Can the mentees recreate this using the code?**

Look at the **Radon Map for Wales:** (https://www.ukradon.org/cms/assets/gfx/content/resource_2686cs3a0844cee4.pdf)

Why do the houses built in high radon-affected areas need **ventilation?** Does having a **cellar** affect this?

Ventilation **reduces radon levels** and circulates fresh air throughout the homes.

Radon **originates from the soil,** so cellars are often the first point of entry.

OPTION 2: CARBON

Carbon-14 has a decay constant of **3.8394×10^{-12} s^{-1}**

Carbon-15 has a decay constant of **0.28 s^{-1}**

Can mentees find the half-life of both of these using the code?

C-14: 5,700 years, C-15: 2.45 seconds

One of these is used for **carbon dating.** Which one is more suited, based on the half-life values?

It's carbon-14 due to the long half-life!

FURTHER RESEARCH IDEAS

- Mentees can learn more about using Python here: https://www.codecademy.com/
- Mentees could look into concerns about radioactivity when mobile phones were first invented: https://institutions.newscientist.com/article/2174540-no-mobile-phones-still-wont-give-you-brain-cancer/

Session Name: Physics Recruitment Agency

Weekly Theme: MY PHYSICS JOURNEY | THINKING LIKE A PHYSICIST | [✓ WHERE PHYSICS CAN TAKE ME] | COLLABORATION, TEAMWORK, AND COMMUNICATION | THE WORLD AROUND ME

Aim

To illustrate the wide range of careers available to people with physics skills

Learning Objectives

By the end of this session, the mentee will be able to...

- Name 2-3 careers they hadn’t heard of before the session
- Explain how different physics skills can be used in a job
- Evaluate what physics skills they have
- Discuss the benefits of a Physics A-level in different careers

Equipment List

- Careers Connectors cards
  - 1 set per 2-3 mentees
- Paper and pens

Scaffolding

If mentees finish early:

- Ask them to think about their hobbies/ interests/part-time jobs. What skills do they use, and can they link them to science?
- Gender discussion: why do you think more girls are studying biology/ chemistry than physics?

If mentees are struggling:

- Ask them to list skills (any skills!) and encourage linking these to science
- Ask them to name a career someone they know is doing (e.g. family member, friend, etc.) and help them think of science skills they use in their job
  - *Be mindful of using “parents” or “family” in case mentees don’t have these*

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, review of ground rules • Brief overview of the session's objectives and activities • Explain what a recruitment agency is, and how the mentees will be taking on this role in the activity
25 mins	**Careers Connectors/Interview Speed Dating** • Choose one of these activities to complete • See details of activities on next page
15 mins	**Recruitment Agency Activity** • This builds on the activity above, and allows mentees to get creative! • See details of activity on next page
10 mins	**Reflection** • Allow time for mentees to complete their reflections • You can complete yours at the same time!

Science Capital Links

scientific literacy	[✓ science-related attitudes]	[✓ transferable science skills]	science media
out-of-school science	[✓ family science skills]	knowing someone in science	talking about science

Session Name: Physics Recruitment Agency

TOP TIP
These activities are designed to not be straightforward. There is no "correct" answer! The idea is to encourage mentees to realise people have lots of different skills and can be suited to many career paths.

SESSION NOTES

CAREERS CONNECTORS ACTIVITY

1. **Split the mentees into groups of 2-3.** Give each group 1 set of profiles and 1 set of job roles (don't give them any photos yet!).
2. 10 minutes: Give the groups 10 minutes to match profiles to job roles based on their skills and what they enjoy doing.
3. **10 minutes:** Groups will then present their decisions to everyone with discussion.
    - Make sure mentees back up their choices with reasoned arguments
    - Discuss the different strategies they used to analyse the information
4. **5 minutes:** Give each group 1 set of profile photos and ask them to match these to each profile.

INTERVIEW "SPEED DATING"

1. **Split the mentees into 2 groups (A and B).** Give each mentee in Group A a job role, and each mentee in Group B a person profile. Set the two groups up in a speed dating format (each mentee in Group A is sat opposite a mentee in Group B).
2. **20 minutes:** Group A mentees will conduct a mini "interview" with Group B mentees. They will have 2-3 minutes to ask questions and for Group B mentees to answer. Then Group B mentees will move one seat down to the next "interview". Continue until everyone has interviewed each other.
    - Give an example question and answer before they start (e.g. "How would you demonstrate your attention to detail?" answered with "Baking is a very precise skill, you have to pay attention to every measurement to produce a tasty cake.")
    - Have example interview questions on the board to help!
3. **10 minutes:** Group A mentees will discuss and decide which people to hire for which roles. Group B mentees will discuss which roles they would choose.
    - Make sure mentees back up their choices with reasoned arguments
    - It's nice to mention that interviews are also for the interviewee to decide if they like the company and want to work for them!
4. **5 minutes:** Groups will then present their decisions to everyone with discussion.
    - Make sure mentees back up their choices with reasoned arguments
    - Discuss the different strategies they used to analyse the information

RECRUITMENT AGENCY

Give each mentee a pen and paper and ask them to **write a person profile for someone they know.**

- They could choose themselves, a family member, a friend, or even a pet if they're feeling creative!
- Encourage mentees to link back to the skills and careers they've seen throughout the session, and whether their person profile would be a good fit/has any of those skills.

