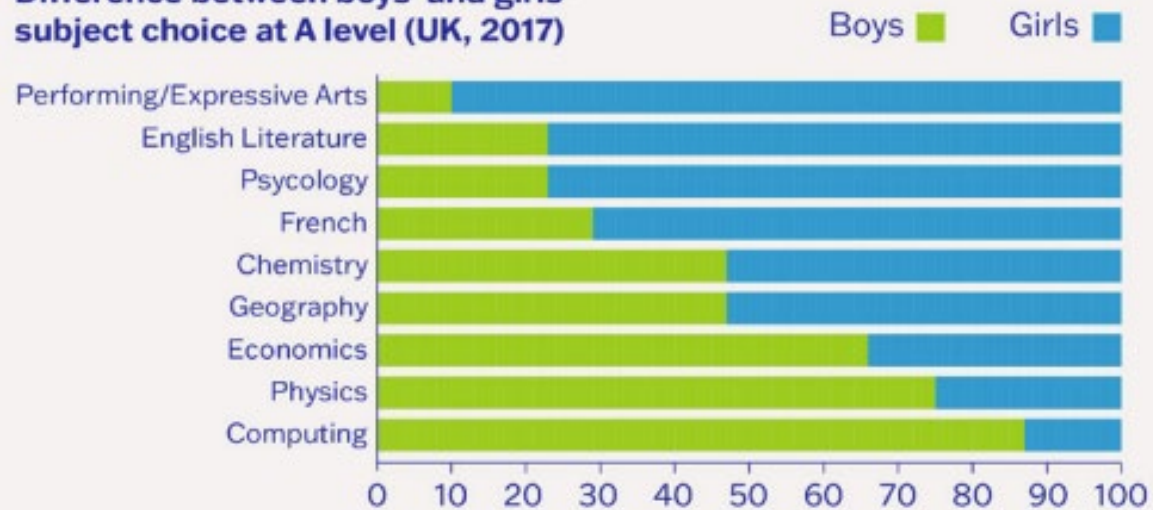


Limit Less: Support young people to change the world





Difference between boys' and girls' subject choice at A level (UK, 2017)



What can we learn from these lived experiences?

“It was at primary school, when I was about seven, that I was first told I wasn’t good at maths. My dyspraxia (a motor coordination disorder) meant I had bad handwriting and my dyslexia meant I sometimes reversed my numbers when copying problems off the board, so my answers would be wrong. On top of that, I was an August child, so my co-ordination was always going to be delayed. I was put in the bottom group for maths and my parents were told I was not keeping up with my classmates and that I was not an academic child. That really bothered me, because I loved maths. Being written off and underestimated made me determined to prove my teachers wrong.”

18-year-old female student with neurodiversity

“I loved physics even before I knew what it was, especially magnets, light and space. When I was 8 years-old I asked for a telescope for Christmas. I was quickly dismissed and told it was a boys’ toy and to look at the Barbies instead. Later on, as my passion grew, people tried to direct me towards biology or chemistry instead as they were more suitable for a girl even if she was into science, and my parents got me a microscope for Christmas. While this was progress, I still had very little interest in anything but physics.”

Working-class female in her mid-20s

Carole Kenrick (she/her)

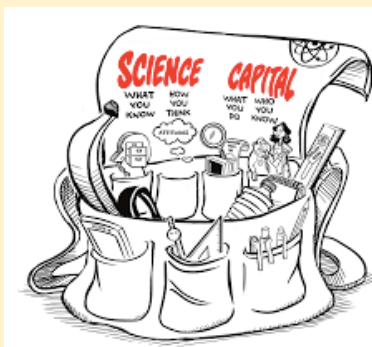


Carole.Kenrick@iop.org
@HelpfulScience

One thing to try
before half term

- When you think about scientists, what comes into your mind?





Limit Less

Top Tips for Inclusive Science Teaching

IOP Institute of Physics

IOP Institute of Physics

3 themes:



Create an
inclusive
classroom
culture



Make the
learning
relevant

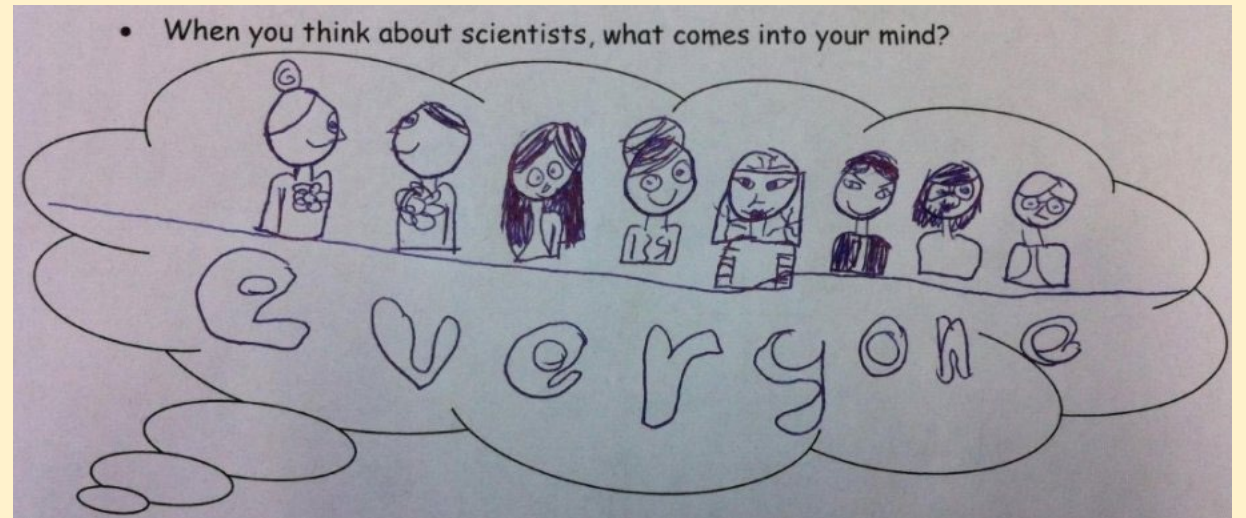


Build
numeracy and
literacy for
science



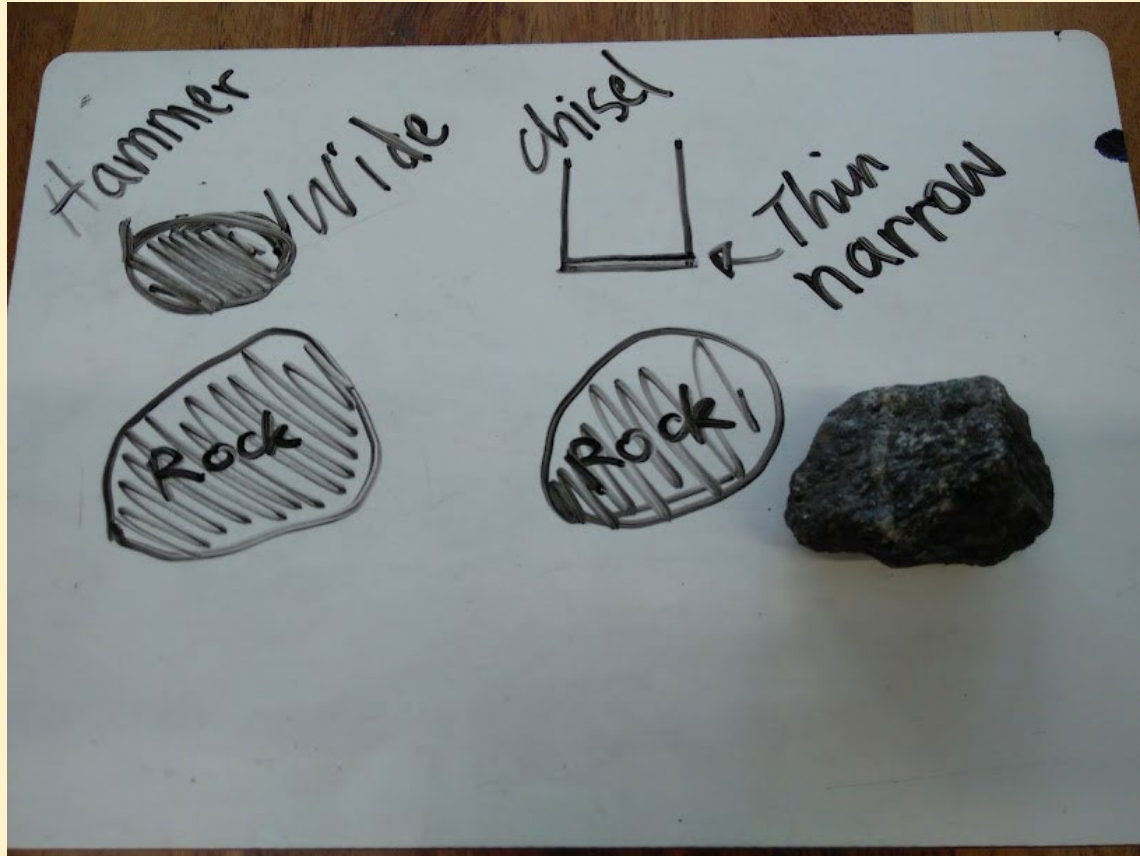
Create an inclusive classroom culture

1. Enable all children to participate
2. Examine and challenge stereotypes, biases and assumptions
3. Model inclusive language and expect it from children



