Ark Pioneer learning at Home

Core Curriculum

Science

Work to be completed

- ☐ Day One- Knowledge Organiser based revision
- ☐ Day Two- Resultant forces questions
- ☐ Day Three- Tyres and stopping distances questions
- ☐ Day Four- Extended writing questions
- ☐ Day Five- News Article
- ☐ Stretch Activity

Resources / links to help with work:

https://www.sciencenewsforstudents.org/article/smart-clothes-generate-electricity

https://www.thenational.academy/online-classroom/year-7/science#subjects

How will this work be checked?

Each week you will be given 'red pen work' to carry out corrections on the learning that you are doing at home. Please make sure this work is done and that you correct all work in your exercise book.

You must also complete the weekly quiz for your core curriculum subjects online and the link to those is on our school website in the 'quizzes' drop-down option from 'Home Learning'.

How much time should I be studying and what happens if I don't finish all my work?

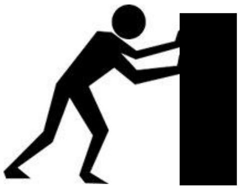
For core curriculum subjects you are expected to do 30min each day as a minimum. Those subjects are English language, English literature, Maths, Science, History and Geography. These subjects all have a weekly quiz and will be checked in on by your form teacher when they call each week.

All other subjects are 'Extended Curriculum' and they should be done after you have finished the Core Curriculum tasks for the day. You should plan to do work in different subjects each day. We recommend that pupils do one hour per week in each of the 'extended curriculum' subjects.

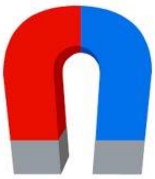
We recognise that it is not possible for all pupils to complete all work given the exceptional circumstance. Please speak with your form tutor about the work if it is becoming unmanageable.

Forces Knowledge Organiser

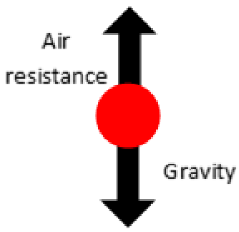
1. A **force is an interaction** (e.g. a push, pull or twist) **between 2 objects that can change an objects shape, speed or direction.**
2. Forces are either **contact or non-contact**
3. **Contact forces** need the objects to be touching.
4. **Examples of contact forces** include: drag forces, friction, air resistance, tension and normal contact forces.

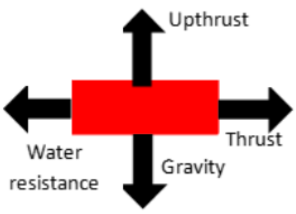


5. **Non-contact forces** can act at a distance. They do not need the objects to be touching.
6. **Examples of non-contact forces** include: gravity, electrostatic attraction and magnetism.



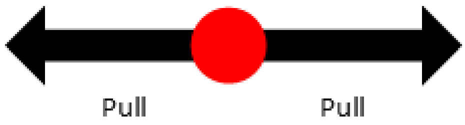
7. Forces have **size and direction.**
8. Forces acting on one object are represented by **free-body force** diagrams using arrows to show the direction and size of the forces.





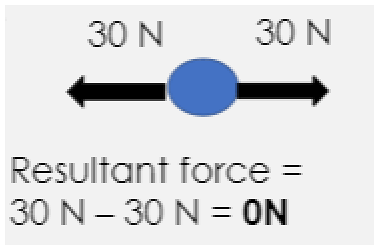
Balanced and Unbalanced forces

9. Forces are **balanced** *only* when forces acting on the same object are equal in size but opposite in direction.

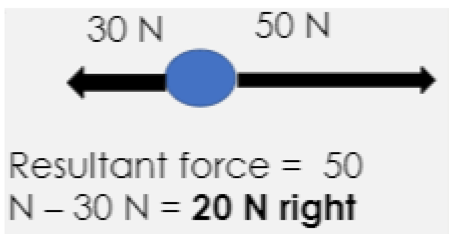


10. An object's motion or shape does not change if the forces are balanced. This means the object stays as it is (either stays still or remains moving at the same speed).
11. **Unbalanced** forces change an objects shape, speed or direction.

