



**Engage**

**Teacher Conference**

# **Top tips for inclusive science teaching**

Discover simple practical ways to make your teaching, interactions, and classroom as inclusive as possible. For secondary teachers.

**Eleanor Wylie**

Professional Support Coach, Institute of Physics

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Professional Support Coach, Institute of Physics

## Welcome, please be aware:

- Talks are recorded
- There will be time for questions at the end
- You can send messages in the chat or raise your hand.



# Top Tips for Inclusive Science Teaching with Eleanor and Sue



<https://www.mentimeter.com/app/presentation/allujsr3fs46negdniyv48qfv9dzvgbn/view?question=81stw1pxg6az>

# IOP's Campaign - Limit Less underrepresented groups

- Girls
- Young people from disadvantaged backgrounds
- Disabled young people
- LGBT+ young people
- Young people of Black Caribbean descent

**IOP** Institute of Physics

Think of a student in one or more of these under-represented groups. What barriers might they encounter when trying to make progress in physics?

Lack of role models

Lack of role models

Negligible science capital in household, don't feel 'smart' enough, unsure of possible career outcomes, not as many teachers from physics background to encourage uptake.

Maths

No model in the family

Not knowing about careers in physics

Few Female physics teachers

Think it's too hard

Historically Physics seen as for Men

Physics is seen as a 'hard' science

Peer pressure Parents not aware of opportunities

Not aware of Physics careers

<b>Creating an inclusive classroom culture</b>	1	Enable all students to participate
	2	Model inclusive language and expect it from students
	3	Examine and challenge stereotypes, biases and assumptions
<b>Making the learning relevant</b>	4	Value students' existing knowledge and experience of science
	5	Teach about a range of jobs and careers that use science and science skills
	6	Give students opportunities to make links between their learning and their lives, interests and local area
<b>Building numeracy and literacy for science</b>	7	Build scientific vocabulary
	8	Get students talking and listening
	9	Make time for maths

the poster - <https://www.iop.org/sites/default/files/2023-02/Inclusive-Science-Teaching-Poster.pdf>





Revised Top Tips for Inclusive Teaching – the booklet <https://www.iop.org/sites/default/files/2023-02/iop-top-tips-for-inclusive-science-teaching.pdf>

Build numeracy and literacy for science

## Build scientific vocabulary

There's a correlation between students' literacy levels and their science attainment.

### Ideas to try...

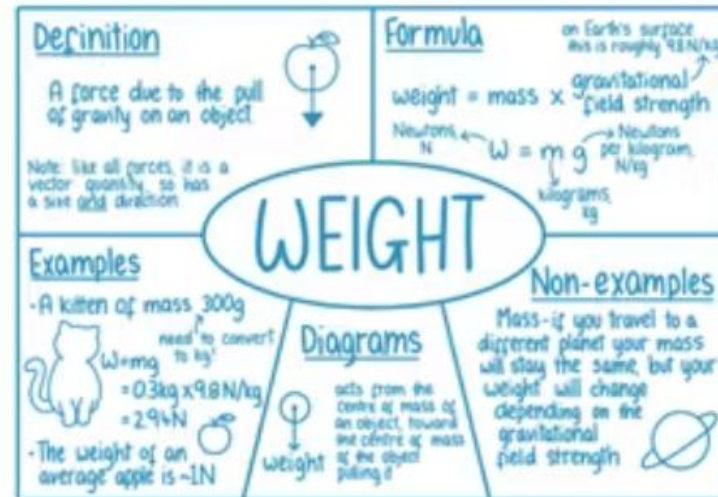
Start with everyday language, models and analogies to build understanding of concepts before introducing technical language.

Identify key words for each topic and explore their meaning with students; for example, using Frayer models.

Share the construction, roots and stories behind key words.

Regularly review vocabulary from previous topics.

Use quizzes, spelling/meaning tests and synoptic questions to regularly review key vocabulary.