Session Name: Pendulums

Weekly Theme: MY PHYSICS JOURNEY | THINKING LIKE A PHYSICIST | WHERE PHYSICS CAN TAKE ME | [✓ COLLABORATION, TEAMWORK, AND COMMUNICATION] | THE WORLD AROUND ME

Aim

To use communication and teamwork skills in a practical way

Learning Objectives

By the end of this session, the mentee will be able to...

- Have worked as part of a team to construct a pendulum
- Explain what resonant frequencies and conservation of energy mean
- Discuss how the skills used in the session would be useful in different careers

Equipment List

- Pendulums worksheets
- Pendulum equipment resources box
  - 1 set per 6-8 mentees

Scaffolding

If mentees finish early:

- Which role did you enjoy the most/least? Why?
- Did your team work well together? What went well/could be improved?
- Can they re-arrange the equation to find g? Why might this be useful to scientists?

If mentees are struggling:

- Ask them to reflect on what it is they're not enjoying about the activity. Is it the role they have?
- Mentees won't have learnt about pendulum motion yet. Encourage them to think about other motion equations they've come across in physics lessons.

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, review of ground rules • Brief overview of the session's objectives and activities
25 mins	**Pendulum Activity** • Mentees receive the kit and the worksheet • Each mentee chooses a role and constructs the pendulum in a team - swap roles every 5 mins • Mentees swing the pendulum and complete the table on their worksheet
15 mins	**Discussion** • Discuss the science behind the pendulums ◦ Why do they all swing at different intervals?
10 mins	**Reflection** • Allow time for mentees to complete their reflections • You can complete yours at the same time!

Science Capital Links

scientific literacy	[✓ science-related attitudes]	[✓ transferable science skills]	science media
out-of-school science	family science skills	knowing someone in science	talking about science

Session Name: Pendulums

SESSION NOTES

PENDULUM ACTIVITY

Set a **5 minute timer,** and get the mentees to swap to the next listed role on their worksheet once the timer is up. Rinse and repeat until all mentees have tried all roles.

  - This encourages mentees to try every role and see what they like/don't like!

TOP TIP

The intention of this activity is for the mentees to construct the pendulums, but it's worth practising construction beforehand with your co-mentor!

THE SCIENCE

- Each pendulum swings back and forth at a different rate, depending on the length of the string. So, the pendulums descend into swinging randomly.
  - At certain time intervals, the pendulums will line up and swing in a pattern: at **15s,** pendulums swing in **opposite directions** to each other, at **30s** they **line up** again, and then the pattern repeats
- The equation for the period of a pendulum is:

$$T = 2\pi\sqrt{\frac{L}{g}}$$

$T =$ time period (s)
$L =$ length of string (m)
$g =$ 9.8 m/s

This is the table mentees will be filling out on their worksheet:

Length (cm)	No. of Swings in 30s	T (s)
38.8	24	1.25
35.8	25	1.20
33.1	26	1.15
30.7	27	1.11
28.5	28	1.07
26.6	29	1.04
24.8	30	1.00
23.3	31	0.97
20.5	32	0.91

These are the "correct" values for the worksheet tables. Remember that mentees won't have these exact numbers in the middle column due to human error!

DISCUSSION

- Mentees know **L and g,** so get them to **work out T** for each pendulum and add it to their worksheet table.
- Do they notice anything about this value compared to their record for number of swings in 30 seconds?
  - The number of swings per **second** (frequency, F) is: $F = \frac{1}{T}$

PENDULUMS: WORKSHEET

CHOOSE YOUR ROLE!

1 person

A: SUPERVISOR
You watch what everyone is doing and make sure the construction looks like the picture.

B: DEMONSTRATOR
You demonstrate the correct length for each pendulum.

1 or 2 people

D: ENGINEER
You tighten/loosen the screws to make the pendulums the right length.

C: BUILDER
You will put the pieces of the pendulum together, then swing the pendulum.