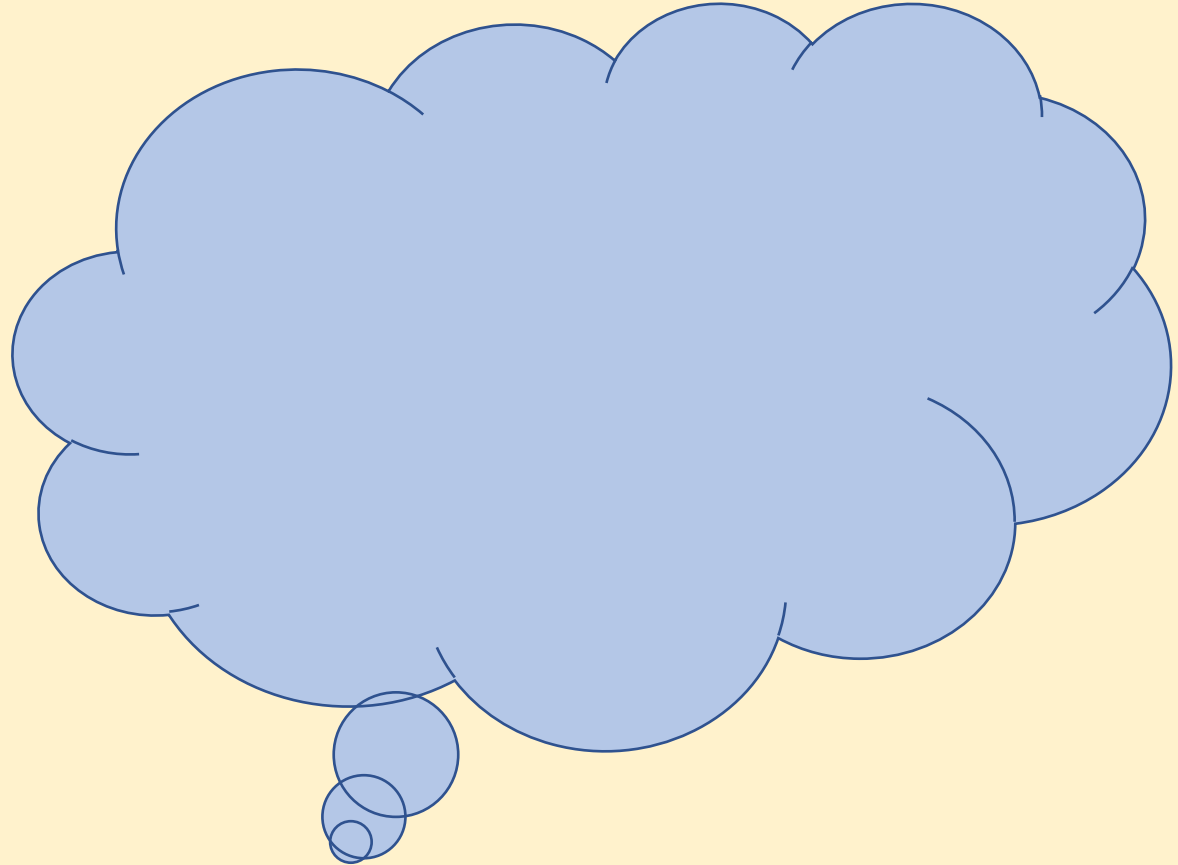


1. Enable all children to participate

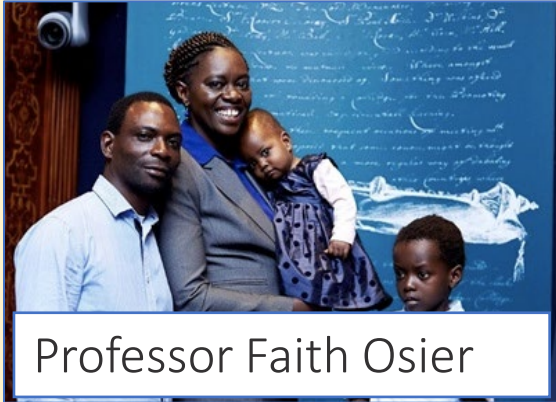


Shut your eyes and imagine a physicist...

- What do they look like?
- What are they doing?



2. Examine and challenge stereotypes, biases and assumptions



Professor Faith Osier



Electrician



Nurse





Phizzi professionals

Shivani Dave (they/them): broadcaster & journalist

School

All the way up to A-levels I had a hugely inspirational physics teacher. Without a doubt, he was the person who encouraged me and gave me the confidence to study physics at a higher level. I studied maths, physics and chemistry at A-level and went on to study physics at university.

What next?

During my degree in physics, I found a passion for radio by joining the student club. On graduation I felt I wanted to pursue this as a career, combining my two passions of radio and physics, and went on to study a masters in Science Media Production at Imperial College, London.

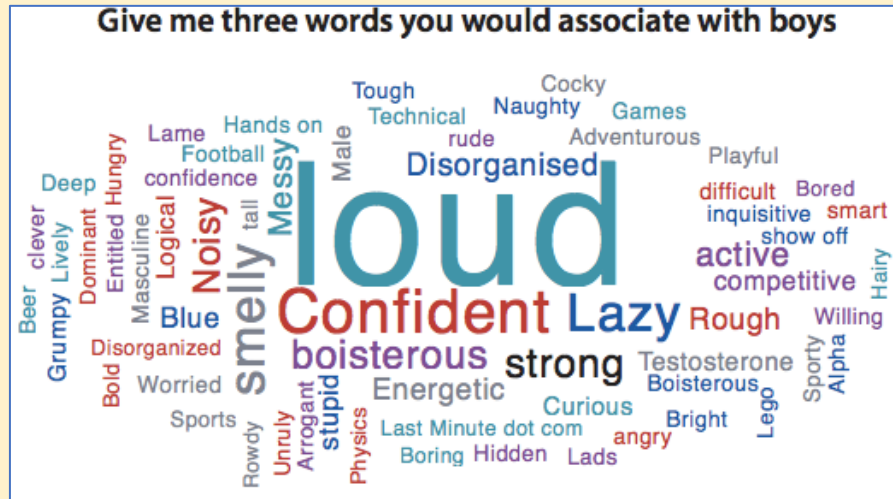
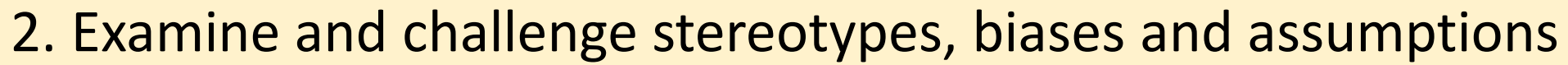
Why physics?

I followed my passion rather than defining my choices by a specific career path. In doing this I found that physics (and STEM more generally) opens up a whole world of professional opportunities. Skills learnt while studying STEM are invaluable and transferable to a number of further career paths.

And now?

Currently, I present radio shows and TikToks for different news/broadcast organisations – again driven by my passions. Physics isn't a natural route into this career but having this background in physics only helps me to be better.







2. Examine and challenge stereotypes, biases and assumptions

Classroom interactions self-evaluation template

Research by the Institute of Physics suggests that boys tend to dominate in the classroom, answering more questions and getting more of the teacher's attention, usually without the teacher being aware of any imbalance. This template will help you to assess your own practice.

If you are comfortable doing so, you may find it useful to invite a colleague or student to complete the template for you during a lesson.