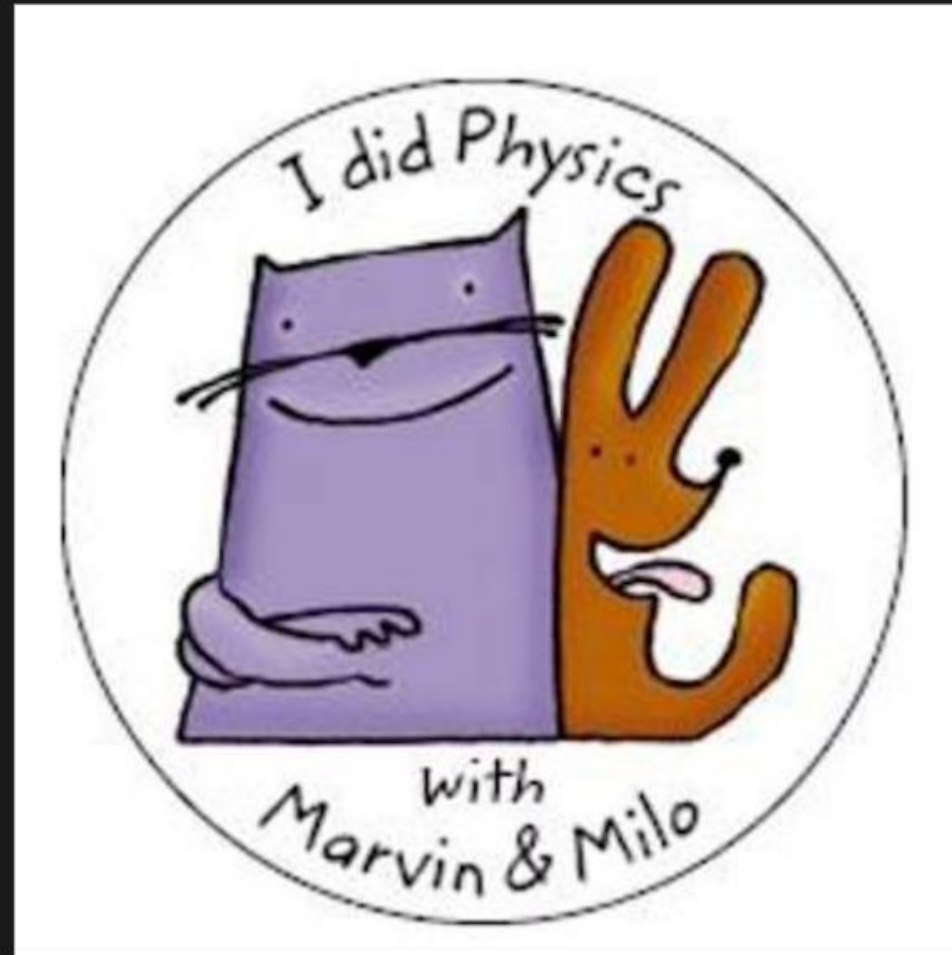


Use Frayer models, such as this one, to help students develop their understanding of key words.