1 or 2 people

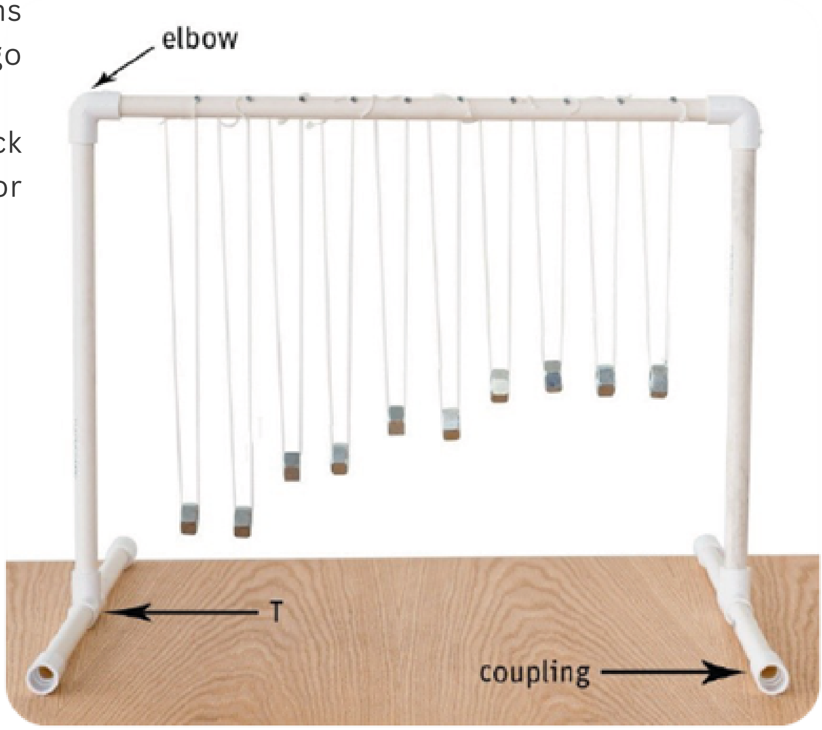
You will swap roles throughout the activity!

PENDULUM ACTIVITY

1. Assemble the pipe sections to look like the frame in the picture below.
2. Adjust the length of the pendulums so they are as follows *(measuring from the bottom of the pipe to the middle of the bob):*

38.8 cm	35.8 cm	33.1 cm	30.7 cm	28.5 cm	26.6 cm	24.8 cm	23.3 cm	21.8 cm	20.5 cm

3. Using the board, pull all the pendulums towards you and let them go simultaneously. What happens?
4. Now count the number of swings (back and forth = 1 swing) in 30 seconds for each pendulum. Record it below:



Length (cm)	No. of Swings in 30s	T (s)
38.8		
35.8		
33.1		
30.7		
28.5		
26.6		
24.8		
23.3		
20.5		

TOP TIP

1 person holds the stopwatch. Everyone else chooses a pendulum to watch for 30 seconds!

Session Name: Space Telescope Mission

Weekly Theme: MY PHYSICS JOURNEY | THINKING LIKE A PHYSICIST | WHERE PHYSICS CAN TAKE ME | [✓ COLLABORATION, TEAMWORK, AND COMMUNICATION] | THE WORLD AROUND ME

Aim

To use communication and teamwork skills in a practical way

Learning Objectives

By the end of this session, the mentee will be able to...

- Have worked as part of a team
- Discuss the importance of different roles within a team
- Link the skills they are using to different careers they would be useful in

Equipment List

- Telescope worksheets
  - 1 set per 3-4 mentees
- PowerPoint presentation

Session Flow

Time	Activity
10 mins	**Introduction and Aims** • Welcome, review of ground rules • Brief overview of the session's objectives and activities • Mentees get into groups of 3/4 and choose their roles
25 mins	**Space Telescope Activity** • Choose one mission for everyone to complete • Mentees then work through that mission in their teams and complete the proposal letter
15 mins	**Discussion** • Each group reads out their proposals • Facilitate a discussion about pros and cons of each proposal
10 mins	**Reflection** • Allow time for mentees to complete their reflections • You can complete yours at the same time!

Scaffolding

If mentees finish early:

- Did your team work well together? What went well/could be improved?
  - Ensure mentees are respectful and constructive when giving feedback to each other
- Mentees could have a brief look at another of the missions and start to plan it.

If mentees are struggling:

- There is a lot of information to read and absorb, so some mentees may need extra time for this.
- Ensure mentees are deciding role allocation in a fair way (i.e. everyone has an input).
- Encourage them to think about the skills each role has in the team, and how they are all valuable.

