

BLOODHOUND EDUCATION

Introduction to materials & their properties

BLOODHOUND
EDUCATION



Surface Engineering

- In association with SEA, the Surface Engineering Association.

https://www.youtube.com/watch?v=W8WIP7Q-WnQ

BLOODHOUND
EDUCATION

SEA
SURFACE ENGINEERING ASSOCIATION

What is surface engineering?

- See introductory video link below:

- https://www.youtube.com/watch?v=W8WIP7Q-WnQ

- Surface engineering is defined as the set of technologies that modify the surfaces of solids to **enhance** their performance or introduce new functionalities, particularly in the context of **protecting** against wear, friction, oxidation, and corrosion in manufacturing processes and consumer goods.

BLOODHOUND EDUCATION

SEA SURFACE ENGINEERING ASSOCIATION

Bloodhound LSR Car



BLOODHOUND
EDUCATION

bloodhoundeducation.com

What is STEM?

- Science, Technology, Engineering and Maths
- We are going to be **scientists**
- What do scientists do?



BLOODHOUND
EDUCATION

bloodhoundeducation.com

what surfaces can you see?

- Surfaces are everywhere!
- Look around you and name different surfaces you can see.

BLOODHOUND EDUCATION

bloodhoundeducation.com

SEA SURFACE ENGINEERING ASSOCIATION

Images from pixabay

How important are surfaces?

- We come into contact with many surfaces in our lives
- Here are some I thought of…



Images from pixabay

BLOODHOUND EDUCATION

SEA SURFACE ENGINEERING ASSOCIATION

bloodhoundeducation.com

How important are surfaces?

- Improvements can be made to enhance the properties of surfaces
- This improves lifetime, wear, grip, appearance etc.
- Coatings can also change thermal or electrical properties

Frying pans

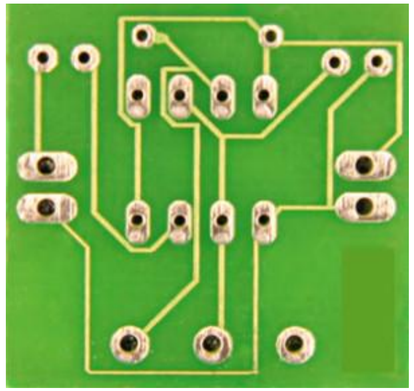




Camping mugs







Circuit boards

BLOODHOUND EDUCATION

SEA SURFACE ENGINEERING ASSOCIATION

bloodhoundeducation.com

How important are surfaces?

- Contact always happens between surfaces
- Surfaces can look smooth but are rough under a microscope
- Rough surfaces cause more friction



BLOODHOUND EDUCATION

SEA SURFACE ENGINEERING ASSOCIATION

bloodhoundeducation.com

Bloodhound and surfaces









- Wheels need to run smoothly without friction between the metal surfaces inside, so they use bearings and lubricants inside them to help the wheels roll easily.
- Brake disks are made of steel so that the friction between them and the brake pads does not melt the metal. Temperatures can get up to 290 degrees Celsius when braking.
- External surface – the covering of the bloodhound body needs to be slippery and smooth so that it can run smoothly through the air. The bodyshell is made of light composite fibreglass. This makes it more aerodynamic so that there is less friction with the air.

The turbine blades on the Eurofighter jet engine are treated with ceramic coatings to protect them from extreme heat and allow the engine to run more efficiently.