# Build numeracy and literacy for science - build scientific vocabulary



**What do the tips look like  
in the classroom?**



MAKING THE LEARNING RELEVANT <https://spark.iop.org/collections/marvin-and-milo>



Reversing Arrows <https://spark.iop.org/reversing-glass>



<https://www.iop.org/explore-physics/at-home>

# context and careers for lenses and refraction (reversing arrows)

swimming pools opticians

astronomy - telescopes

stage lighting

engineer

microscopy

optician

opticians

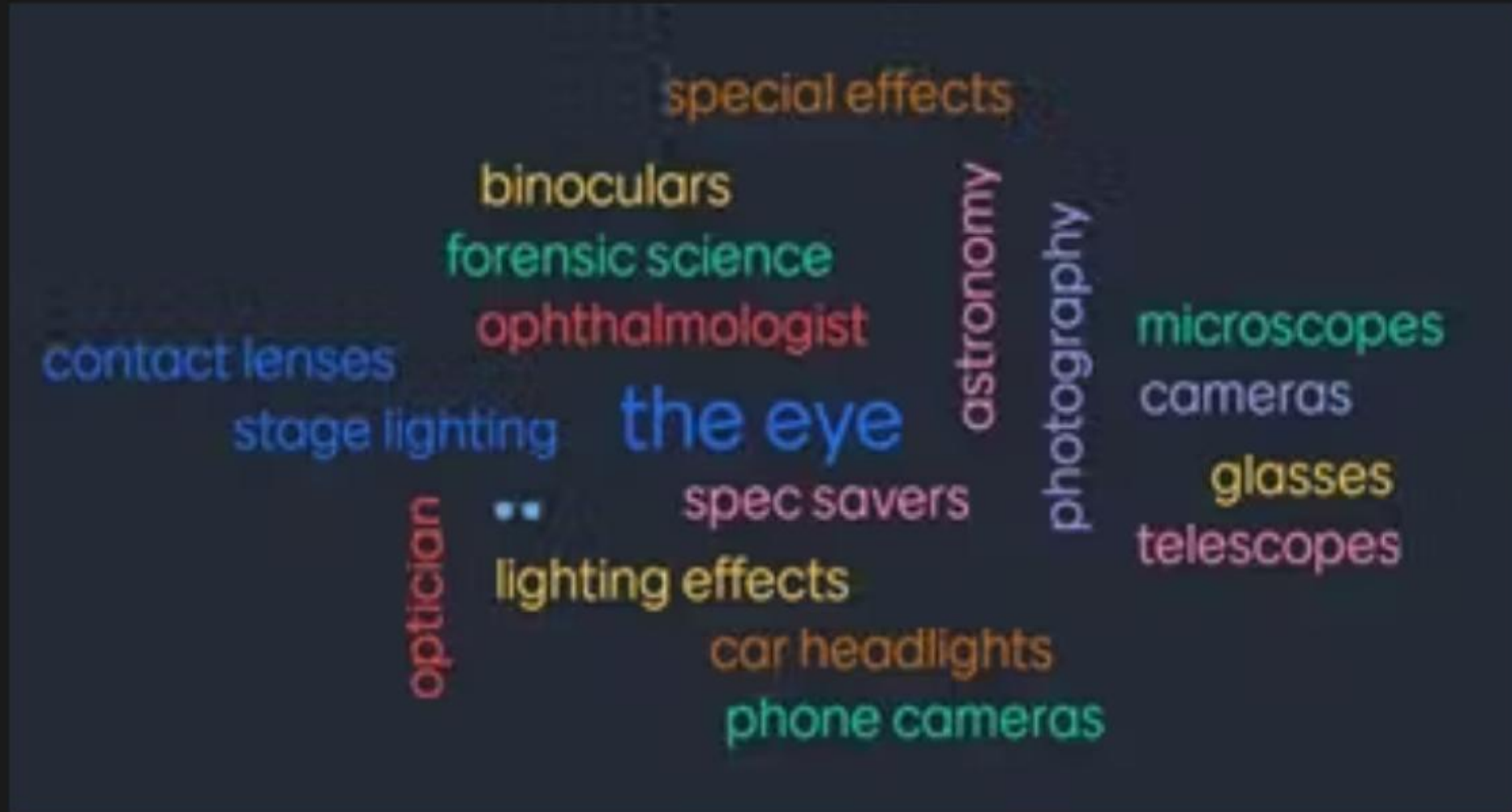
animators

optometry

swimming pools







context and careers for lenses and refraction (reversing arrows)





**Thinking about tip 3 – Ibn Saul discovers the Law of Refraction 984 CE**

<https://www.historyofinformation.com/detail.php?entryid=2413>

Another  
example!



Flame Balloons <https://spark.iop.org/flame-balloons>



<https://youtu.be/l3ta8x5cBq4>

Marvin and Milo Bursting Balloons - introducing specific heat capacity - water balloon doesn't pop because of water's high SHC!