Science Capital Links

scientific literacy	[✓ science-related attitudes]	[✓ transferable science skills]	[✓ science media]
out-of-school science	family science skills	knowing someone in science	talking about science

Session Name: Space Telescope Mission

SESSION NOTES

TOP TIPS

- Once mentees have chosen their roles based on the PPT information, give them their information pages. Encourage them **not to share their own page with the others in their group.**
  - This challenges them to collaborate and communicate effectively!
- If there is a team of 3, the Project Manager role can be shared across the group.
- All required information is in the booklet.
- You could make it a **competition;** mentees could vote on the best team at the end!
- The case studies are loosely based on current or past **real space missions.**
- Some **possible solutions** for the different missions are below:

No.	Budget	Structure	Mirror	Instrument	Cooling System	Orbit	Launch Vehicle	Cost	Mass (kg)
1	£2,000,000,000	2.4m	2m	Both	0.3K	L2	Soyuz	£1,385,000,000	1650
2	£800,000,000	1.4m	1m	Camera	3K	LEO	Vega	£588,000,000	960
3	£9,000,000,000	4.4m deployable	8m deployable	Spectrometer	0.3K	L2	Ariane 5	£6,850,000,000	2450
4	£4,000,000,000	2.4m deployable	4m deployable	Camera	18K	Geo-stationary	Falcon 9	£2,740,000,000	1150
5	£1,200,000,000	1.4m deployable	2m deployable	Camera	0.3K	LEO	Vega	£1,073,000,000	1510
6	£10,000,000,000	4.4m deployable	8m deployable	Camera	300K	Geo-stationary	Delta IV	£7,050,500,000	1270
7	£700,000,000	1.4m	1m	Camera	18K	LEO	Vega	£538,000,000	660
8	£2,500,000,000	4.4m	4m	Both	3K	L2	Ariane 5	£1,965,000,000	1275

EXTRA NOTES IF NEEDED

- X Y Z

SPACE TELESCOPE MISSION: INTRODUCTION WORKSHEET

INTRODUCTION

Designing a space telescope is an incredibly complex job, with many requirements that must be met. Some of these are because of the **scientific discoveries** that the astronomers would like to make, while others are due to **limits** that the engineers put on the spacecraft. Beginning in the 1990s, astronomers and engineers around the world were busy designing the Herschel Space Observatory. This project will help you explore the kinds of decisions they had to make.

Your task is to **design a space observatory** for the UK Space Agency. In your team, you will have to make several decisions about what your space telescope will look like.

As a team, you need to:

1. Decide on a **team name**
2. **Assign team roles** to each group member based on their skills and the below information
   - Hand out the **Team Role sheets** to the relevant team members
3. **Work together** to make decisions using the information on those sheets
4. Fill out your **draft proposal letter**

CHOOSE YOUR ROLE!

A: PROJECT MANAGER

You ensure that the mission does not go over **budget** (in terms of both mass and cost), and to ensure that the **risk of overspending** in terms of budget is as low as possible.

B: ROCKET SCIENTIST

You ensure that the **mass and size** of the structure does not surpass the **limits** of the launcher. You must also select the appropriate **launch site,** and the **orbit** from which the satellite will observe.

C: INSTRUMENT SCIENTIST

You make sure the **instruments** on-board are appropriate for meeting the science goals, and to ensure that the instruments will be able to **meet the scientific requirements.**

D: MISSION SCIENTIST

You will ensure that the satellite's **mirror and cooling system** are suitable for the mission to succeed.

SPACE TELESCOPE MISSION: INTRODUCTION WORKSHEET

AVAILABLE MISSIONS

Everyone will vote to choose one mission that all teams will work on:

MISSION 1: THE BIRTH OF STARS

A private organization has funded your group to **research into the birth and evolution of stars** in the distant and nearby Universe. The budget of your mission is **£2 billion.** You will need the **appropriate instruments** on board your satellite in order to observe such objects.

MISSION 2: MULTIWAVELENGTH UNIVERSE

A government research grant has come through to **take images of the sky** in ultraviolet, optical and near-IR wavelengths from a satellite in space, in order to map stars, galaxies and other yet to be discovered phenomena. The budget of your mission is **£800 million.**

MISSION 3: INTERSTELLAR DUST

A university has approached your group to design a mission for a satellite telescope in order to **analyse the spectra of interstellar dust** in nearby galaxies. The budget of your mission is **£9 billion.** You will need the **appropriate instruments** on board the telescope.