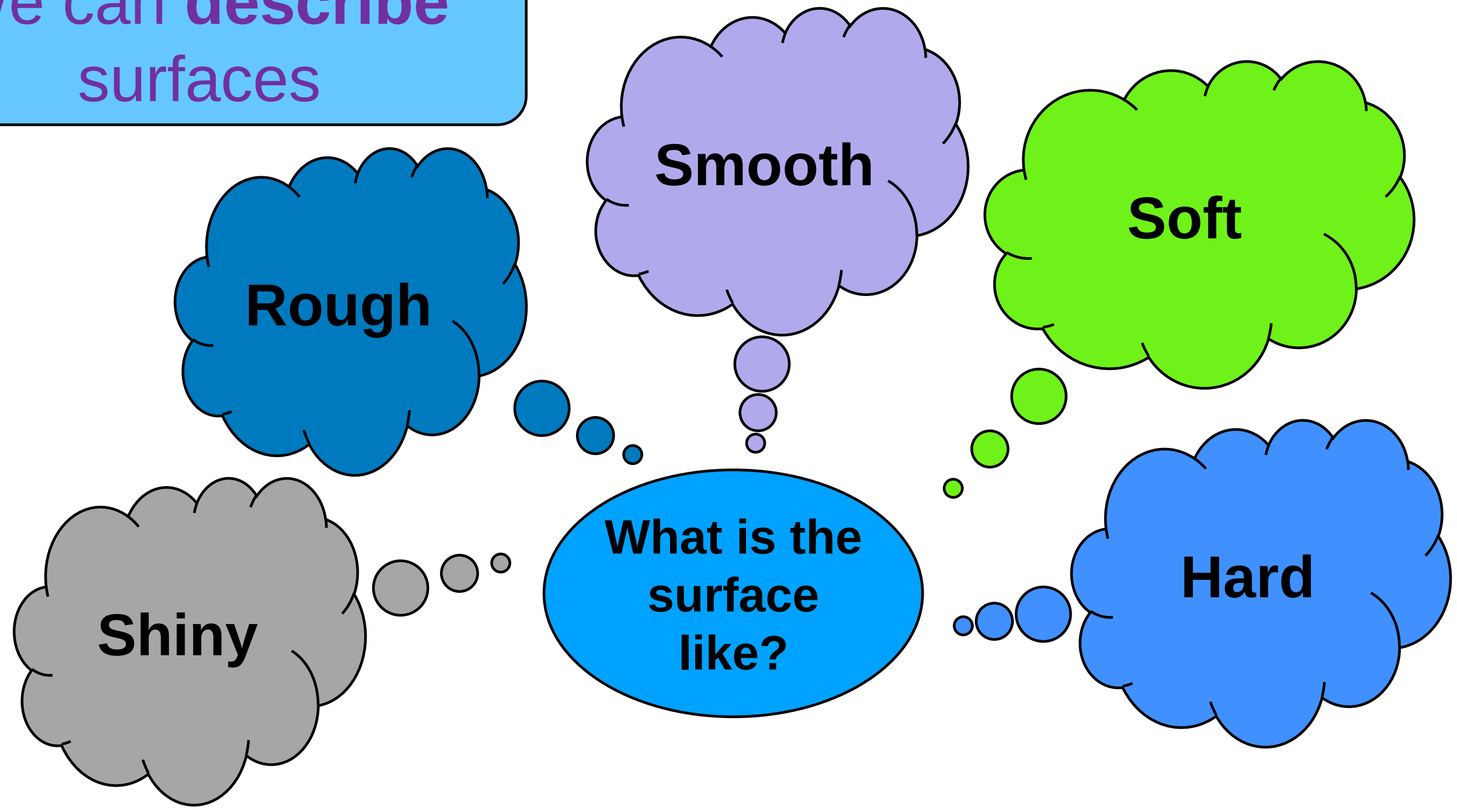
How can we compare different surfaces?



- What do they feel like?
- What they look like?

We can **describe** surfaces

So this is called **qualitative** testing



BLOODHOUND EDUCATION

SEA SURFACE ENGINEERING ASSOCIATION

bloodhoundeducation.com

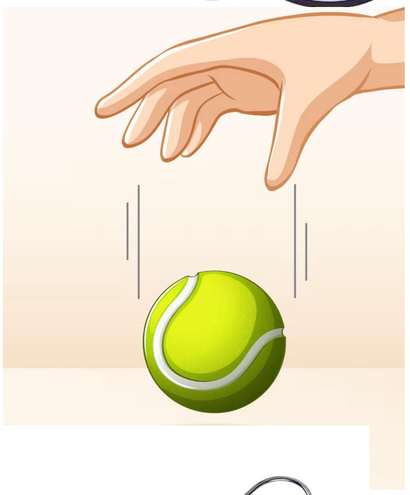
Images from freepic, pixabay

How can we compare different surfaces?