Date: _____

Class: _____

| | Boys | Girls |
|-----------------------|------|-------|
| Number in class | | |
| Hands up | | |
| Questions directed at | | |
| Answers called out by | | |

Notes



Committed
Passionate about being
committee
Proactive
Cooperative
Respectful

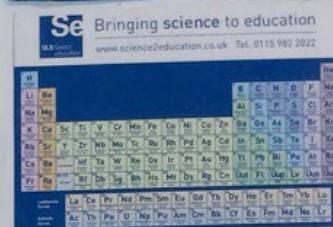
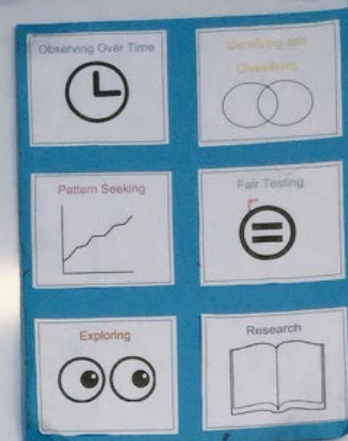
Criteria

Essential

- Committed
- Respectful
- Want to be in committee

Desirable

- Proactive
- Co-operative
- Creative
- Imaginative
- Experience
- Like science







3. Model inclusive language and expect it from children

Boys / girls shouldn't
do / wear that

Boys don't cry

She's so bossy!

You threw that
like a girl!

Man up!

Boys/girls can't...

I need two strong
boys to help



Make the learning relevant

4. Value children's existing knowledge and experience of science
5. Teach about a range of jobs and careers that use science and science skills
6. Give children opportunities to make links between their learning and their lives, interests and local area





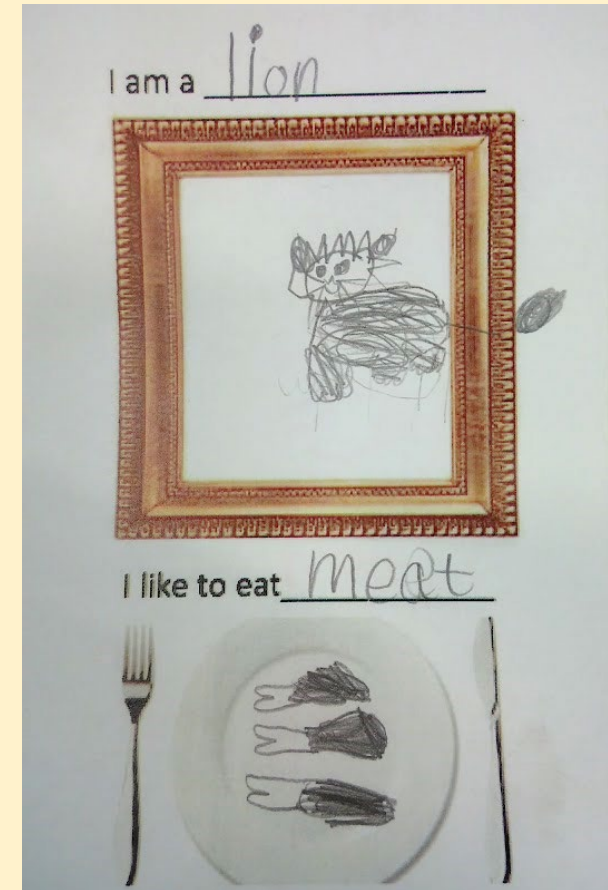
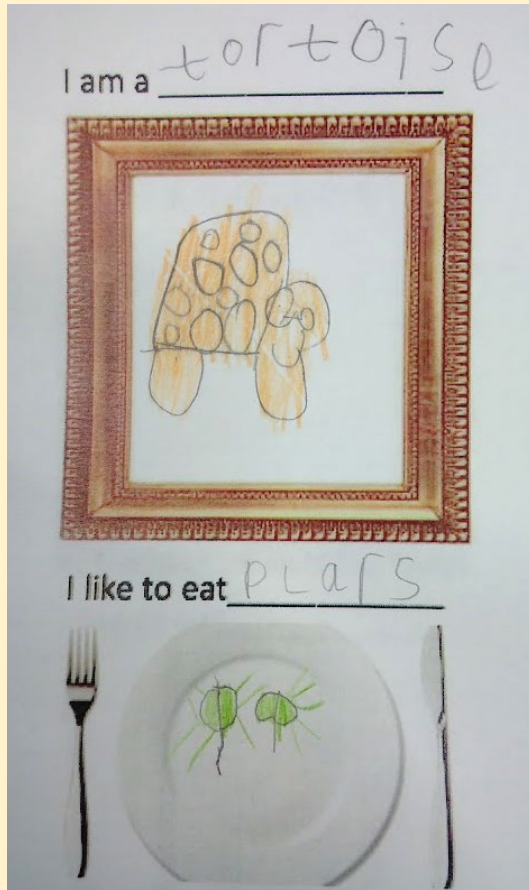
4. Value children's existing knowledge and experience of science



WHAT IS IT LIKE IN SPACE?

How would your day be **similar**?
How would your day be **different**?





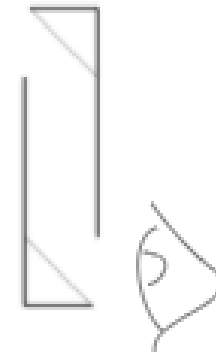
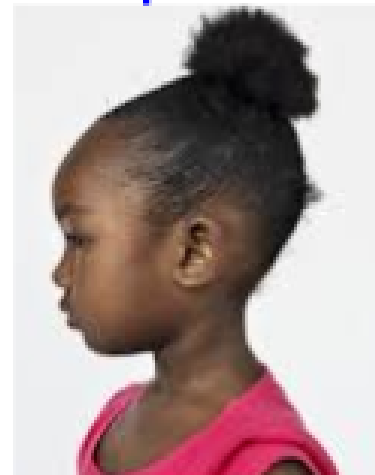
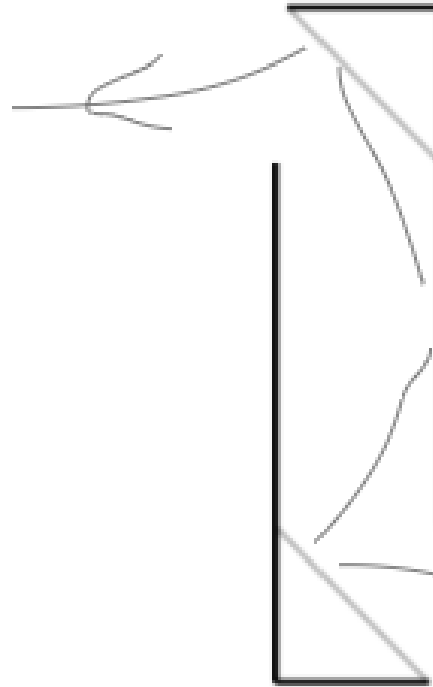
Shadow investigation results

Do now:

Carl has drawn a light ray diagram to show how we see through a periscope.