MISSION 4: THE BIRTH OF STARS

A private rocket company, SpaceX, has approached your group to launch a telescope into space in order to **study the formation of planets,** but you **must** use their rocket. The budget for your mission is **£4 billion.**

MISSION 5: INFRARED SKIES

A funding agency is providing funding to perform an **all-sky survey** from near infrared to far infrared. The budget of your mission is **£1.2 billion.**

MISSION 6: HIGH-RES GALAXIES

Your group has received funding to send a telescope on board a satellite into space with the main objective of **analysing stars in a nearby galaxy at very high resolution.** The budget of your mission is **£10 billion.** Your group will need to use the **appropriate instruments** in order to collect data if it is to be analysed.

MISSION 7: ASTEROID IMAGES

The government has asked you to design a satellite to take **images of near-Earth asteroids.** The mission should last for **as long as possible.** The European Space Agency will provide the launch and operations cost and a budget of **£700 million,** but only providing **their launch site is used.**

MISSION 8: FINDING LIFE ON OTHER PLANETS

The European Space Agency has offered to fund your group in their study into **exoplanets** to help search for **biomarkers** outside of the solar system, as long as **you use their rocket.** The budget of your mission is **£2.5 billion.** You will need to **decide your focus:** exoplanet detection, or examining spectroscopy data.

SPACE TELESCOPE MISSION: PROPOSAL LETTER

Dear ______________________________

We would like to propose a project to send a telescope into space onboard a satellite. The aim of the mission is to ____

____

INSTRUMENTS

The instruments on board will detect ____

____

They will allow the mission goals to be met by ________________________________

____

MIRROR

The main mirror of the telescope will be ____

____

COOLING SYSTEM

The minimum operating temperature required by the instruments is __________K.

The temperature onboard the satellite will be __________K.

MASS

The total mass of the satellite will be __________kg.

The breakdown of individual components is given here:

Mass (kg)	
Satellite Structure:	
Mirror:	
Cooling System:	
Instruments:	
Total Mass:	

SPACE TELESCOPE MISSION: PROPOSAL LETTER

ORBIT

The satellite will observe from a ______________________________

orbit, at a distance of __________ km from Earth. The mission duration will be

__________ years.

LAUNCH VEHICLE AND SITE

To reach orbit, the satellite will be launched on a ____________________

operated by ____________________, from ____________________ .

The maximum capacity of this launch vehicle is ____________________ tonnes.

BUDGET

The total cost of the mission will be £ ______________________________ .

The breakdown of individual components is given here:

Cost (£)	
Satellite Structure:	
Mirror:	
Cooling System:	
Instruments:	
Development Cost:	
Launch Cost:	
Ground Control Cost:	
Total Cost:	

Kind regards, ______________________________

SPACE TELESCOPE MISSION: PROJECT MANAGER ROLE

INTRODUCTION

Your colleagues are in the process of selecting various aspects of the mission design. Each of these will influence the **cost, size, and mass of the whole project.** Your task is to **keep track of the cost and mass** of all the components, and ensure that they **meet the requirements.**

the main satellite structure links all parts and carries the power, propulsion and communication systems. The **cost, size and mass** of this structure will primarily depend on the **mirror selected** by the mission scientist, as shown in the table below. A **deployable** mirror also requires a **much more complex** satellite structure, which will be **twice as expensive and twice as massive.** However, it will also be **half the diameter.**

Mirror Diameter (m)	Structure Diameter (m)	Structure Cost (£)	Structure Mass (kg)
0.5	0.8	100 million	50
1	1.4	200 million	100
2	2.4	500 million	200
4	4.4	1 billion	300
8	10	2 billion	400

MISSION BUDGET AND MASS

You can use the table below to keep track of the overall mission budget and mass:

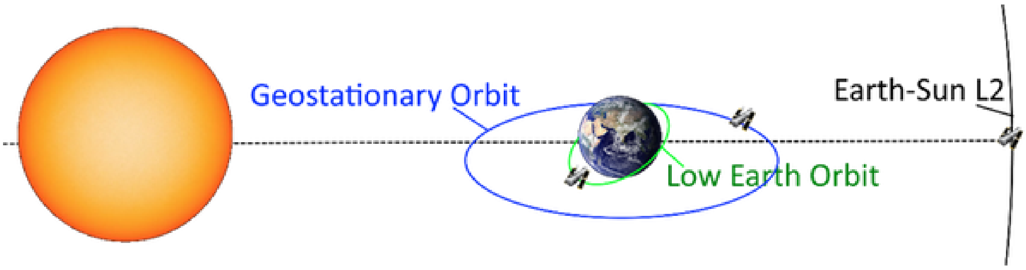
Mass (kg)		Cost (£)	
Satellite Structure:		Satellite Structure:	
Mirror:		Mirror:	
Cooling System:		Cooling System:	
Instruments:		Instruments:	
Total Mass:		**Total Cost:**	

