Science - Year 5

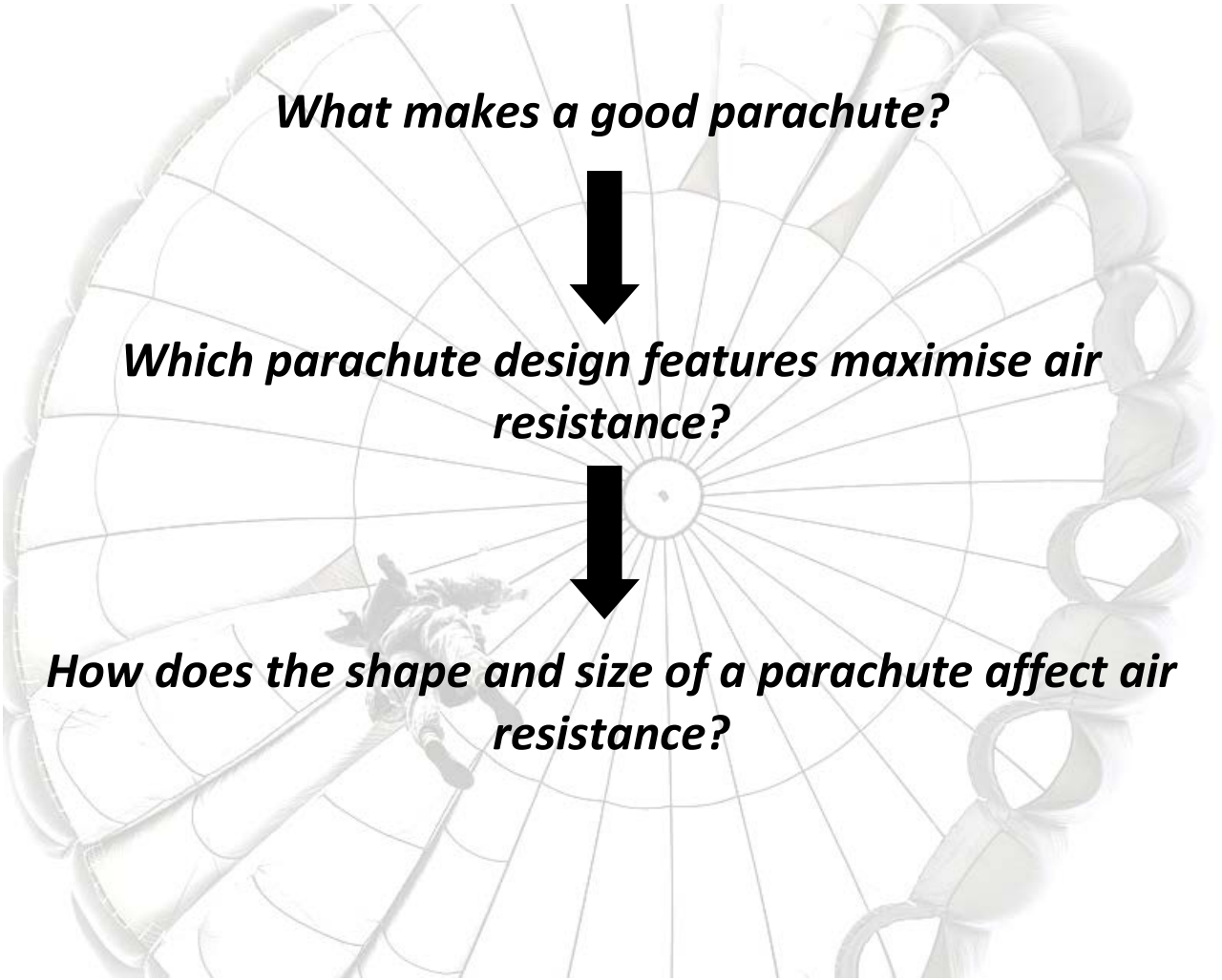
Forces – Block 5F

May the Forces Be With You

Session 2

Resource pack

Broad to specific scientific questions



What makes a good parachute?

Which parachute design features maximise air resistance?

How does the shape and size of a parachute affect air resistance?

Investigations remit and parachute equipment

Although they are likely to need guidance, try and encourage chn to think about three possible variables and things that will remain constant, for themselves (see questions). Get them to think also about the most logical order to test them in (e.g. if they test size first they will need to complete 9 parachute drops rather than just 3 if they test material first)

You will need to identify the key aspect of your parachute and test each variable to ascertain the best material, the best size and the best length of string. You will need to plan methodically to ensure your testing is fair, logical and the results are not unreliable.

Parachute remit:

- The parachute needs to create a slow and controlled descent
- The parachute needs to be made from a strong, windproof material

Equipment:

- Various plastic bags from small to bin liner size
- Sugar paper
- J-cloths
- Lego™ figures weighted with modelling clay
- String
- Scissors
- Sticky tape
- Stop watch
- Force meter
- Tape measure

Possible variables to investigate

(encourage children to suggest enquiry questions)

1. Material of parachute:

- Does the material of the parachute increase or decrease the speed of descent?
- Does the material of the parachute increase or decrease the air resistance?

Through discussion encourage chn to suggest 3 different materials and use the same size by calculating area.

2. Size of parachute:

- Does the size of the parachute increase or decrease the speed of descent?
- Does the size of the parachute increase or decrease the air resistance?

Through discussion encourage chn to suggest 3x different sizes of the same material (having already eliminated two of the potential materials). Chn should calculate area.

3. Length of parachute strings

- Does the length of the parachute strings increase or decrease the speed of descent?
- Does the length of the parachute strings increase or decrease the air resistance?

Through discussion encourage chn to suggest 3x different lengths of string sets, measured accurately

Measuring and recording your results

There are three things you will need to measure; two need to stay constant and the third will be variable. Can you think what they are?