12. The unit of force is **Newton (N).**
13. The **resultant force** on an object is the net force.
14. **When forces are balanced the resultant force is 0N.**

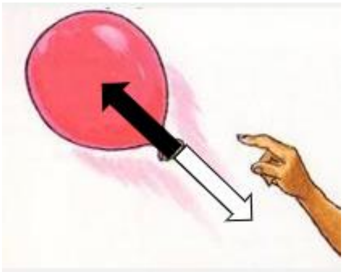


15. **When the forces are unbalanced the resultant force is *not* 0N.**



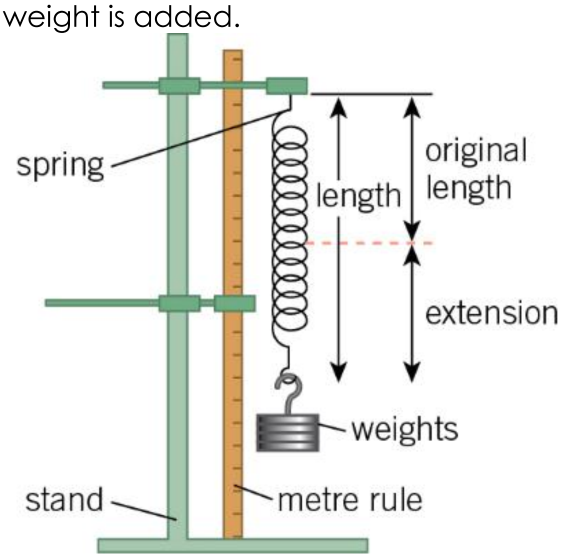
Interaction Pairs

16. **Forces *always* act in interaction pairs.**
17. Interaction pairs act on 2 different objects.
18. If A exerts a force on B, then B exerts a force on A. The forces are equal in size but opposite in direction.



Deformation

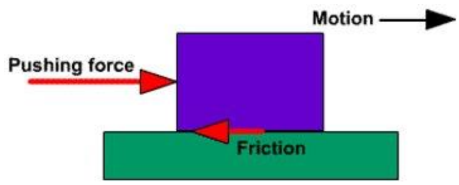
19. **Changing the shape** of an object can be called **deformation.**
20. The **extension** of a spring is an example of deformation.
21. **The extension of a spring = final length- original length.**
22. The extension of spring can be measured when different weights are added.
23. The extension is larger when more weight is added.



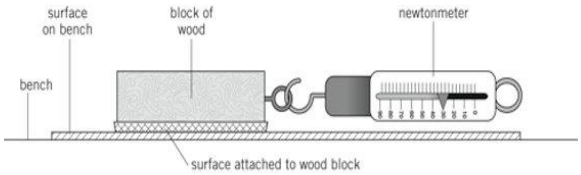
24. If too much force is added, then a spring does not return to its original shape. The spring has reached its **elastic limit**.

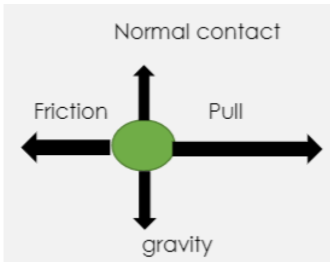
Drag Forces and friction

25. Drag forces occur in **fluids**.
26. **Fluids are liquids and gases.**
27. Drag forces include water resistance and air resistance.
28. Friction occurs between solids.
29. **Drag forces and friction are caused by interaction of 2 objects moving or trying to move over one another.**
30. Drag forces and friction act in the **opposite direction to motion**.



31. To move a block along a surface, the forces need to be **unbalanced**. The pulling force needs to be bigger than friction.





32. Rougher surfaces generate more friction than smoother surfaces.
33. Friction is reduced by adding a **lubricant**.

Day One

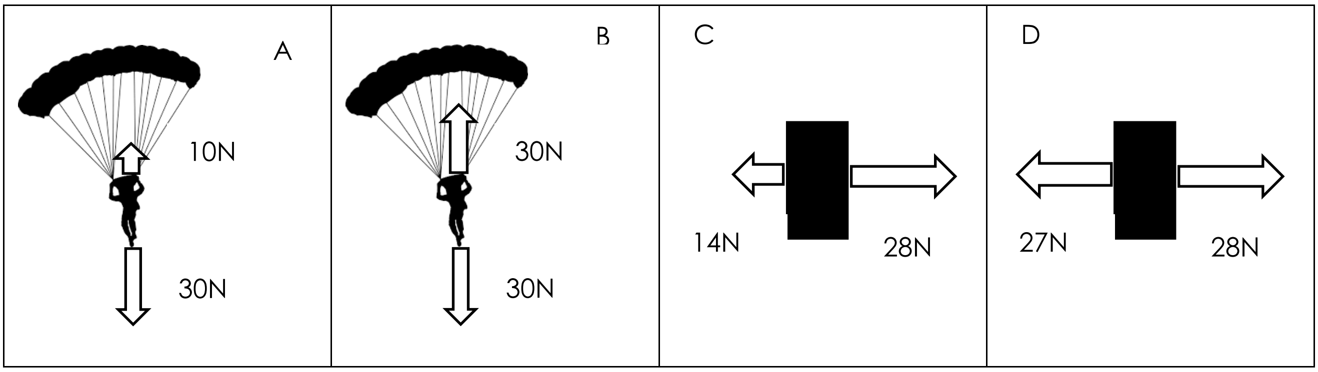
Use the knowledge organiser to test yourself on the week's questions by:

- Writing the answers in the 'Copy' column
- Cover the answer and write it out in the 'Cover, Check' column
- Check the correct answer, by marking and correcting in red pen

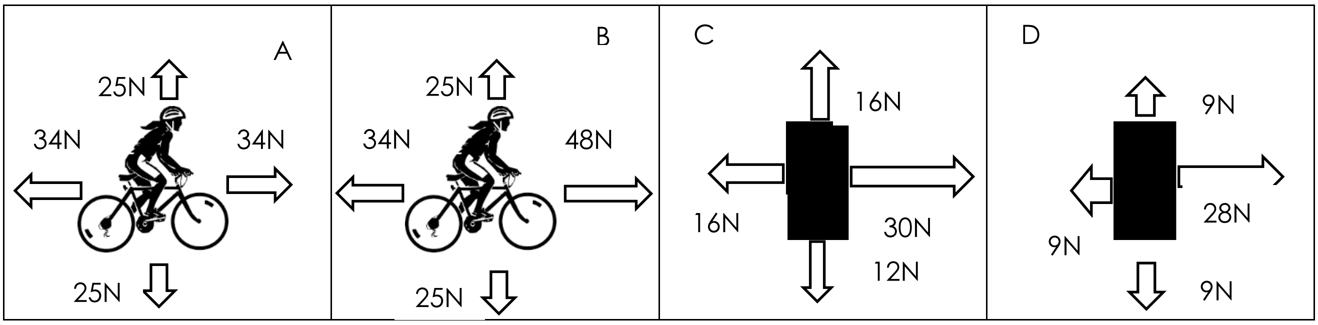
	Question	Copy, Cover	Check
	1. What unit are forces measured in?		
	2. State three examples of contact forces.		
	3. What is the difference between balanced and unbalanced forces?		
	4. Sketch a free body diagram of a parachute moving at a constant speed. Label the forces.		
	5. Sketch a free body diagram of a car accelerating. Label the forces.		
	6. What is extension?		
	7. Calculate the extension when a 4cm spring stretches to a length of 9cm.		
	8. Which direction do drag forces and friction act in?		
	9. What kind of surface generate the most friction?		
	10. What is a lubricant?		

Day Two- Resultant Forces Questions

1. Calculate the size and direction of the resultant force.



2. Calculate the size and direction of the resultant forces.



3. Circle all the pairs of balanced forces in Q1 and Q2.

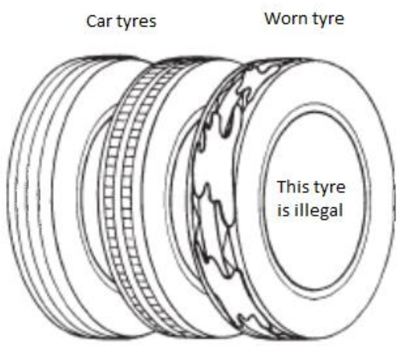
4. Explain the motion (movement) of the parachutist in Q 1B.

5. Explain the motion of the parachutist in Q 1A

6. A student looks at Q2A and says that the bike is not moving. Do you agree with them? Explain your choice.

Day Three- Tyres and Stopping Distances

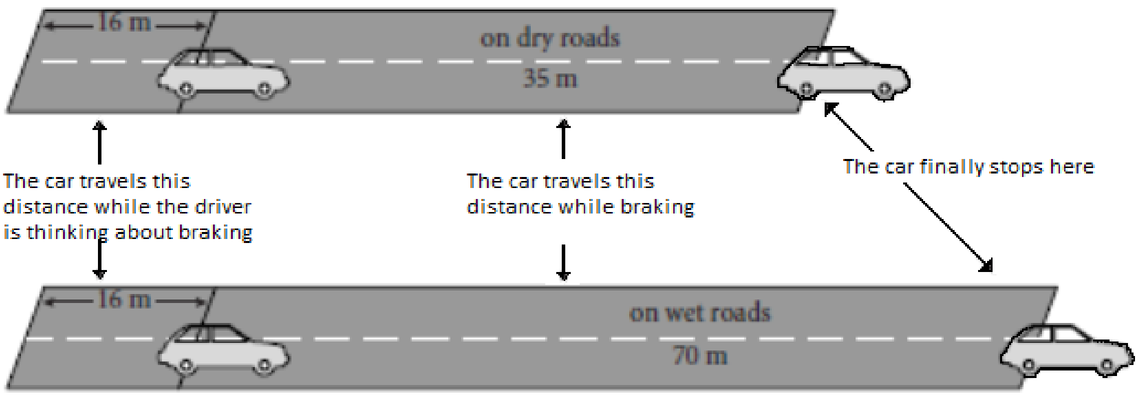
Read this information about tyres and stopping cars.