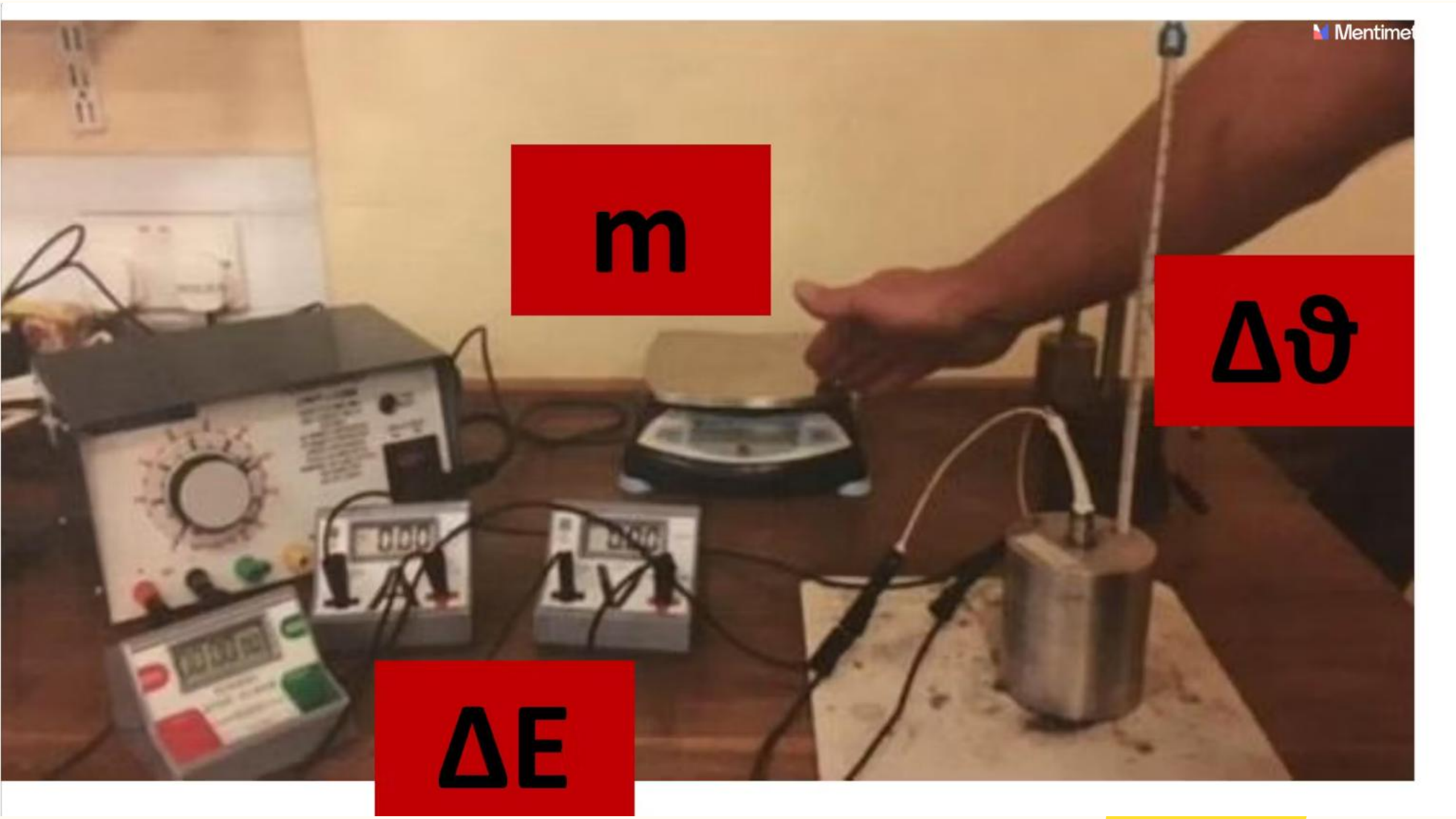




**m**

**$\Delta\theta$**

**$\Delta E$**





ITALIAN RECIPE

# PINACH & RICOTTA RIGATONI

Rigati tubes filled with  
spinach and ricotta in a  
creamy béchamel sauce with  
mature Cheddar cheese

CLASSIFIED V **SUITABLE FOR FREEZING** ❄️

Per pack as prepared provides

Energy	Fat	Saturates	Sugars	Salt
407kJ	11.7g	4.8g	10.6g	1.9g
97kcal				

USE BY

08 Nov  
17 15:37

# CUMBERLAND PIE

Minced beef and carrots in  
a rich gravy topped with  
buttery mash and  
toasted breadcrumbs