He thinks he has made some mistakes!

Can you spot the mistakes and draw a correct diagram to show him how it's done?



(side
view of
eye)

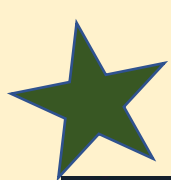
14/10/2020

Shadow investigation results

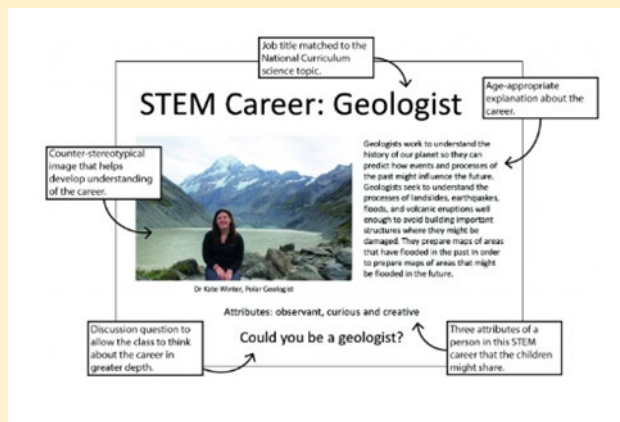
I think that Carl has made the following mistakes:

- ...
- ...
- ...

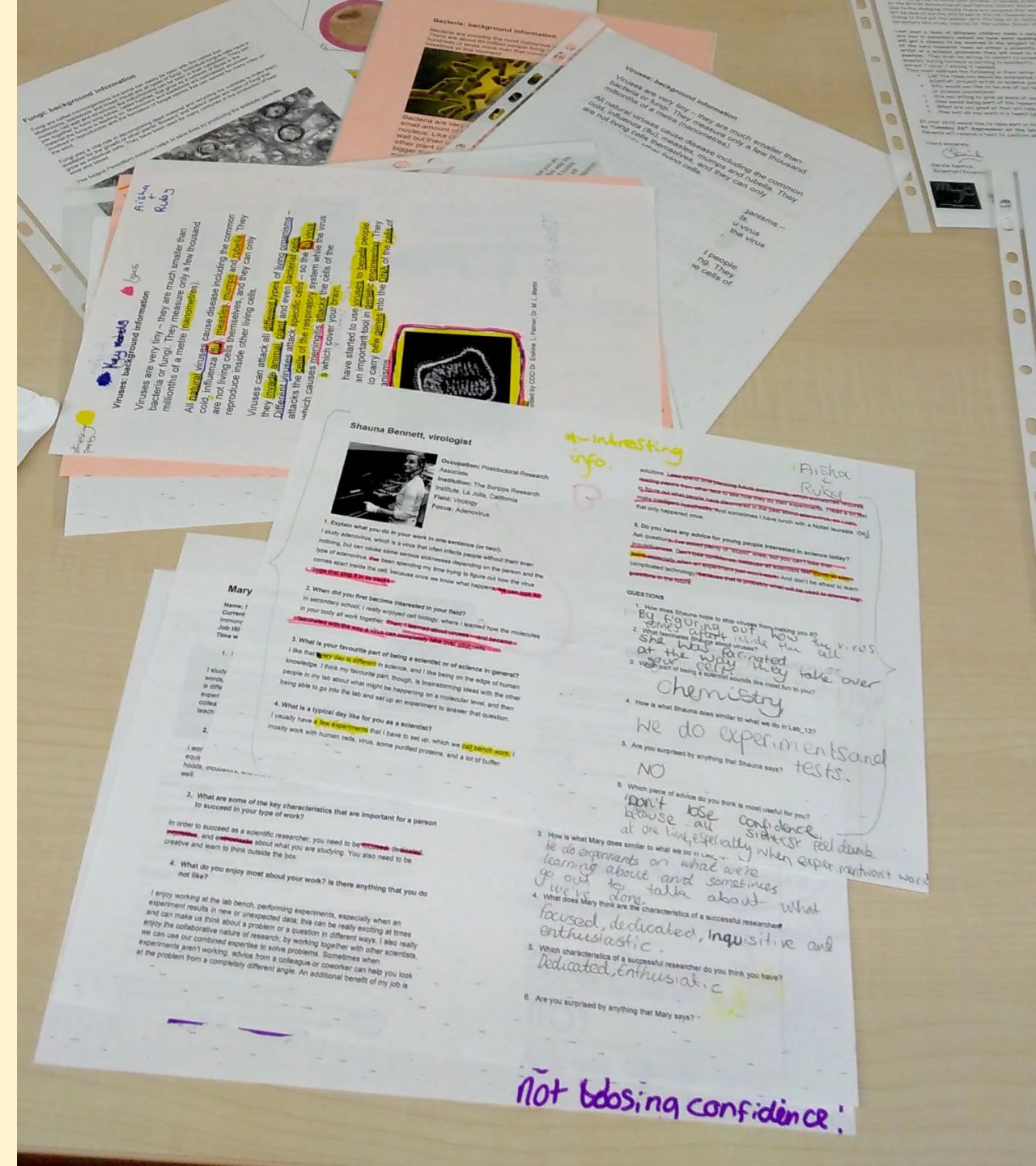
Correct diagram:



5. Teach about a range of jobs and careers that use science and science skills



Example: trainee pathologists



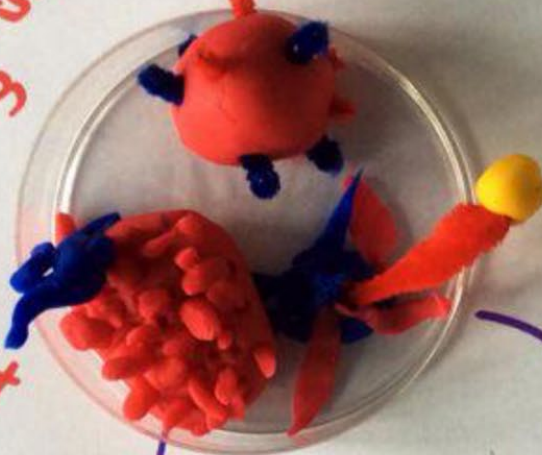
Virus

Shape

↓
mostly
Spikes
on them
looks
like
a spider
with light
bulb,
Chandigarh
and ball
with
spikes.

icosahedral
virus.

influenza
- the flu



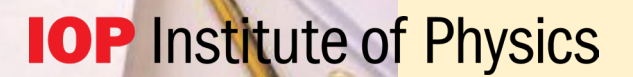
Helical
virus / tabaco
mosaic
virus

complex
virus

bacteriophage
- a virus that
infects bacteria.

Size

↓
They are
only a few
thousand
millionths of
a meter
nanometres
metres



QUESTIONS

1. How does Shauna hope to stop viruses from making you ill?

By figuring out how the virus comes apart inside the cell.

2. What fascinates Shauna about viruses?

She was fascinated at the way they take over your cell.

3. Which part of being a scientist sounds like most fun to you?

Chemistry

4. How is what Shauna does similar to what we do in Lab_13?

We do experiments and tests.

5. Are you surprised by anything that Shauna says?

NO

6. Which piece of advice do you think is most useful for you?

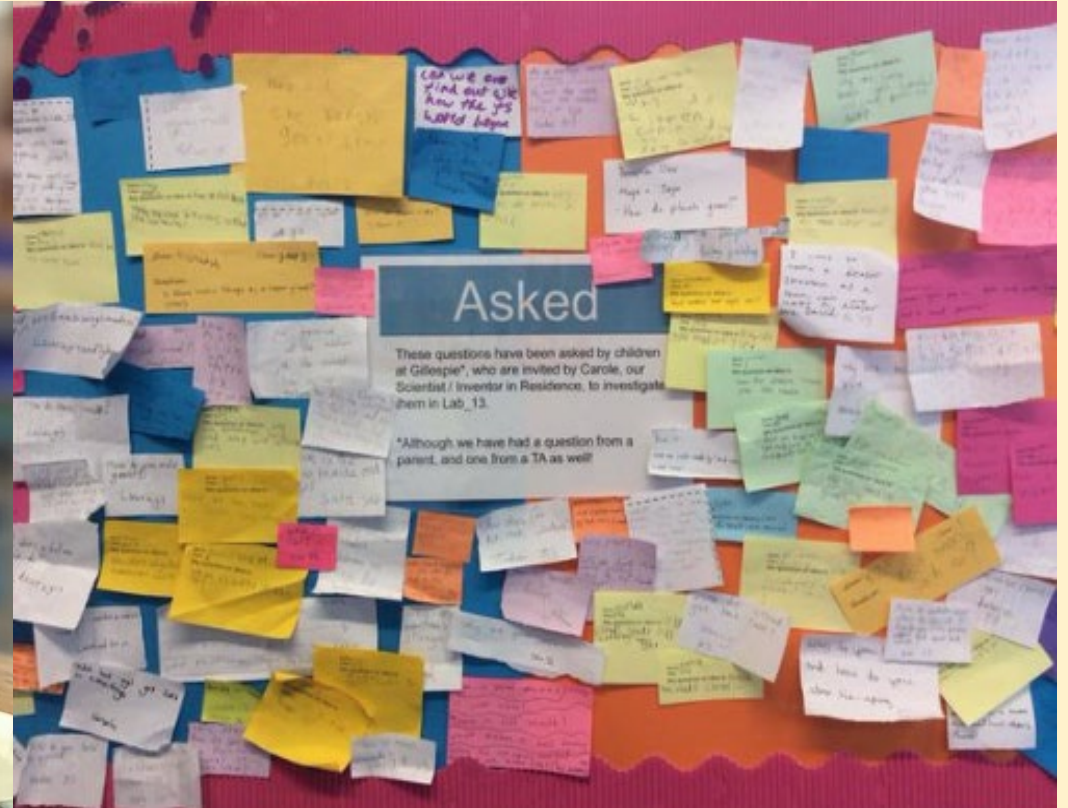
'Don't lose confidence, because all scientists feel dumb at one time, especially when experiment won't work'

6. Which piece of advice do you think is most useful for you?

Asking Questions!
Not losing confidence!



6. Give children opportunities to make links between their learning and their lives, interests and local area





Build numeracy and literacy for science

- 7. Build scientific vocabulary
- 8. Get children talking and listening
- 9. Make time for maths

7. Build scientific vocabulary

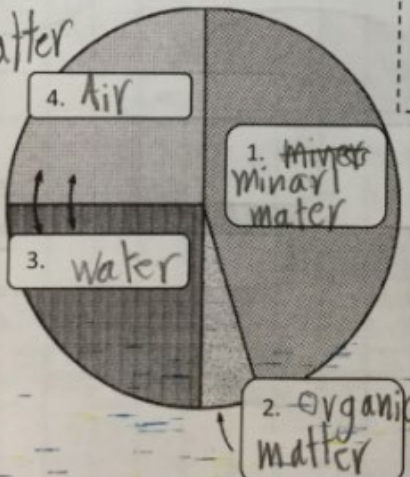
Secrets in the Soil

What is soil? It's the top layer of the earth

Why is soil important to us?
If we didn't have soil we will die because we need soil to grow trees and trees won't exist. Also it will be called mineral matter

Soil is made of 4 things:

1. Organic matter
2. Mineral matter
3. Air
4. Water



Observing soil:

SAMPLE A
It is made of sediments.

