P1 – Forces and Space

Number of weeks (between 6&8)	**Content of the unit**	**Assumed prior learning** (tested at the beginning of the unit)
7 weeks 28 lessons	• Forces and their effects • Moments and levers • Solar system • Days, years, seasons • Gravitational field strength	• observe changes across the four seasons • observe and describe weather associated with the seasons and how day length varies • describe the movement of the Earth, and other planets, relative to the Sun in the solar system • describe the movement of the Moon relative to the Earth • describe the Sun, Earth and Moon as approximately spherical bodies • use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.
Assessment points and tasks	**Written feedback points**	**Learning Outcomes** (tested at the end and related to subject competences)
- Pre-unit test (baseline) - P1 GAT (formative) - 6 mark question (formative) - Scientific skills investigation (formative) - End of unit test (summative)	- diagnostic marking on badger - diagnostic marking on 6 mark question - diagnostic marking on skills investigation - feedback on progress after end of topic test (*these opportunities in AfL column)	I can state that a force acts as a push or a pull I can state that forces are measured in Newtons I can list some forces I can describe the effect of friction between surfaces I can state that forces are either contact or non-contact I can state that a force may affect the speed, direction or shape of an object I can state that forces occur when two objects interact I can describe forces using force arrows diagrams I can describe forces in terms of deforming objects I can describe objects in terms of stretching objects I can explain ways to reduce or increase friction as necessary I can discuss applications of friction I can identify if a particular force is contact or non-contact I can describe levers as uses of moments I can state that a moment is the turning effect of a force I can describe how to increase or decrease a moment I can explain when a force is balanced or unbalanced I can describe resultant force I can describe Hooke's Law I can describe the effects of air or water resistance I can explain ways to reduce or increase air or water resistance as necessary I can calculate extension of springs using Hooke's Law I can calculate resultant force I can calculate moments I can explain how levers work to multiply force I can calculate resultant moments I can interpret resultant forces to predict the effect on an objects motion I can explain the resultant effect of two opposite moments I can apply Hooke's Law to the measurement of forces using a force meter

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		I can identify gravity as the force which exists between the Moon and the Earth and between the Sun and the Earth I can list the planets in our solar system in order I can state that light travels very fast, at the speed of light I can state that on Earth, a day is 24 hours I can list the seasons of the Earth in order I can state that on Earth, a lunar month is 28 days I can state that on Earth, a year is 365 days I can describe celestial bodies in order of magnitude I can state that gravity always pull towards the centre of the object I can describe a solar system as a collection of planets and other objects orbiting a star I can explain that our Sun is a star, that there are other stars and solar systems in our galaxy and other galaxies in the Universe I can state that gravity is a non-contact force that will affect objects within the gravitational field I can describe a day as the time taken for the Earth to spin once on it's axis I can describe a lunar month as the time taken for the Moon to orbit the Earth I can describe a year as the time taken for the Earth to orbit the Sun I can state that the Earth is tilted on it's axis I can describe how the seasons are due to the orbit of the Earth around the Sun and the fact the Earth is tilted on it's axis I can state that all objects have a gravitational field, some will be stronger than others I can state that the gravitational field strength of the Earth is 10 N/kg I can describe weight as the force a object experiences due to a gravitational field pulling on it I can describe how the gravitational field strength of an object changes due to the size (mass) of the object I can calculate weight when given mass and gravitational field strength I can describe how the movement of light is measured in light years, and that this is a measurement of astronomical distance and not time I can explain the difference between a calendar and a lunar month I can explain how the different seasons occur in the northern hemisphere, with reference to the tilt of the Earth and proximity to the Sun I can state that light and heat energy travels to earth from the Sun as an electromagnetic wave (link to Light unit) I can explain the existence of a leap year, with reference to the fact that an earth year is actually 365.25 days I can explain that a light year is how far light travels in one year I can apply knowledge of the seasons in the northern hemisphere to explain why the southern hemisphere experiences seasons differently