Per 100g

Energy	Fat	Saturates	Sugars	Salt
407kJ	12.6g	5.3g	5.8g	1.1g
97kcal				

Per pack as prepared provides

Energy	Fat	Saturates	Sugars	Salt
1376kJ				
328kcal				
10%	10%	20%	6%	

SUITABLE  
FOR  
FREEZING

# ALOO GOBI SAAG

Potato, cauliflower  
and spinach in a thick  
creamy sauce with  
fenugreek and  
mustard seeds

Per 100g

Energy
258kJ
61kcal

Per pack as prepared provides

Energy	Fat	Saturates	Sugars	Salt
537kJ	12.7g			0%
128kcal				
10%	10%			0%

GOOD  
HEALTH

For your 3 + 4  
+ 11 + 11

CK MULTIPACK MULTIPACK

# HEINZ

ESTD 1869

## BEANZ

In a rich tomato sauce

• 1 OF YOUR 5 A DAY •

Per 10 cans (207g)

Energy	682kJ	162kcal	8%
Fat	0.4g		1%
Saturated	0g		<1%
Sugar	9.8g		11%
Salt	1.2g		21%

of an adult's reference intake  
Typical values per 100g  
Energy 329kJ/78kcal

High Protein\*

High Fibre

Low Fat

Heinz Baked Beans in tomato sauce

e415g

LOW SODIUM • GLUTEN FREE • VEGAN • NO ARTIFICIAL COLOURS, FLAVOURS OR PRESERVATIVES

### BEANZ MEANZ HEINZ

We could tell you that our Beans are hard to beat. That they're brimming with deliciously rich, tomatoey flavour.

But you already know that. Because you know what Beanz Means...

• LOW SODIUM • GLUTEN FREE • VEGAN • NO ARTIFICIAL COLOURS, FLAVOURS OR PRESERVATIVES

#### nutrition

Servings per can - 2

Typical values	Per 100g	Per 10 cans	%* of RDI
Energy	329kJ	682kJ	8%
	78kcal	162kcal	
Fat	0.2g	0.4g	1%
- of which saturates	<0.1g	<0.1g	<1%
Carbohydrate	12.5g	25.9g	10%
- of which sugars	4.3g	8.6g	11%
Fibre	3.2g	7.7g	
Protein	4.2g	8.7g	19%
Salt	0.6g	1.2g	21%

\*% per serving. Reference intake of an average adult (8400kJ/2000kcal)

#### Ingredients

Beans (51%), Tomatoes (34%), Water, Sugar, Spirit Vinegar, Modified Cornflour, Salt, Spice Extracts, Herb Extract

\*Protein contributes to a growth in muscle mass.

1 of your 5 a day in 10 cans when eaten as part of a balanced diet.

#### how to cook

**2 1/2 MINS**

**Microwave (800W):** Use a covered, microwaveable container. Heat for 1 1/2 minutes, stir. Heat for a further 1 minute.

**Hob**  
Heat gently in pan.

#### how to store

Empty unused contents into a suitable covered container. Keep refrigerated and use within 2 days.

Best before end - see can end.

#### get in touch

Phone 0800 5285757 (PKX 1800 995311) or visit [heinz.co.uk](http://heinz.co.uk)  
Please quote code on the can end.

© H.J. Heinz Foods UK Ltd, London, SE1 9SS  
© H.J. Heinz Company (Great Britain) Ltd, Avoca Court, Blackrock, Co. Dublin

Not to be sold individually

METAL widely recycled

Can we work out the specific heat capacity of the beans?



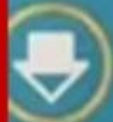
MULTIPACK



HIGH PROTEIN\*



HIGH FIBRE



LOW FAT



• LOW SUGAR • GLUTEN FREE • VEG

BEANZ MEANZ HEINZ

We could tell you that our Beanz are hard to beat. That they're brimming with deliciously rich, tomatoey flavour.