SPACE TELESCOPE MISSION: ROCKET SCIENTIST ROLE

CHOOSING THE ORBIT

The orbit selected will consider many different factors. From an observing point of view, an appropriate **Observing Fraction** is needed. In terms of cost, a **higher altitude** will mean a **more expensive Ground Control cost.**

Orbit Selection	Orbit Altitude (km)	Fuel Lifetime (years)	Observing Fraction (%)	Ambient Temperature (K)	Ground Control Cost (£/year)
Low Earth Orbit	<1,000	10	50	400	20 million
Geostationary Orbit	36,000	20	50	300	40 million
Earth-Sun L2	1,500,000	10	100	300	50 million



CHOOSING THE LAUNCHER AND SITE

Different launchers have different **sizes** and **limits** in terms of the mass they can carry. The mass carried **depends** on the orbit chosen (Low Earth Orbit (LEO) or beyond). It is advisable for the **satellite mass to be below 80% of maximum mass** for the chosen launch vehicle. Each vehicle can also only be launched from certain **sites.**

Launch Vehicle	Diameter (m)	Maximum Mass to LEO (tonnes)	Maximum Mass Beyond LEO (tonnes)	Launch Cost (£)	Operator	Available Launch Sites
Ariane 5	5.5	20	9	100 million	ESA (Europe)	Guiana Space Centre, French Guiana
Soyuz	3	8	4	60 million	Roscosmos (Russia)	Guiana Space Centre, French Guiana Balkonur, Russia
Delta IV	5	23	13	200 million	NASA (USA)	Kennedy Space Centre, Florida
H-2B	5	15	8	80 million	JAXA (Japan)	Tanegashima, Japan
Vega	3	2.3	--	23 million	ESA (Europe)	Guiana Space Centre, French Guiana
Pegasus	1.2	0.4	--	15 million	Orbital (USA)	Carrier Aircraft, Ocean
Falcon 9	3.5	10	7	40 million	SpaceX (USA)	Kennedy Space Centre, Florida

SPACE TELESCOPE MISSION: INSTRUMENT SCIENTIST ROLE

CHOOSING THE INSTRUMENTS

The **instruments** on board the satellite will dictate the type of science that can be carried out by the telescope. Your job is to choose the right type of instrument to complete your mission. Different instruments observe different **wavelengths,** which detect different **objects** in the Universe. Your instrument can see **different** things nearby and far away, because of **redshift.** Each instrument also needs to be at a different **temperature** in order to work properly (usually, the instrument needs to be colder than the object it's observing).

Type	Wavelength (μm)	What is Observed		Temperature Requirement (K)
		Nearby Universe	Distant Universe	
Sub-mm	300 - 1,000	Birth of stars Very cold dust	Birth of stars Very cold dust	0.4
Far Infrared	30 - 300	Birth of stars Cool dust Outer regions of the Solar System (e.g. outer planets, Kuiper Belt, comets)	Birth of stars Warm dust around young stars	0.4
Mid Infrared	3- 30	Warm dust around young stars Formation of planets Inner Solar System (e.g. inner planets, asteroids)	The first stars (100 million years after Big Bang)	40
Near Infrared	0.8 - 3	Cool stars (e.g. red dwarfs, red giants) Near-Earth objects Methane spectral signature for exoplanets	The first galaxies (400 million years after Big Bang)	4
Optical	0.4 - 0.8	Most stars Nearby galaxies Exoplanet detection	Hot, young stars	300
UV	0.1 - 0.4	Hot, young stars	Very hot regions (e.g. star birthplaces, supernovae)	400

For each instrument, you can choose whether to have a **camera, spectrometer, or both.** You will have to decide whether it is worth the extra cost and mass to have both, or whether you need to choose one.

Option	Mass (kg)	Cost (£)	Benefits
Camera	50	50 million	Produces an image of the observed object
Spectrometer	50	50 million	Produces a spectral analysis, which gives the chemical composition of that object
Both	75	75 million	All of the above

SPACE TELESCOPE MISSION: MISSION SCIENTIST ROLE

CHOOSING THE MIRROR

The **specifications** of the mirror will affect the quality of the pictures taken by the telescope. You will need to balance the **budget, mass, and size** of the mirror to complete your mission.

DIAMETER

A **larger** diameter means **more light** collected and a **higher resolution** image, but a **smaller** mirror will collect light at a **faster rate.**

DEPLOYABILITY

A **deployable** mirror can fold in half. This **halves the diameter,** and allows for a smaller support structure and rocket to be used. However, it has **double the mass** and **4 times the cost** of a regular mirror.

