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| **Topic: P7: Forces 2 (12 lessons)**In this unit you will expand upon the introduction to forces you had in Year 7. You will use your knowledge of resultant forces to investigate why objects float. We will then learn about how pressure affects our everyday life, and the opposing challenges pressure causes in space and deep in the ocean. You will investage how energy and force are related and use two equations at once! We will finish the unit by highlighting why laws of the road are so vital to saving lives.  |
| **Core Questions for the Unit** | Core questions:1. How do objects of different weights float?
* Define Upthurst
* Describe how to calculate weight.
* Explain how balanced forces lead to objects floating.
1. What effects the pressure of a surface?
* Define pressure
* Use and rearrange the pressure equation.
* Explain how pressure is accounted for in everyday life.
1. How does water depth affect pressure?
* Describe how pressure changes with depth.
* Explain what causes the pressure changes.
* Apply this to submarine design.
1. How does pressure change in space and on different planets?
* Identify the different pressures in space
* Comprehend information on pressure effects on the body.
* Apply this to spacecraft and spacesuit design.
1. In what way are force and distance related to energy?
* Define work
* Use and rearrange the work, force, distance equation.
* Explain the link between J and Nm
1. How do levers and seesaws work?
* Define a moment
* Resolve moment equation problems.
* Calculate the weight of a block using moments.
1. What are elastic objects?
* Define an elastic object.
* Describe using examples how force causes an object to change shape.
* Link force to energy.
1. How does the force on spring affect its extension?
* Plan an investigation.
* Investigate how force effects the extension of a spring.
* Draw conclusions from a plotted graph.
1. How is speed shown on a graph?
* Describe the parts of a speed-time graph.
* Calculate acceleration using the gradient
* Compare speed and velocity.
1. What are newton’s laws?
* Describe Newton’s 3 laws
* Demonstrate newtons 3 laws
* Use and rearrange f= m x a
1. What affects the stopping distance of a car?
* Identify the factors that effect TD, BD and SD
* Describe how they affect SD
* Evaluate UK driving laws.
1. What are the safety features of cars?
* Describe safety features on cars,
* Explain how they protect from accidents and injury during accidents
* Apply knowledge to design a car.
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| **Links to other subjects** | Geography – Different ocean depths.Chemistry – States of matter.Technology – Car, submarine and spacecraft design.Space – Pressure on different planets and in the vacuum of space.Biology – Effect of increased and decreased pressure on the body. |
| **Scientific skills** | * Investigation on moments and spring constant will use data collection and plans to test variables.
* Conclusions will be made after plotting a graph on force vs extension.
* Communicate ideas in evaluation writing and presentations on safe car design.
* Risk assessment for hooks law practical.
* Evaluate resources on pressure changes.
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| **Development of new knowledge****)**  | * Moment as the turning effect of a force
* Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water
* Forces measured in newtons, measurements of stretch or compression as force is changed
* Force-extension linear relation; Hooke’s Law as a special case
* Work done and energy changes on deformation.
* Simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged
* Pressure in liquids, increasing with depth; up thrust effects, floating and sinking
* Pressure measured by ratio of force over area – acting normal to any surface
* Pressure changes in the solar system are a big challenge for spaceflight.
* The Earth and the moon exert a force each other due to Newton’s 3rd law.
 | **Strengthening of prior****knowledge** | Year 7 * Forces as pushes and pulls, arising from the interaction between two objects
* Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces
* Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity
* The force of gravity changes across the universe which is made of groups, galaxies and solar systems.
* Speed and the quantitative relationship between average speed, distance and time
* The representation of a journey on a distance-time graph
* Relative motion: trains and cars passing one another
* Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only)
* Change depending on direction of force and its size.

YEAR 5 Is able to describe how some forces act upon stationary and moving objects (e.g. friction, air resistance, water resistance etc.)Is beginning to understand how levers, pulleys and gears allow a small force to have a greater effect. YEAR 3Can demonstrate an understanding of how different surfaces affect how objects move across them.Demonstrates an understanding of friction as a force acting between two objects in contact and magnetic force as a force acting at a distance.YEAR 2Shows an understanding in the difference between push and pull forces.Is able to describe the direction of movement associated with push and pull forces.Shows an understanding of the effect of gravity on objects.Is beginning to understand friction as a force that acts to slow down a moving object. |
| **Vocabulary:**These are the main words we will be using. | **Tier 2 Words:**Law Justify Form Standard BalancedUnbalanced Conclude Evaluate Investigate Variable Rotate Constant  | **Tier 3 Words:**Work Energy Joule NewtonUpthrust Moment Deform Extension. | **Reading Opportunities****Numeracy Opportunities**  | **Reading**:<https://www.cnet.com/news/what-happens-to-the-unprotected-human-body-in-space/> - Pressure in space. <https://www.telegraph.co.uk/travel/cruises/news/inside-symphony-of-the-seas-worlds-largest-cruise-ship/> - Cruise ship<https://sciencing.com/can-oceans-pressure-crush-you-12458.html> - Pressure in the ocean<https://spaceplace.nasa.gov/jupiter/en/> Pressure on Jupiter<https://news.softpedia.com/news/Why-Cheetah-is-the-Fastest-Land-Animal-69322.shtml> Spine of a Cheetah <https://www.nasaspaceflight.com/2020/05/virgin-orbit-first-orbital-launch-launcherone/> - Rocket launch<https://www.edgarsnyder.com/car-accident/cause-of-accident/cell-phone/cell-phone-statistics.html> - Car accident**Maths:****Unit conversion (link to year 7 and 8)** **Rearrange equations (link to year 7 and 8)****Graph drawing**  |
| **The activities you are likely to do in lesson.** | 1. How do objects of different weights float?