But you already know that. Because you know what

$m$

$\Delta E = Pt$

Energy	682kJ / 162kcal	8%
Fat	0.4g	1%
Saturates	0g	<1%
Sugars	9.8g	11%
Salt	0.6g	21%

Heinz Baked Beans  
e415g

nutrition

Servings per can – 2

Typical values	Per 100g	Per ½ can	%RI*
Energy	329kJ / 78kcal	682kJ / 162kcal	8%
Fat	0.2g	0.4g	1%
– of which saturates	<0.1g	<0.1g	<1%
Carbohydrate	12.5g	25.9g	10%
– of which sugars	4.7g	9.8g	11%
Fibre	3.7g	7.7g	
Protein	4.7g	9.7g	19%
Salt	0.6g	1.2g	21%

Beans (51%), Tomatoes (34%), Water, Sugar, Spirit Vinegar, Modified Cornflour, Salt, Spice Extracts, Herb Extract

\*Protein contributes to growth in muscle mass.

1 of your 5 a day in ½ a can when eaten as part of a balanced diet.

2 1/2 MINS

Microwave (850W): Use a covered microwaveable container. Heat for 1 1/2 minutes, stir. Heat for a further 1 minute.

Hob Heat gently in pan.

how to store

Empty unused contents into a suitable covered container. Keep refrigerated and use within 2 days.

Best before end - see can end.

- H.J. Heinz Foods UK Ltd, London, SE1 9SG
- H.J. Heinz Company (Ireland) Ltd, Avoca Court, Blackrock, Co. Dublin



individually

$\Delta \theta$

\*RI per serving. Reference intake of an average adult (8400kJ/2000kcal)

get in touch

Phone 0800 5285757 (ROI 1800 995311) or visit heinz.co.uk Please quote code on the can end.

HIGH PROTEIN\*

We could tell you that our Beans are hard to beat. That they're brimming with deliciously rich, tomatoey flavour.

$$850 \times 150 = 127500 \text{ J}$$

Per 1/2 can  
207g

Energy  
682kJ  
162kcal

8%

Fat

9.8g

11%

Salt

1.2g

21%

Heinz Baked Beans  
in tomato sauce

e415g



### nutrition

Servings per can – 2

Typical values	Per 100g	Per 1/2 can	%RI*
Energy	329kJ 78kcal	682kJ 162kcal	8%
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Fibre	3.7g	7.7g	
Protein	4.7g	9.7g	19%
Salt	0.6g	1.2g	21%

\*RI per serving. Reference intake of an

### ingredients

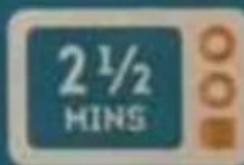
Beans (51%), Tomatoes (34%), Water, Sugar, Spirit Vinegar, Modified Cornflour, Salt, Spice Extracts, Herb Extract

\*Protein contributes to a growth in muscle mass. 1 of your 5 a day in 1/2 a can when eaten as part of a balanced diet.

### how to store

Empty unused contents

### how to cook



### Microwave

(850W): Use a covered microwaveable container. Heat for 1 1/2 minutes, stir. Heat for a further 1 minute.

### Hob

Heat gently in pan.

415g

$$75 - 20 = 55 \text{ }^\circ\text{C}$$

of an adult's  
reference intake  
Typical values per 100g:  
Energy 329kJ/78kcal