UV QUALITY

If you want to use your mirror to observe UV light, it needs to be **far more highly polished** than a regular mirror. This means it's **twice as expensive.**

Mirror Diameter (m)	Mass (kg)	Cost (£)
0.5	3	12 million
1	10	25 million
2	30	50 million
4	100	200 million
8	300	1 billion

TOP TIP

The table above contains values for **regular mirrors.** If you want to add deployability or UV quality you need to change the mass and/or cost!

CHOOSING THE COOLING SYSTEM

You may need a **cooling system** for your satellite, depending on **which wavelength** is being observed. Some **instruments** require a certain temperature to operate.

Temperature (K)	Cost (£)	Mass (kg)
400	0	0
300	500,000	20
200	1 million	40
100	2.5 million	70
50	12 million	150
18	40 million	500
3	90 million	800
0.3	200 million	1,200

Session Name: Egg Drop

Weekly Theme: MY PHYSICS JOURNEY | THINKING LIKE A PHYSICIST | WHERE PHYSICS CAN TAKE ME | [✓ COLLABORATION, TEAMWORK, AND COMMUNICATION] | THE WORLD AROUND ME

Aim

To design and build a device that will safely land an egg from a height.

Learning Objectives

By the end of this session, the mentee will be able to...

- Use teamwork and collaboration skills to construct a device
- Budget resources effectively to meet an aim
- Test a device in a fair way
- Discuss the effectiveness of the designed device

Equipment List

- Egg Drop worksheets
  - 1 per team
- Eggs
- Can ask the school to supply some of these:
  - Scissors
  - Scrap paper/newspaper
  - Carrier bags
  - Cotton wool
  - Straws
  - Plastic cups
  - Toilet roll tubes
  - Tape
  - Glue
  - Toothpicks/lollipop sticks
  - String

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, review of ground rules • Brief overview of the session's objectives and activities
10 mins	**Egg Drop Design** • Mentees get into teams of up to 4 ◦ Each team gets a worksheet • Teams plan their budget and sketch a device design
20 mins	**Egg Drop Construction and Testing** • Teams construct and test their devices
15 mins	**Discussion** • Discuss each team's device - what went well/not so well? Why do they think that is?
10 mins	**Reflection** • Allow time for mentees to complete their reflections • You can complete yours at the same time!

Scaffolding

If mentees finish early:

- Why are eggs egg-shaped? What part of an egg is strongest? Why do we crack eggs in the middle and not the top?

If mentees are struggling:

- Ensure no mentees have an egg allergy or are vegan beforehand
- If mentees are being excluded in a group, encourage them to choose team roles so everyone takes part

Science Capital Links

[✓ scientific literacy]	science-related attitudes	[✓ transferable science skills]	science media
out-of-school science	family science skills	knowing someone in science	[✓ talking about science]

Session Name: Egg Drop

SESSION NOTES

TOP TIPS

- You can **alter the table on the PPT** to adjust for the materials you have. Ensure this is correct when showing it to the mentees!
- Ensure you include **separate planning and construction times** when running this activity.
  - This challenges them to think about what they're going to do and not just dive in with the materials.
  - Once they have completed their budget sheet, they can collect their chosen materials.
- Once all devices are ready, they will need to be **safely dropped from a height.** This could be done out of a window, or in a stairwell.
  - Speak to your School Lead about the best location to do this.
  - Make sure you place a **bin bag/newspaper** where the eggs are dropped to avoid mess!
- You could make it a **competition;** mentees could vote on the best design at the end. You could have prizes for best design, cheapest design, etc.
- Encourage mentees to think about **how they worked as a team** and what **skills** they used:
  - Did they work well? Why/why not?
  - Which parts did they enjoy/not enjoy?
  - Were there any disagreements within the team? How were they solved?
  - Did the final device look like the design sketch? Why/why not?

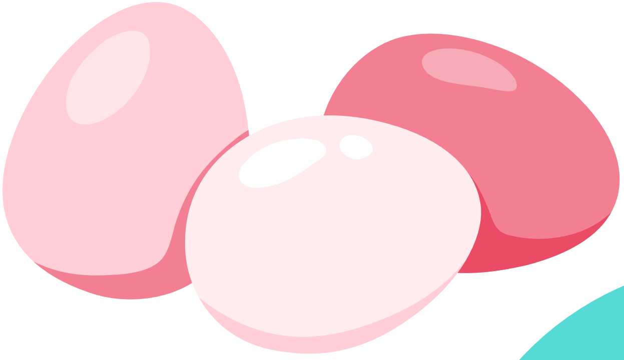
THE SCIENCE

There have actually been lots of studies as to **why eggs are egg-shaped.** Aristotle thought eggs were **pointier if they had female chicks inside!**

In June 2017, M. C. Stoddard and colleagues published a study on the topic of egg shape in birds based on an analysis of **49,000 eggs from 1,400 bird species.** They found that birds who are **better fliers** have **pointier eggs.**

Eggs are shaped due to a combination of factors:

- The **size** of the mother bird's **oviduct.**
- It allows eggs to **fit snugly inside the nest** and keep each other warm.
- It ensures the shell is **strong under compression forces.**
  - This does mean it is **weaker under tension forces** as a result!