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Lesson	Clear learning intentions (KQ)	Clear success criteria (Bands) (Keywords)	Hook (starter)	Presentation of content (teacher input)	Guided practice (pupil activities)	Requisition (per group)	Independent practice (homework)	Closure (AfL)
1. Pre unit test	How much do I know from KS2?	To complete exam	Word-search on keywords from KS2	Mind map of what pupils remember from KS2 as refreshers before exam	Pupils complete baseline test in silence		None	Pupil complete sentences: *One thing I know about this topic is…* *One thing I don't understand is…* *One question I have is…*
2. Force	What is a force?	I can state that forces a measured using a Newton meter and measured in Newtons (G) I can list some contact and non contact forces (F) I can evaluate whether a force is contact or non contact (E) I can analyse which forces act on real life objects, including the reaction force (D)	All: Draw and label the forces on a ball on a shelf (to be improved throughout the first few lessons) No differentiation needed as this is to gauge prior knowledge	Introduce Newton and Newtonmeters (show a Newtonmeter and pass some around) Introduce various types of force Lead white board dual	Student discuss points in pairs Students answer differentiated questions from slide board White board dual Peer marking each other's starter	Newton Meters to pass around		AFL - Peer assessment using a success criteria
3.	What are balanced forces?	I can carry out a practical to show the effects of a force (F) I can recall that objects at rest have balanced forces (E) I can explain that objects at steady speeds also have balanced forces (D) I can design a practical to show that objects are steady under balanced forces (C)	Introduce Newton and a basic version of his 'Very first law'. (objects with balanced forces are **still** or moving with a **steady speed**)	Introduce Newton's idea and set up practical	Two investigations to discover whether Newton is correct, using newton meters. Show that forces are balanced on a still object, and show that forces are balanced on an object moving at a steady speed. Differentiated into bronze/silver and silver/gold	Plastic tray, weights and two newton meters per group. Suggested group size is 3.		Whole class AFl using mini white boards Quick quiz Feeling comment question.

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4.	Can I draw force diagrams?	I can draw force arrows correctly (E) I can use arrows to show when forces are balanced or unbalanced (D) I can evaluate real life situations using force arrows (C)	Introduce FORCE GOGGLES (with them on you see objects with force arrows on them)	Teacher gives force diagrams to students. Force diagrams: Teacher goes through the rules: • Use a ruler and pencil • The size of arrow shows the size of the force. • The direction of the arrow shows the direction of the force. Lead planner AFL task on slide	Students to use planners to show how to draw diagrams Students to act out someone putting on force goggles, whilst the others put the correct arrows on objects around the room. Students to peer assess yesterday's starter and correct their own to show they can use force arrows	Goggles		
5.	What are unbalanced forces?	I can state that unbalanced forces cause objects to change their speed, direction or shape (F) I can describe how unbalanced forces will affect an object's speed (E) I can demonstrate my understanding using force arrow diagrams? (D) I can apply my understanding to challenging, real life situations? (C)	Videos to show changing shape and direction (changing shape to be revisited in hookes law lesson) Lesson to focus on changing speed	Teacher introduces unbalanced forces and acceleration and declaration. Using slides and toy car demo. Whole class response system using whiteboards, deceleration vs acceleration	Lower: students to act out force goggles again but this time showing changing arrows with changing speed. Higher; to complete group activity on descriptions of unbalanced forces on balls			

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6.	What is the resultant force?	I can state what a resultant force is (F) I can calculate the size and direction of a resultant force (E) I can analyse how an object's speed will be dependent on its resultant force (D)	Recap the three things that unbalanced forces do	Introduction with slides. (Stating that resultant forces do the same as unbalanced forces, as resultant forces are the RESULT of unbalanced forces). Simple resultant force maths questions with white boards Provide questions and answers	Students in groups complete questions around the room about resultant forces – some GCSE questions. Resultant forces dance mat plenary: https://www.youtube.com/watch?v=ZlyYFWAYrSY (Make sure kids are aware that the arrows are drawn incorrectly, a bigger force should be a longer arrow, perhaps it can be an extension to say what is wrong with the video?)	N/A		AFL – self assess the questions around the room MINI white boards- Check if students can calculate a resultant force and the consequential direction. Whole class – Resultant force Dance mat
7. Friction Investigation	How do we plan an investigation?	I can **describe** some safety precautions during scientific investigations (H) I can **identify** the independent and dependent variables in an investigation (F) I can **identify** the control variables in an investigation (E) I can **explain** the importance of control variables (B)	Mind map all the forces you can think of Think pair share - how can we increase and reduce the effects of friction?	Starter: What is friction? Think, pair, share. Fill in the blanks, worksheet on friction. Friction a friend or enemy? Whole class AFL – Miniwhiteboards	Students look at pictures and in pairs discuss if friction is a friend or enemy, student will then write down their ideas in a table in full sentences. Students: Plan a hot wheels loop ramp that allows cars to go all the way around the loop Differentiation/extension: To think about when completing the project: What are you trying to measure in this challenge? How can you use the cars and the materials to test friction? How will you know if there is more or less friction?	Students will be given: A toy car A ramp 4 Different materials A metre ruler A pencil and paper		Mini white boards Peer assessment of exam answers using a success criteria