## Specific Heat Capacity and Baked Beans

127500 J

for

415 g

by

55 °C

## Specific Heat Capacity and Baked Beans

127500 J

for

415 g

by

55 °C

$127500 \div 55 =$

2318 J

for

415 g

by

1 °C



# Specific Heat Capacity and Baked Beans

127500 J

for

415 g

by

55 °C

$127500 \div 55 =$

2318 J

for

415 g

by

1 °C

$2318 \div 415 =$

5.6 J

for

1 g

by

1 °C

## Specific Heat Capacity and Baked Beans

127500 J

for

415 g

by

55 °C

$$127500 \div 55 =$$

2318 J

for

415 g

by

1 °C

$$2318 \div 415 =$$

5.6 J

for

1 g

by

1 °C

$$5.6 \times 1000 =$$

5600 J

for

1 kg

by

1 °C

# Context and Careers for Specific Heat Capacity

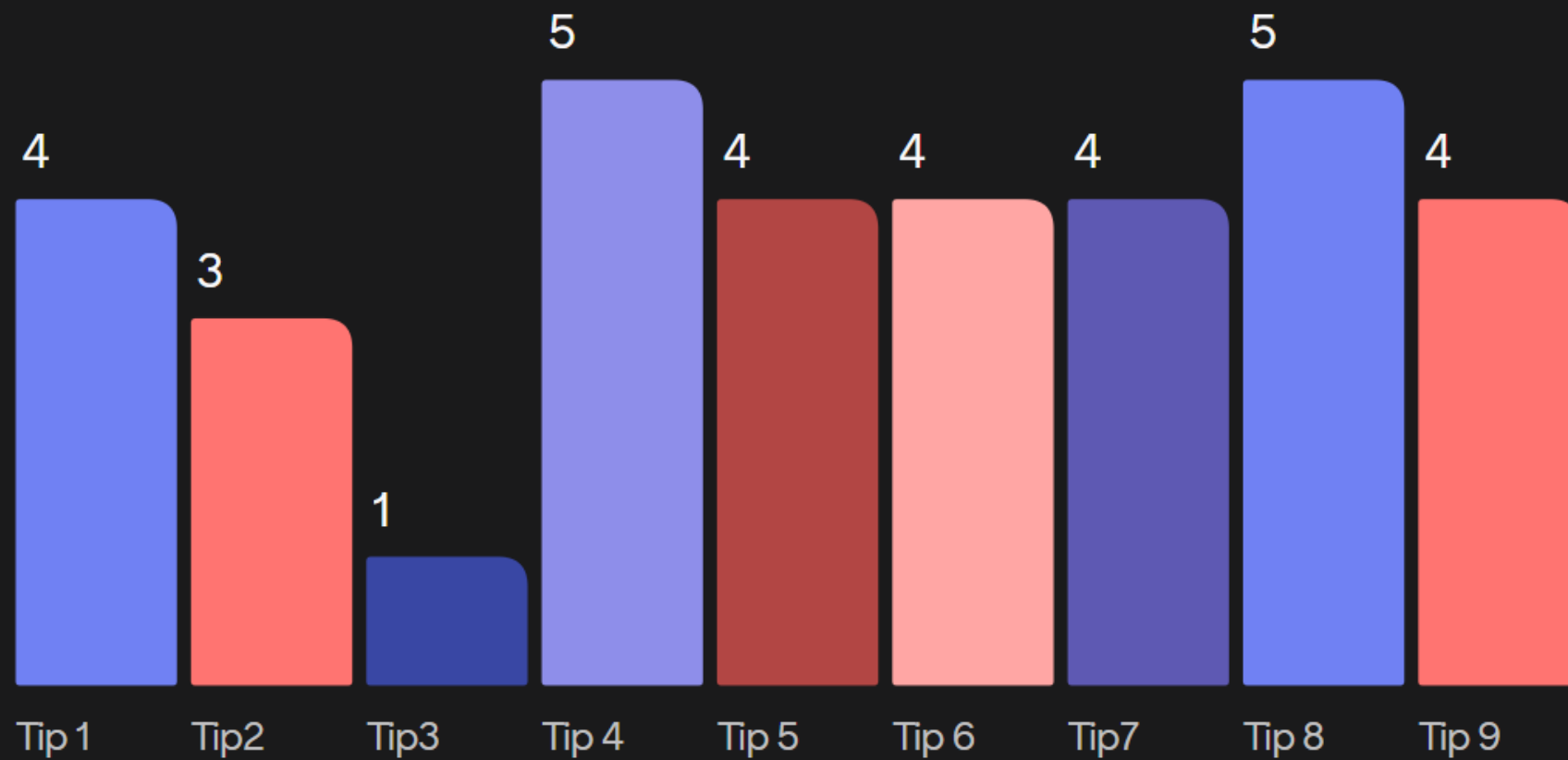
climate  
chef  
mechanics  
heating systems  
material scientist  
engineering  
architecture  
distillers  
chemists