EGG DROP: WORKSHEET

INTRODUCTION

Your mission is to design a device that will safely drop an egg from a height **without** breaking the egg!

BUDGET

You have a budget of £10. As a team, work out what materials you will spend your budget on and draw a design for your device:

Resource	Price Per Unit (£)	Quantity	Total Cost

TOTAL COST:

INITIAL DESIGN SKETCH:

Session Name: Presenting Physics

Weekly Theme: MY PHYSICS JOURNEY | THINKING LIKE A PHYSICIST | WHERE PHYSICS CAN TAKE ME | COLLABORATION, TEAMWORK AND COMMUNICATION | [✓ THE WORLD AROUND ME]

Aim

To recognise the physics in mentees' day-to-day lives

Learning Objectives

By the end of this session, the mentee will be able to...

- Deliver a presentation on an everyday phenomenon
- Demonstrate various presentation skills
- Receive and give feedback on presentations

Prepare in Advance

- Introduce this activity in the previous session (15 mins):
  - Give a brief example presentation on something in daily life and the physics behind it
  - Tell the mentees to prepare a 2-3 min presentation on a phenomenon of their choice for this session

Scaffolding

If mentees finish early, you could discuss:

- Do's and don'ts of presentation skills (e.g. eye contact, speaking clearly, use of the space you're in, etc.)
- What careers are these skills useful in?

Presentations can be a huge source of anxiety. If mentees are nervous when you tell them to prepare a presentation, you could allow them to prepare and present in pairs (they must present 50% each).

Session Flow

Time	Activity
5 mins	**Introduction and Aims** • Welcome, review of ground rules • Brief overview of the session's objectives and activities • Remind mentees they'll be presenting
45 mins	**Mentee Presentations + Feedback** • Ask the other mentees to make notes on what they are doing well during each presentation • Mentees will then do their presentations • After each presentation, have a short discussion to provide feedback to the mentee ◦ e.g. good eye contact, speaking clearly, engaging content, good body language, etc. ◦ Remind mentees to be kind when giving feedback
10 mins	**Reflection** • Allow time for mentees to complete their reflections • You can do yours alongside them!

Science Capital Links

scientific literacy	science-related attitudes	[✓ transferable science skills]	[✓ science media]
out-of-school science	family science skills	knowing someone in science	[✓ talking about science]

Session Name: Presenting Reflection

Weekly Theme: MY PHYSICS JOURNEY | THINKING LIKE A PHYSICIST | WHERE PHYSICS CAN TAKE ME | COLLABORATION, TEAMWORK, AND COMMUNICATION | THE WORLD AROUND ME

Aim

To reflect on physics mentoring sessions and what they have gained from them

Learning Objectives

By the end of this session, the mentee will be able to...

- Deliver a presentation reflecting on their mentoring sessions and what they've gained from them
- Demonstrate various presentation skills
- Receive and give feedback on presentations

Prepare in Advance

- Introduce this activity in the previous session (15 mins):
  - Give a brief example presentation on your mentoring journey
  - Tell the mentees to prepare a 2-3 min presentation on their own mentoring journeys

Scaffolding

If mentees finish early, you could discuss:

- Do's and don'ts of presentation skills (e.g. eye contact, speaking clearly, use of the space you're in, etc.)
- What careers are these skills useful in?

Presentations can be a huge source of anxiety. If mentees are nervous when you tell them to prepare a presentation, you could allow them to prepare and present in pairs (they must present 50% each).

Session Flow

Time | **Activity**

5 mins

Introduction and Aims

- Welcome, review of ground rules
- Brief overview of the session's objectives and activities
- Remind mentees they'll be presenting

45 mins

Mentee Presentations + Feedback

- Ask the other mentees to make notes on what they are doing well and anything they agree with during each presentation
- Mentees will then do their presentations
- After each presentation, have a short discussion to provide feedback to the mentee
  - e.g. good eye contact, speaking clearly, engaging content, good body language, etc.
  - Remind mentees to be kind when giving feedback

10 mins

Reflection

- Allow time for mentees to complete their reflections
- You can do yours alongside them!

Science Capital Links

scientific literacy	science-related attitudes	[✓ transferable science skills]	[✓ science media]
out-of-school science	family science skills	knowing someone in science	[✓ talking about science]