If there were no friction between the tyre on a car and the road the wheel would not grip the road, it would spin. This is what happens when a car skids. When a car skids, the driver cannot steer.

In heavy rain there is a lot of water on the surface of the roads. To stop a car from slipping, car tyres have a tread pattern which helps to clear the water from between the tyre and the road. After several thousands of miles the tread wears away until eventually the tyre has little pattern left – we say it is bald.

If a driver travels at 80km per hour (about 50mph) and something happens so that he must stop, this diagram shows how far the car travels before stopping.



<u>Answer the following questions in your book in full sentences.</u>

1. What would happen if there were no friction between the wheels of a car and the road?
2. At 80km per hour what is the shortest *total* distance a car travels before stopping on a) dry roads and b) wet roads?
3. Why should people drive more slowly in wet weather?
4. Why do car wheels often spin on icy roads?
5. Why are grit and sand put on roads in winter?
6. Why is it illegal to drive with tyres which have less than 2mm depth of tread?
7. Racing drivers often use smooth tyres in dry weather and stop to fit tyres with tread if it is wet. Explain why.

Day Four

Extended Writing Question:

A skydiver jumps out of an aeroplane. Explain what happens to the forces acting on her and subsequently her speed:

- When he initially jumps from the plane
- While he is freefalling
- When he opens his parachute

You may use diagrams to help explain. You can use all or none of the sentence starters below. Use the checklist to ensure you have fully answered the question.

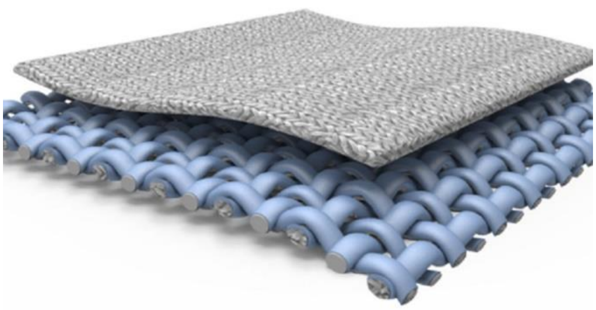
Sentence starters	Success criteria
The forces acting initially are........ *When she is freefalling, the forces......* *Her speed is......... because.........* *When she opens the parachute.........*	☐ Identify the forces acting on the skydiver ☐ Explain how the forces act on the skydiver initially ☐ Explain how the forces act on the skydiver while she is freefalling (which ones change)? ☐ Explain what happens to the speed of the parachutist as she freefalls ☐ Explain how the forces act on the skydiver when she opens the parachute (which ones change)? ☐ Explain what happens to the speed of the parachutist when she opens the parachute

Day Five

Read the news article below and then write a summary on what these scientists have been doing. You could include any of your own ideas for smart clothing or other ways you think electricity may be able to be generated using forces in the future.

'Smart' clothes generate electricity

New fabric harvests energy from its wearer



Power to the people: New material developed by physicists in South Korea generates electricity as it moves.
SANG-WOO KIM

By Stephen Ornes

March 23, 2015 at 6:00 am

You'll get a charge out of the clothes of the future. Scientists in South Korea have developed a flexible, foldable and wearable fabric that generates electricity as it bends and flexes. A person wearing a shirt tailored from the material only has to move around to power a small screen or other electronic devices.

The advance represents an important step toward making wearable power sources a reality, says Yunlong Zi. He's a physicist at the Georgia Institute of Technology, in Atlanta, who did not work on the new fabric. In his own lab, he studies ways to harvest energy. "Cell phones need batteries, but batteries have limited life," he notes. With clothing that can generate electricity, he notes, that's no longer an issue: "You can make power by yourself."

Sang-Woo Kim led the development of this new material. He works at Sungkyunkwan University in Suwon, South Korea. A shirt made from the new fabric can be worn — even patched — like any other item of clothing. "It feels like an ordinary jacket," he told *Science News for Students*.

Fully equipped, it's just a tad on the heavy side, he acknowledges. That added weight comes from the electronic gizmos the researchers wired into the shirt. For tests, these included small screens, lights and even a keyless remote. Press the shirt's cuff, for instance, and the remote unlocks a car's doors.