# Context and Careers for Specific Heat Capacity

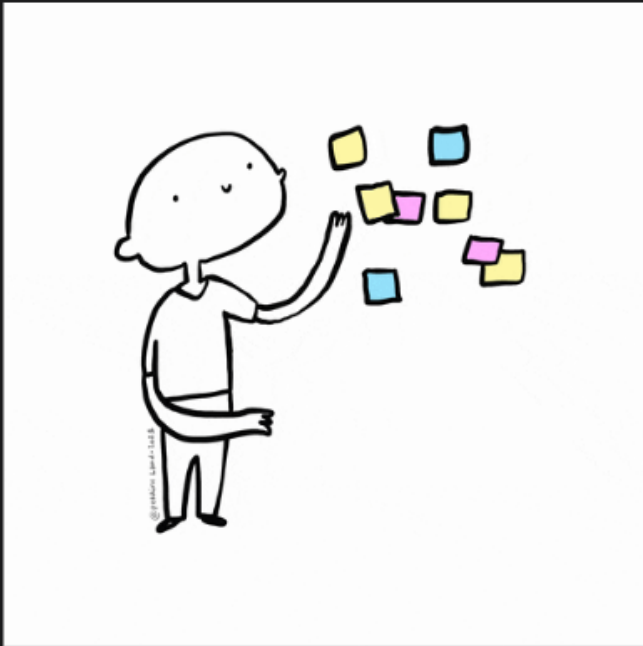


For specific heat capacity which Top Tips have we covered?



l students to participa  
clusive language and e  
and challenge stereot  
dents' existing knowle  
out a range of jobs an  
dents opportunities to  
and local area  
entific vocabulary  
ents talking and listen  
e for maths

Share examples of your own ideas/good practice or ideas you'd like to try!



Try to link more practicals to students everyday lives

Give the short experiments a try at home with kids

Look for diverse role models

Posters showing a diverse range of role models

Connect the experiments to potential careers



Podlet

carolekenrick • 1 • 3h

## Inclusive teaching resources

Further reading, resources and ideas for putting the inclusive teaching tips into practice

Overview

Further reading


1. Enable all students to participate

2. Examine and challenge stereotypes, biases and assumptions

3. Model inclusive language and expect it from students

**carolekenrick**

### Inclusive teaching booklet



PDF

107 tips for inclusive science teaching

<https://www.tsp.org/sites/default/files/2021-02/107-tips-for-inclusive-science-teaching.pdf>

**sue woolhouse**

### Feedback


We'd love to hear from you please complete this 5 minute survey:

<https://forms.office.com/e/YUdfh>

Try so we can hear about the tips

**carolekenrick**

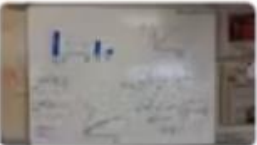
### A model of culturally relevant pedagogy in physics



[wp.scitation.org](http://wp.scitation.org)

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### Mini whiteboards




Best practices for whiteboarding in the physics classroom:

<https://www.physport.org/recommendaations/entry.cfm?ID=101110>

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### Free downloadable posters:



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### Gender related inclusive language infographics

[https://www.un.org/gender/sites/www.un.org/gender/files/ugd\\_gender\\_checklist\\_for\\_content\\_creation\\_2018.pdf](https://www.un.org/gender/sites/www.un.org/gender/files/ugd_gender_checklist_for_content_creation_2018.pdf)

<https://profishcomm.ca/gender-inclusive-language/>

**sue woolhouse**

### Inclusive Language Infographic

<https://padlet.com/carolekenrick/inclusive-teaching-resources-36xirew780r3fv3h>

Thank  
you!



**Thank you!**

[eleanor.wylie@iop.org](mailto:eleanor.wylie@iop.org)

[suzanne.woolhouse@iop.org](mailto:suzanne.woolhouse@iop.org)



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# Engage Teacher Conference

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 [crest@britishscienceassociation.org](mailto:crest@britishscienceassociation.org)

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