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8.	How do we represent our results?	I can **apply** mathematical concepts to calculate results (average) (H) I can **present** observations and data using an appropriate table (F) I can **present** observations and data using an appropriate line graph (D)						Peer assessment
9.	How do we write an evaluation and conclusion?	I can **interpret** observations and data to identify simple patterns of correlation (G) I can **draw** more complex conclusions from the interpretation of data (D) I can **present** reasoned explanations of conclusions from data, in relation to predictions and hypotheses (C) I can **evaluate** data, with reference to potential sources of random and systematic error (B)						

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10.	What is deformation?	G I can recall that unbalanced forces cause objects to either change shape or break F I can think of every day objects that either change shape or break E I can explain that some objects return to their original shape after force, these are 'elastic'. D I can see a relationship between the force on an object and the amount an elastic object stretches C I can create an equation to describe the relationship between force and extension				Slinky, playdough, matchstick		
11.	Hookes law	I can describe Hooke's Law (F) I can calculate extension of springs using Hooke's Law (E) I can apply Hooke's Law to the measurement of forces using a force meter (D)	Starter graphs – students match up graphs to a description of the graph.	Teacher provides equipment and talks through hookes law. Crane material and questions are around the room AFL- Peer assessment- Check each other's graphs using a success criteria Self assessment – students check their answers	Students carry out a practice using a spring and weights. They then gather their results and draw a Graph. Students then describe the graph using the key words from the lesson Students complete a worksheet which applies the concept of hookes law using a crane.	Spring, weights, pencils, rulers and graph paper		Self and peer of graph work Students use mini white boards to spot the mistakes in a poorly drawn graph
12.	What affects pressure?	I can state that pressure depends on force and area (F) I can experiment to find my own pressure (E) I can explain what happens to pressure if force increases or area decreases. (D) I can rearrange a math equation to find pressure (C)	Starter- Students put objects in order of how painful they would be	Teacher talks through pressure and runs whiteboard challenge. Teacher runs practical for students to find their own pressure.	Students discuss concepts, take part in white board challenge, fill in blanks and carry out practical.	Square paper, weighing scales, calculators.		

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13. Terminal Velocity	What forces act on a parachute?	I can draw a force diagram to show the forces acting on a falling object (F) I can describe the changes in forces that happen as an object falls (E) I can explain how an object reaches terminal velocity in terms of the forces acting on it (D)	Hold up two identical bottles, one filled (with sand, rocks or even just water) and one empty. Class take bets on which will drop first. Stand on chair and drop them (They land at the same time!) This demo should capture attention, and also show them that physics may need them to re think their previous ideas and not make assumptions. Explanation of this would definitely be an extension*	Human demo with one student representing sky diver and other students representing air particles. Show that as sky diver moves slowly through particles, the force of air resistance is small. However, this force increases with their speed. Videos of sky diver		*Explanation: In a vacuum, all objects accelerate at 9.8m/s/s (gravity). Regardless of their mass. If we use bottles with similar air resistance then we can witness this effect. Extension- if you drop them out of a window the heavy one will land first. This is because there is a larger downward force on the heavier one, so it takes longer for air resistance to balance it. So its final velocity will be higher.		
14. Weight and Mass	What is gravitational field strength?	I can state that the gravitational field strength of the Earth is 10 N/kg (F) I can describe how the gravitational field strength of an object changes due to the size (mass) of the object (E) I can calculate weight when given mass and gravitational field strength (D)	Students look at the size of an object and predict which has the greatest gravitational pull.	Different gravitational strengths are around the room, students go around and calculate the weight of themselves on different celestial objects Whole class AFL- Students calculate the weight of object 'x' on different gravitational strengths using mini whiteboards.	Students weigh themselves and calculate their weight on earth by measuring their mass and X10 Students then use their mass and calculate their weight on different planets.	Weighing scales.		Whole class AFL- Students calculate the weight of object 'x' on different gravitational strengths using mini whiteboards.
16.	GAT – What level am I working at?	Complete the GAT to my Level	Students self-assess preparation for GAT homework task	Conduct the GAT	Complete the GAT	N/A		Peer assessment