- How hard are they?

We can **measure** the rebound of a ball



- How much friction do they cause?

Measuring is called **quantitative** testing

We can **measure** friction using a newton meter



BLOODHOUND EDUCATION

SEA SURFACE ENGINEERING ASSOCIATION

bloodhoundeducation.com

Images from free pic, pixabay

Surfaces detectives!



- Choose 5 surfaces to survey in your school
- Write them down in a table like this one
- Qualitative testing – describe the surfaces in as much detail as you can
- What does it look like, what does it feel like?
- Add a question of your own

Surface	What it looks like	What it feels like	(Your question)
Path			
Tarmac			
Grass			
Wood floor			
Tiled floor			



BLOODHOUND EDUCATION

SEA SURFACE ENGINEERING ASSOCIATION

bloodhoundeducation.com

How slippery?





Quantitative - Friction test

You will need:

- A shoe
- A 100g mass (inside the shoe)
- A newton meter (10N)
- Different surfaces to try

Surface	Pull 1 (N)	Pull 2 (N)	Pull 3 (N)	Average (N)
Path				
Tarmac				
Grass				
Wood floor				
Tiled floor				

Add up all the values, then divide by the number of values

How much pulling force in Newtons will it take to make the shoe move on different surfaces?



BLOODHOUND EDUCATION

SEA SURFACE ENGINEERING ASSOCIATION

bloodhoundeducation.com

How bouncy?



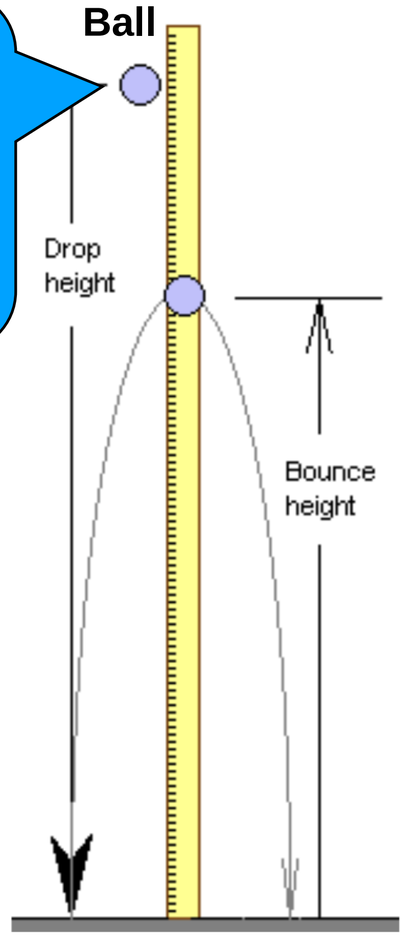


Quantitative - Rebound test

You will need:

- A ball
- A metre ruler
- Different surfaces to try

What height will the ball bounce when dropped onto different surfaces?



Surface	Ball	Drop height (cm)	Bounce Height (cm)
Path			
Tarmac			
Grass			
Wood floor			
Tiled floor			

Would you measure the bounce just once? What would be best?