* DIN – knowledge question of this unit and previous units with maths and challenge questions.
* Link it – recap of the types of forces and definition of Upthrust, recalling of the weight equation.
* Reading opportunity on large cruise ship <https://www.telegraph.co.uk/travel/cruises/news/inside-symphony-of-the-seas-worlds-largest-cruise-ship/>
* Think, pair, share on how different boats float and linking back to balanced forces.
* Flow map on how to work out the upthrust on a boat using knowledge of balanced forces.
* Calculate the weight of the boat using m x g.
* RIN – Recap questions, especially on the variables investigated and the types of forces.
1. What effects the pressure of a surface?
* DIN – knowledge question of this unit and previous units with maths and challenge questions.
* Decode of pressure
* Think pair share of video, why can we lie on a bed of nails?
* Dual coding of sharp and blunt objects.
* What factors effect the pressure and introduce calculation to rearrange with unit conversions.
* Maths link to surface area.
* Apply knowledge to work out the best lorry for driving across the ice.
* RIN – checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning.
1. How does water depth affect pressure?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Link back to particle model of solids liquids and gases.
* Decode on depth.
* Show pressure tower and explain the pressure differences.
* Active reading of water pressure in the deep ocean. <https://sciencing.com/can-oceans-pressure-crush-you-12458.html>
* Cause and effect map of pressure on the human body.
* RIN - checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning.
1. How does pressure change in space and on different planets?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Link back to planets in the solar system and the atmosphere on them/ pressure and depth from last lesson.
* Think, pair, share – Jupiter is made of gas, can you fall through it ?
* Reading opportunity – Pressure on Jupiter - <https://spaceplace.nasa.gov/jupiter/en/>
* DART – body in space - <https://www.cnet.com/news/what-happens-to-the-unprotected-human-body-in-space/> -
* Calculations of pressure at different depths on different planets.
* Write a letter activity to astronauts who want to visit Jupiter.
* RIN – checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning.
1. In what way is force and distance related to energy?
* DIN- knowledge question of this unit and previous units with maths and challenge questions
* Decode on work
* Link back to the units of energy and forces.
* Think, pair, share what objects do work – bubble map on this.
* Introduce the nm, highlight that nm = nxm for calculation, link nm to joules
* Work calculations using real life examples (pupils use objects and calculate their weight)
* RIN - Checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning.
1. How do levers and seesaws work?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Link to balanced forces
* Think pair share on how a crane balances/ dual coding on how a crane balances.
* Decode on moment
* Calculate simple moments using practical equipment (see-saws, toy cranes ect)
* Challenge – resolve moment problems using conservation of moments.
* Use examples to explain why the law of moments is important (opening doors ect)
* RIN- checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning.
1. What are elastic objects?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Decode on elastic.
* Bubble map of everyday elastic objects.
* Video questions on golf ball / Link back to elastic energy.
* Active reading on spine of a Cheetah <https://news.softpedia.com/news/Why-Cheetah-is-the-Fastest-Land-Animal-69322.shtml>
* RIN - checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning
1. How does the force on spring affect its extension?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Tree map on elastic and inelastic.
* Decode on constant.
* Link back to variables and their definitions.
* Plan investigation on force vs extension (can use flow map or gap task)
* Use m x g to calculate weight.
* Plot graph after link back to success criteria
* RIN- Checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning
1. How is speed shown on a graph?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Link back to SDT equation and what the units are.
* Link back to a distance time graph.
* Dual coding on speed/ time graph
* Double bubble map on DT and ST graphs.
* Class models examples and then draws/ uses some for questions.
* Link back to acceleration and gradient.
* RIN- Checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning
1. What are newton’s laws?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Link back to balanced forces and newtons first law.
* Decode on law
* Model how far pupils travel on a chair.
* Introduce f = mxa from this discussion.
* Define Newtons 3rd law and link to the chair modelling.
* Reading opportunities on rocket launches. <https://www.nasaspaceflight.com/2020/05/virgin-orbit-first-orbital-launch-launcherone/>
* F = m x a calculations (Challenge – link this to other acceleration equation/compound equation)
* RIN- Checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning
1. What affects the stopping distance of a car?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Think pair share on two vehicles and which would stop.
* Link to biology and reaction times – can look at range and mean here too.
* Bubble map on the factors affecting stopping distances use echalk game.
* Tree map on TD, BD and SD
* RIN- Checkpoint quiz on the previous lessons/ 2 stars and a wish on work/ exam style question/ review of learning
1. What are the safety features of cars?
* DIN – knowledge question of this unit and previous units with maths and challenge questions
* Active reading on car accident report. <https://www.edgarsnyder.com/car-accident/cause-of-accident/cell-phone/cell-phone-statistics.html>.
* Cause and effect map of a safe car.
* Students design a safe car.
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| **How you will be assessed.** | You will be assessed by: * A retrieval quiz during the Do It Now of every lesson.
* Mini quizzes and challenges during lesson.
* A progress assessment in the middle of the unit – Here we will reflect and improve on key areas and complete DIRT work.
* An end of unit assessment that assesses your knowledge and skills that you have built in this unit and previous units that we link back to.
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