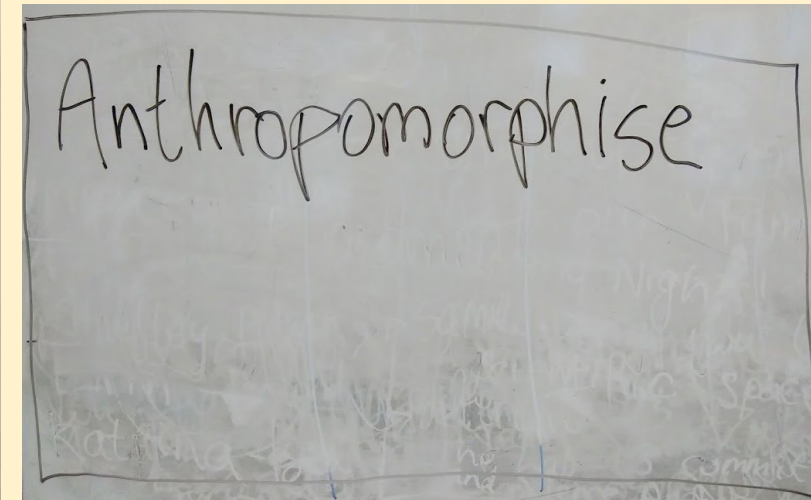
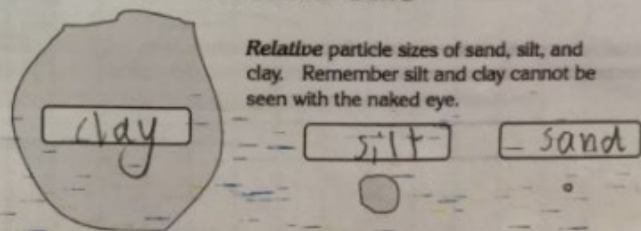
SAMPLE B
Made of dead parts of plants
It is organic matter.

SAMPLE C
There is water in it from rain.
It is organic matter

How big are the mineral particles in soil?

Particle Size

Relative particle sizes of sand, silt, and clay. Remember silt and clay cannot be seen with the naked eye.



Thinking about the purpose of our writing

KS2:

Recount

Non-chronological reports

Instructional / procedural texts

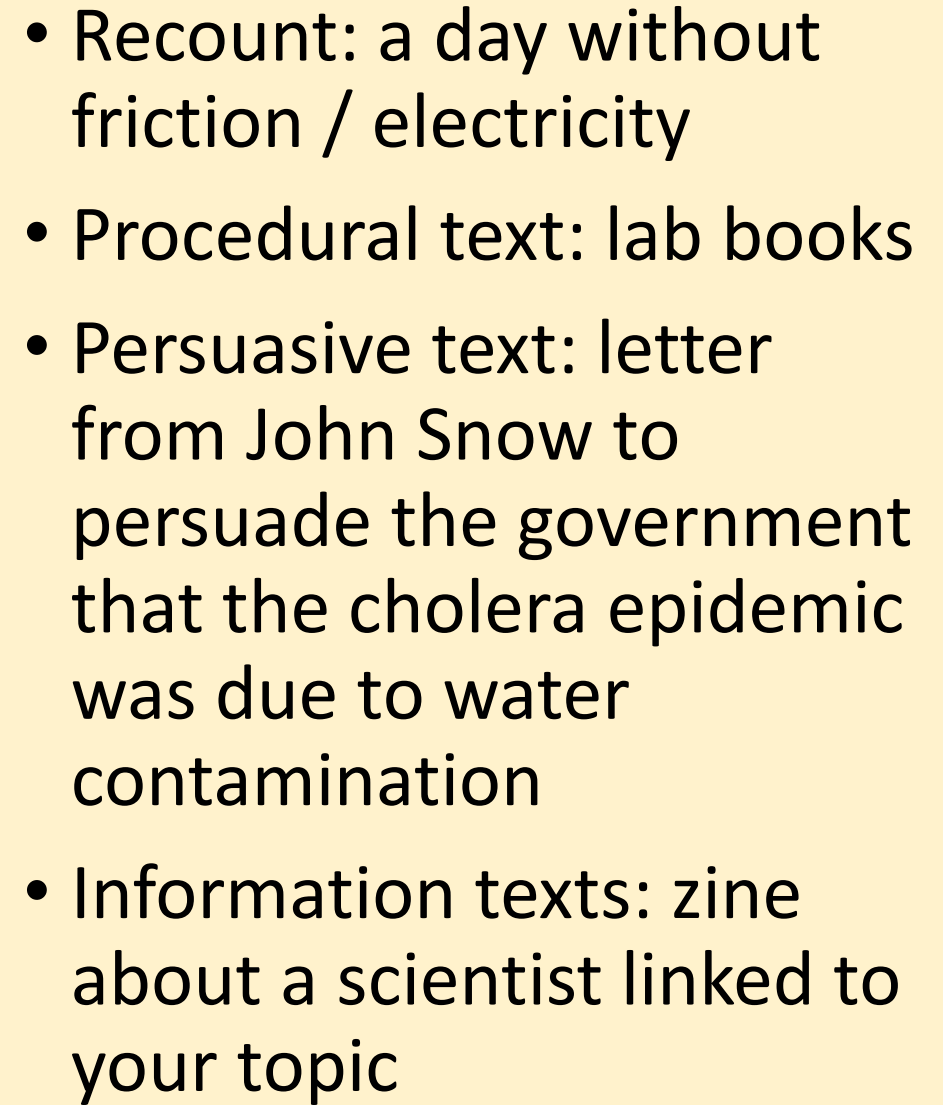
Explanatory texts

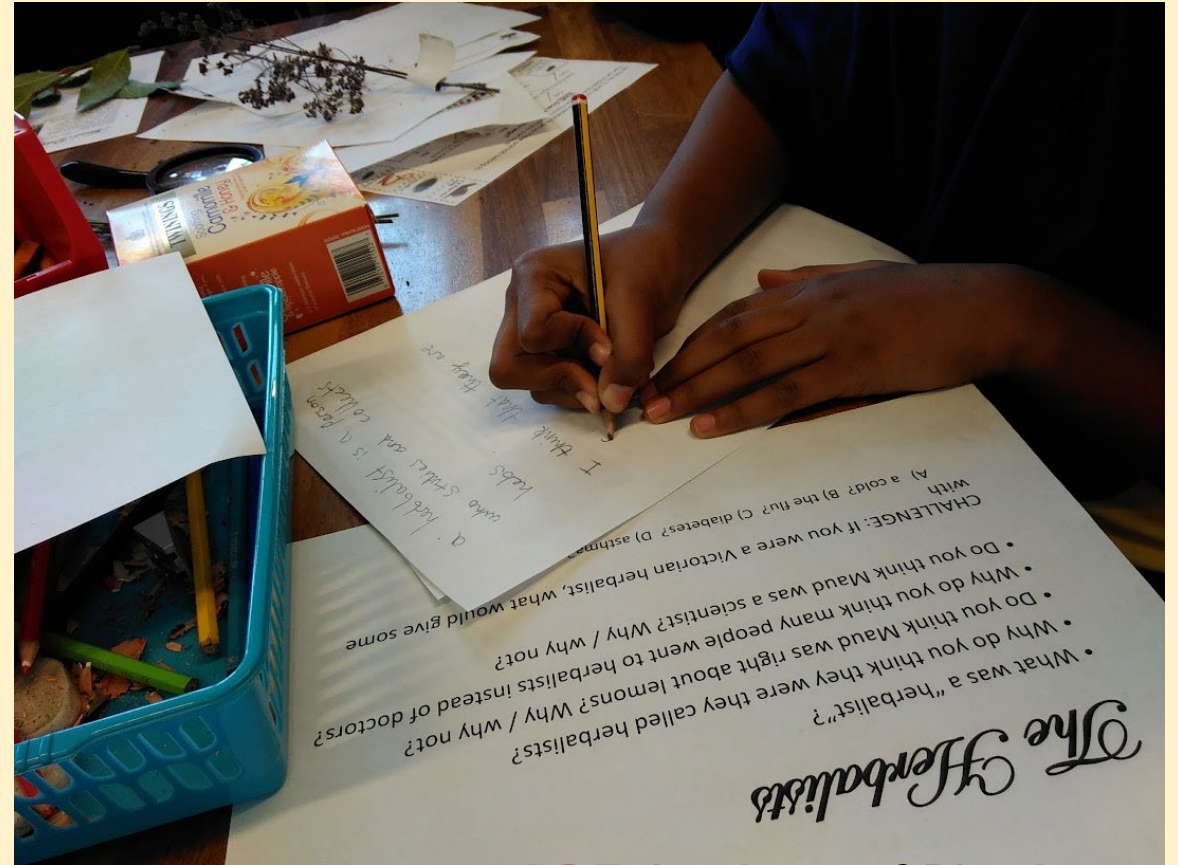
Discussion texts (balanced arguments)

Persuasion texts

Information texts

- Who is our audience?
- What genre are we writing in?





I feel like the message
of the crocus, and feel
like the arrival of
the daisy, my feelings
are jumbled up, lost
in the ^{maze} of my mind
but you are like
an olive branch and
I thank you for
being like a Sarge to me



8. Get children talking and listening

I used to think that...

Now I know that...

Some people think that...

However, I know that...

Because...

Tell me what
you can see

DIFFERENT COLOURS - A TRANSPARENT
~~THE~~ ONE → THEO THINKS IT IS WATER

Tell me what you
think will happen
when[... happens]

IT IS GOING TO TURN INTO A YELLOW
COLOUR. IT IS GOING TO TURN INTO
SOMETHING SLIMY

Tell me what
happened

WHEN WE PUT THE COLOURED LIQUID
INSIDE THE TRANSPARENT ONE IT
MAKES LOTS OF JELLY STUFF

Tell me how it
is different

BEFORE IT'S LIQUID, AFTER IT'S
SQUISHY

9. Make time for maths



Venus

462 degrees Celcius

Mercury

427 degrees Celcius in the day

-173 degrees Celcius in the night

Earth

15 degrees Celcius



What's your 'one thing'?



Stay in touch/links

beth.bramley@iop.org

carole.kenrick@iop.org

iop.org/InclusiveResources

Twitter: @IOPTeaching @PhysicsNews

Links to resources mentioned in **Physics is for Everyone** webinar:

- [Inclusive teaching booklet](#)
- [Do try this at home experiments](#)
- [RI experimental](#)
- [Ogden Trust resources \(filter by age group / topic\)](#)
- [Royal Society profiles of parent/carers scientists](#)
- [Blog post on helping children learn about and relate to scientists \(featuring the pathologists lesson\)](#)
- [Blog post on science as a catalyst for English](#)
- [Instructions for making a zine from a sheet of A4 paper](#)
- [PSTT's Why&How? magazine with an overview of IOP's Limit Less campaign and case studies \(p.43\)](#)