Working Scientifically

What will you change? — **Independent variable**

What will you measure? — **Dependent variable**

What will you keep the same? — **Control**

Surface

Bounce height

Ball and drop height

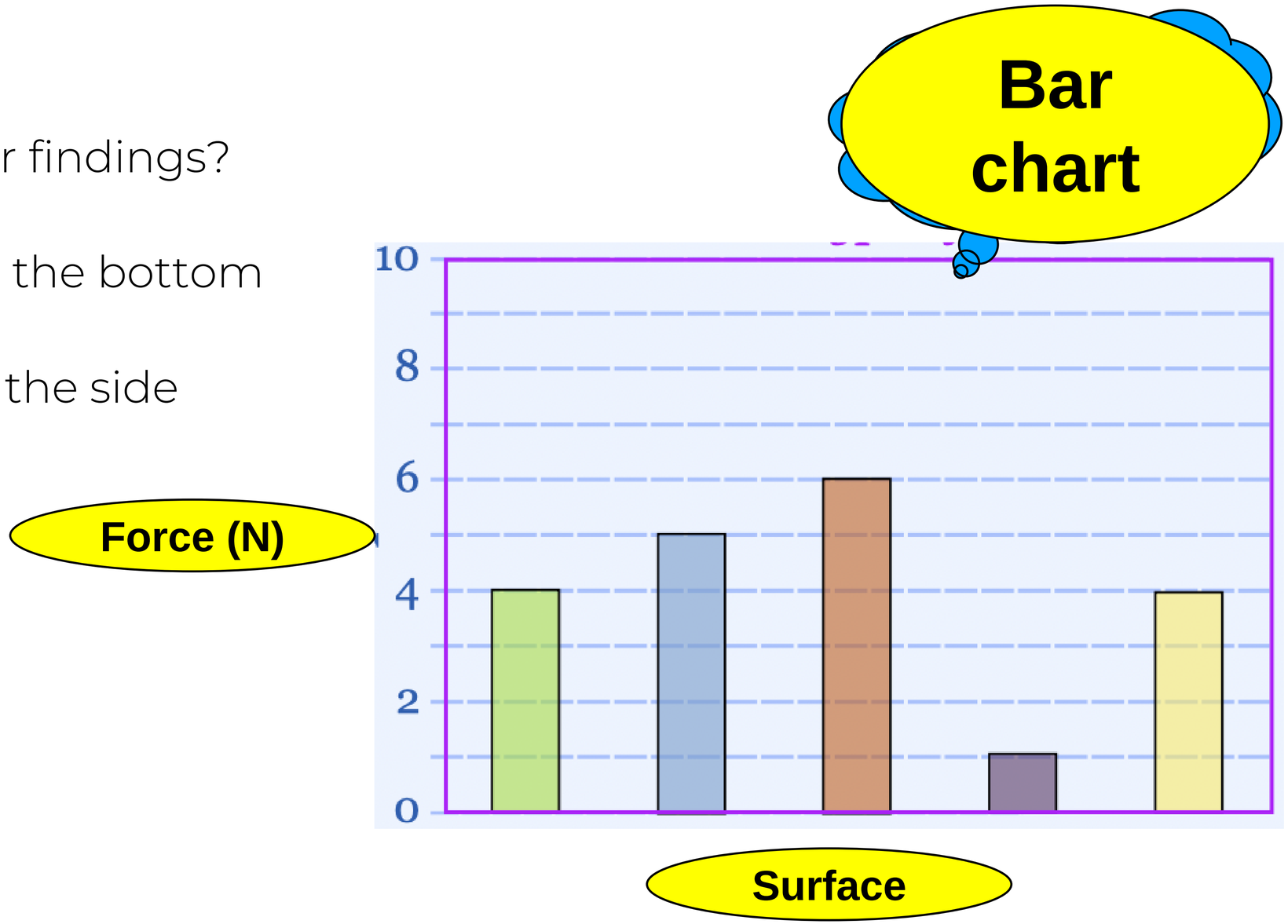
BLOODHOUND EDUCATION

bloodhoundeducation.com

SEA SURFACE ENGINEERING ASSOCIATION

Communicate your findings – Friction

- How shall we display our findings?
- Different surfaces along the bottom
- The amount of force up the side