- *Weight in newtons (N)*
- *Height of drop in cm*
- *Speed of descent in seconds*

Record your results in a table - can you draw one yourself? Think about what you need to record each time. Will you need more than one table, or can you record all of your test results in just one?

Your findings

What have you found out?
Can you make any conclusive observations?
Can you make any recommendations?
Record your recommendations in a video message for your team on the ground. Remember to identify the best size, material and length of strings… and back up your recommendations with hard evidence!

Improvements

How could you have made your investigation more accurate?
Is there any other design feature that you could have investigated?

Investigation mathematics

How you can convert your findings for a member of the recovery team who weighs 70kg (700 N)?

	Weight in newtons (N)	Area of parachute	Length of strings
In house testing	50N	15000cm²	60cm
In field reality	700N	21m²	8.4m

How can you find a conversion ratio? You have two variables to compare (weight in N) so if you can work out that ratio (700N÷50N=14), then you can multiply the other figures up by that!

Key science questions (differentiated)

HA

- Which forces are at play during a parachute jump? *(gravity, air resistance, weight)* How do they affect the jump? Are forces balanced or unbalanced or a mix of both at different points in the jump? Team members are different weights - what difference will this make?
- What should remain constant each time you test the parachutes? *(height of drop, person who drops it, weight and mass of skydiver, number of strings)* How can you make sure these stay the same/constant each time? Why is this important?
- What different features are you going to investigate? *(size of parachute, material of parachute, length of parachute strings)* How will you investigate them all ensuring that each design feature is accurately tested?
- Do you have any ideas for what you could do to the parachute to reduce the amount of oscillating (swinging, like a pendulum) it does as it falls? *(cut a small hole in the top! - chn might have spotted this from images of parachute)* Why might a small hole in the top of the parachute help? What would this do?

MA

- Which forces are at play during a parachute jump? *(gravity, air resistance, weight)* What is pulling the skydiver down? What is 'resisting' this force? When are the forces balanced/unbalanced?
- What should you not change each time you test the parachutes? *(height of drop, person who drops it, weight and mass of skydiver, number of strings)* How can you make sure these stay the same/constant each time? How might the results be affected if these things change, even by just a small amount, each time?
- What different features are you going to investigate? *(size of parachute, material of parachute, length of parachute strings)* Will you change them all each time you test? Or should you focus on one feature at a time? Why?
- What happens if you cut a small hole into the top of the parachute? *(reduces the amount of oscillating)* Why might this help?

LA

- What impact do gravity, air resistance, and weight have on a skydiver? What is pulling the skydiver down? What is 'resisting' this force? When the skydiver is accelerating as she falls, are the forces balanced or unbalanced? Once the skydiver is moving at a constant speed are the forces balanced or unbalanced?
- Why do you need to make sure that the height of drop, the person who drops it, the weight and mass of skydiver, and the number of strings don't change during your testing? How might the results be affected if these things change, even by just a small amount, each time?
- What different features are you going to investigate? *(size of parachute, material of parachute, length of parachute strings)* Will you change them all each time you test? Or should you focus on one feature at a time? Why?
- What happens if you cut a small hole into the top of the parachute? *(steadies the parachute)*

Sample tables (blank and complete) for parachute investigation

PARACHUTE INVESTIGATION	Enquiry question/s:

Variables we kept the same:	Variable/s changed:

	Test one	Test two	Test three	Overall result
Variable change 1				
Variable change 2				
Variable change 3				

Overall recommendations	MATERIAL:	SIZE:	STRING LENGTH:
Scientific rationale			

Possible improvements to our investigation

What else could we have investigated?

PARACHUTE INVESTIGATION	Enquiry question/s: *Does the material of the parachute increase or decrease the speed of descent?* *Does the material of the parachute increase or decrease the air resistance?* *Does the size of the parachute increase or decrease the speed of descent?* *Does the size of the parachute increase or decrease the air resistance?* *Does the length of the parachute strings increase or decrease the speed of descent?* *Does the length of the parachute strings increase or decrease the air resistance?*

Variables we kept the same: *height of drop, person who drops it, weight and mass of skydiver, number of strings*	Variable/s changed: *Material, size, string length*

	Test one	Test two	Test three	Overall result
Variable change 1 ***MATERIAL***				
Plastic bag	*1.2sec*	*1.3sec*	*1.1sec*	*1.2sec*
Cloth	*0.8sec*	*0.8sec*	*0.7sec*	*0.8sec*
Paper	*0.6sec*	*0.5sec*	*0.5sec*	*0.5sec*
Variable change 2 ***SIZE***				
Large (15000cm²) Bin bag	*3.6sec*	*3.8sc*	*3.7sec*	*3.7sec*
Medium(2520cm²) supermarket bag	*1.9sec*	*2.0sec*	*1.9sec*	*1.9sec*
Small (1240cm²) tiny bin liner	*1.2sec*	*1.2sec*	*1.2sec*	*1.2sec*
Variable change 3 **STRING LENGTH**				
Long (60cm)	*4.1sec*	*4.2sec*	*4.2sec*	*4.2sec*
Medium(40cm)	*3.5sec*	*3.7sec*	*3.5sec*	*3.5sec*
Short (20cm)	*3.0sec*	*2.9sec*	*3.1sec*	*3.0sec*

Overall recommendations	MATERIAL: *Plastic bag*	SIZE: *Large*	STRING LENGTH: *Long*
Scientific rationale	*Flexible and captures air easily*	*The larger the surface area, the greater amount of air resistance*	*The longer strings enable more air to be caught by opening up the shoot more*

Possible improvements to our investigation
Drop height could have been made more accurate

What else could we have investigated?
Shape of parachute
Weight of the load