How it works

The power-generating material is known as a wearable triboelectric (TRI-bo-ee-LEK-trik) nanogenerator, or WTNG. Here's what that means: Triboelectricity refers to electricity generated by *friction*. Friction is the resistance encountered when one material moves over or through another material. People feel friction (in the form of heat) when they rub their hands together. In fact, the prefix *tribo* comes from the Greek word for rubbing. Meanwhile, *nano* is a prefix meaning a billionth. The material includes tiny zinc-oxide rods only billionths of a meter long. Those spiky nanoparticles help convert motion into electricity.

Some kinds of triboelectricity are familiar. When a person rubs her head with a balloon, her hair stands on end. That's because the balloon "steals" negatively charged particles called electrons from her hair. The balloon ends up with a negative charge. The hair with a positive charge. Opposite charges attract. So the positive hair stands up to reach the negative balloon. This is static electricity, and it is triboelectric.

The new fabric combines different materials. The top and bottom layers are a cloth coated with silver. The middle layer contains the zinc oxide coated with a polymer. (A polymer is a substance whose molecules are made of long chains of repeating groups of atoms.)

When the fabric bends or moves, the coated rods move back and forth against the silver. The movement produces a reaction similar to that in the hair-and-balloon example. Here, it's the polymer layer that picks up electrons from the silver layer.

The researchers connected the two outer silver layers with a wire. The wire lets a small electric current run through it. As they compressed and released the fabric, the scientists measured that current. Multiple layers of WTNG produced more electricity than single layers, they showed.

The smart shirt generated enough electricity to power a small screen. It glowed. The shirt also lighted up an array of small light-emitting diodes. And it powered the keyless remote. In the near future, Kim's team wants to develop textile-based batteries. These should be able to store energy. For now, the shirt only works when someone is moving. The researchers also are working on a washable version.

The first flexible electronics appeared only a few years ago, and only in the lab. Researchers hope to use the technology to build wearable electronics, including medical sensors that stick to the skin. These currently require an external power source. By taking mechanical energy that would go to waste and converting it to electricity, WTNGs might one day give people the power to recharge our own electronic devices as we move throughout the day.

Power Words

battery A device that can convert chemical energy into electrical energy.

electric charge The physical property responsible for electric force; it can be negative or positive.

electric current A flow of charge, called electricity, usually from the movement of negatively charged particles, called electrons.

electricity A flow of charge, usually from the movement of negatively charged particles, called electrons.

electron A negatively charged particle, usually found orbiting the outer regions of an atom; also, the carrier of electricity within solids.

friction The resistance that one surface or object encounters when moving over or through another material (such as a fluid or a gas). Friction generally causes a heating, which can damage the surface of the materials rubbing against one another.

generator A device used to convert mechanical energy into electrical energy.

light emitting diodes (LEDs) Electronic components that, as their name suggests, emit light when electricity flows through them. LEDs are very energy-efficient and often can be very bright. They have lately been replacing conventional lights in auto taillights and in some bulbs used for home lighting.

nano A prefix indicating a billionth. In the metric system of measurements, it's often used as an abbreviation to refer to objects that are a billionth of a meter long or in diameter.

physicist A scientist who studies the nature and properties of matter and energy.

polymer Substances whose molecules are made of long chains of repeating groups of atoms. Manufactured polymers include nylon, polyvinyl chloride (better known as PVC) and many types of plastics. Natural polymers include rubber, silk and cellulose (found in plants and used to make paper, for example)

sensor A device that picks up information on physical or chemical conditions — such as temperature, barometric pressure, salinity, humidity, pH, light intensity or radiation — and stores or broadcasts that information. Scientists and engineers often rely on sensors to inform them of conditions that may change over time or that exist far from where a researcher can measure them directly.

static electricity The buildup of excess electric charge on some surface instead of flowing through a material. This charge buildup tends to develop when two things that are not good conductors of electricity rub together. This allows electrons from one of the objects to be picked up and collected by the other.

triboelectric A term for an electric charge that develops when two things rub against each other, causing friction.

zinc oxide A chemical — with the formula ZnO — made when one atom of zinc bonds to an atom of oxygen. Its reflective properties make zinc oxide useful in a range of products, from paints to sunscreens. Its germ-killing properties make it useful in some medicines or cosmetics. In foods, it can even be used as a source of the mineral zinc.

Stretch Activity

https://www.thenational.academy/online-classroom/year-7/science#subjects

Click the link above to visit the year 7 section from Oak National Academy. Lessons 1-4 in the forces section are relevant to this workbooklet.. Lessons 5 onwards in the forces section is based on work we will cover in year 8.