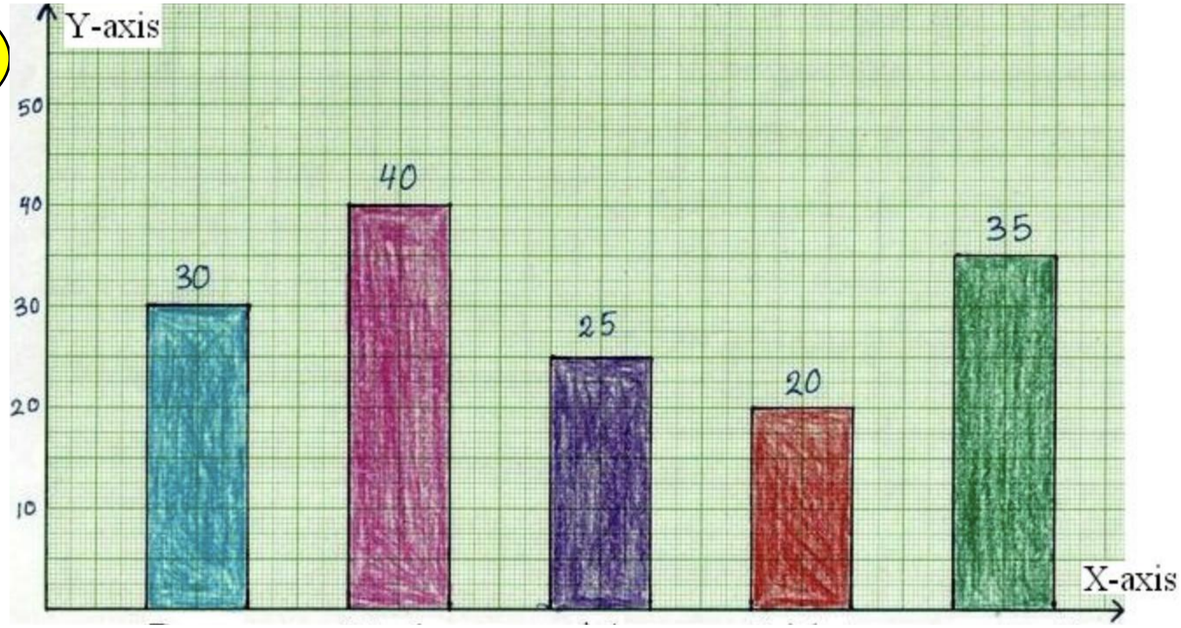
BLOODHOUND EDUCATION

bloodhoundeducation.com

Communicate your findings – Rebound

- How shall we display our findings?
- Independent variable – **Surface**
- Dependent variable – **Bounce Height (cm)**

Bar chart



BLOODHOUND EDUCATION

What did you find out?

The ..... the force then the ..... the surface

The smaller the force then the more slippery the surface

The larger the force then the less slippery the surface

BLOODHOUND EDUCATION

bloodhoundeducation.com

What did you find out?

The higher the bounce then the harder the surface

The ..... the bounce then the ..... the surface

The lower the bounce then the softer the surface

BLOODHOUND EDUCATION

bloodhoundeducation.com

How could you modify the surface to make it more or less slippery?



THINK

Spend time thinking by yourself first





PAIR

Talk with a partner or your table group and take turns sharing your ideas

SHARE

Share your collaborative thoughts with the whole class



BLOODHOUND EDUCATION

bloodhoundeducation.com

How could you modify the surface to make it more or less bouncy?



THINK

Spend time thinking by yourself first





PAIR

Talk with a partner or your table group and take turns sharing your ideas

SHARE

Share your collaborative thoughts with the whole class



BLOODHOUND EDUCATION

bloodhoundeducation.com

What would you like to find out next about surfaces?



BLOODHOUND
EDUCATION

bloodhoundeducation.com

WHAT I have LEARNED

BLOODHOUND
EDUCATION

bloodhoundeducation.com

INSPIRING A GENERATION

SIGN UP AT:
www.bloodhoundeducation.com

FOLLOW US ON:
www.twitter.com/BLOODHOUND_EDU

FIND US ON:
www.facebook.com/BLOODHOUNDEDUCATION



BLOODHOUND
EDUCATION