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16. Solar System	What is in our solar system?	I can list the planets in our solar system in order (G) I can put the obecjts in the solar system in roder of size (F) I can describe how objects stay in orbit due to gravity (E) I can explain how gravity varies for different objects in the solar system (D)	Name as many planets as you can. What is the correct order Use the Song	Video- of our solar system Students have a look at the heliocentric and geocentric model and discuss why the heliocentric model is correct. Students use their knowledge from forces to understand what keeps the planets in orbit	Students discuss and present reasons for why people may have accepted certain theories. Make notes from the video	N/A		Mini-whiteboards on students knowing the order of planets and images of planets
17. Life cycle of a star?	Do stars die?	I can name celestial bodies in the universe in size order (F) I can describe the sages of a star like our Sun (E) I can describe the stages of different sized stars (D) I can explain the forces acting on a main sequenxe star (C)	Put objects into order of size from largest to smallest- DNA, Human, Astroid, Earth, Jupitor, Sun, galaxy, Universe	Video of the universe Provide questions on the universe Whole class AFL multiple choice questions about the size of objects	Students look at different types of stars Students make a poster showing celestial bodies	3 ballons anda ball bearing x 10		Whole class AFL on the magnitude of celestial objects
18. Changing Universe	How did our universe begin?	I can state the Big Bang theory as the origin opf the Unrverse (F) I can describe how the Universe is changing today (E) I can give and justify my opinuion on the origins of the Universe (D)						

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19. Red Shift	What is the evidence for the Big Bang?	I can state the colours in a spectrum (F) I can state 2 peieces of evidence that the universe is explanding (E) I can describe the Doppler effect (D) I can explain the concept of red shift and blue shift (C)	Write down the colours of a spectrum	Teacher- teacher plays the video of an ambulance and all the students have a correct colour spectrum Information broken down about red shift and blue shift using a colour spectrum and wavelength.	Students make the colour spectrum Listen to an ambulance siren and describe how the sound chances when the ambulance passes using the key words high frequency and low frequency. Look at galaxies that show red shift and blue shift.	Prisms Modelling red shift with balloons: http://www.schoolsobservatory.org.uk/astro/cosmos/uniball		Mnemonic Self-assessment, peer assessment
20.	6 mark question	I can score 1-2 marks on the 6 mark question (F) I can score 3-4 marks on the 6 mark question (E) I can score 5-6 marks on the 6 mark question (D)	Pupils draw the life cycle of a star on min-whitebboard. Peer-assess	**Silver**: I can describe the stages of the lifecycle of a satr like our Sun. **Gold**: I can describe the stages of the lifecycle of a satr like our Sun and explain each stage in terms of forces acting.	Model 6/6 answer. Pupils make notes of scienctifit terminology. Pupils plan structure. Pupils write answer.			Peer-assess SPAG.
21. NASA	What do NASA take into consideration when launching a rocket?	I can state the forces applied to a rocket (F) I can design a rocket taking into account the forces acting upon the rocket (E) I can explain when rocket is balanced and unbalanced using key terms and names of forces (D)	Word search Words to look for: NASA, friction, air resistance, gravity, pressure, particles, force, Newton, MrIbrarIsAmazing ☺	Teacher shows a video of a rocket launch by NASA and a water rocket the students will design in teams. Success criteria -Design -Aerodynamic - Quantity of water that might be needed Team work	Students in their teams will design a rocket to taking into account all the forces	PE department to use the playground the next lesson or possibly the park to launch the rockets. Buckets of water.		Peer assessment – rocket designs using a success criteria
22. Rocket	Can I launch my rocket the furthest?	I can launch a rocket (F) I can analyse results to see which rocket was the best (E) I can evaluate my design and make improvements (D)	Safety rules.	Water, measuring cylinders, success criteria.	Calculate the amount of water needed and play a knockouts tournament to see who's rocket travels the highest.	Strong pumps (not the one cylinder pump) a proper pump. Rocket kit Water	Pumps, water bucket, health and safett requisition as students could go to the park.	Self-assessment of calculation and peer assessment of competition

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23.	Revision							
24.	End of topic test -What grade am I working at?	Complete the test	Peer assess homework or 6 marker	Conduct the test	Pupils complete the test.			Self-assessment