

## P2.5 Forces REVISION

<b>Forces</b>	
1. What is the difference between a scalar and vector quantity?	Scalar quantities only have magnitude, vector quantities have magnitude and direction
2. What is a force?	A push or pull that's acts on an object A vector quantity
3. What is a contact force? Give an example	A force between objects that are physically touching. Friction, air resistance, tension
4. What is a non-contact force? Give an example	A force between objects that are physically separated. Gravitational, electrostatic or magnetic force
5. What is a resultant force?	A single force which is the result of 2 or more forces acting on an object
6. How do you calculate the resultant of 2 forces that act in a straight line?	Force in 1 direction – the force in the other direction
<b>Weight and gravity</b>	
7. What is weight?	The force acting upon an object due to gravity
8. Where does weight act on an object?	On the object's 'centre of mass'
9. Describe the relationship between the weight and mass of an object	Directly proportional
10. What is the equation, with units, used to calculate weight using mass and gravitational field strength? (2 marks)	Weight (N) = mass (kg) x gravitational field strength (N/kg)
11. What does the weight of an object depend on?	The gravitational field strength where the object is
12. How do you measure weight?	With a Newtonmeter (calibrated spring-balance)
<b>Work done</b>	
13. When is work done on an object?	When a force causes an object to move through a distance
14. What is the equation, with units, used to calculate work done from force and distance? (2 marks)	Work done (J) = force (N) x distance (m)
15. One joule of work is done when a force of one newton causes a displacement of ...	One metre
16. Describe the energy transfer involved when work is done on an object	Work done against the frictional forces acting on an object Causes the temperature of the object to increase
17. One joule is equal to how many newton-metres?	One newton-metre
<b>Elastic objects</b>	
18. What three things can you do to an object to change its shape?	Stretch, bend or compress
19. How many forces need to be applied to change the shape of an object?	At least 2 Because otherwise the object would move
20. What is elastic deformation?	When a material returns to its original shape once the force which causes the deformation is removed
21. What is inelastic deformation?	When a material remains permanently deformed once the applied force is removed

22. The extension of an elastic object is .....1..... to the force applied provided that the .....2..... is not exceeded	1. Directly proportional 2. Limit of proportionality
23. How can you tell from a graph that a relationship is directly proportional?	There will be a straight line That goes through the origin (0,0)
24. Give the equation that links force, spring constant and extension	Force = spring constant x extension
25. How could you use the above equation to calculate the <u>compression</u> of an object?	Force = spring constant x <u>compression</u> <u>Compression</u> = force / spring constant
26. What happens when a force stretches or compresses a spring and which type of energy will be stored in it?	The force does work Elastic potential energy is then stored
27. Describe the relationship between the work done on a spring and the elastic potential energy that is stored in it	Work done equals the elastic potential energy stored As long as the spring is not inelastically deformed (has not reached the limit of proportionality)
28. What are the units for force, spring constant, extension, compression, work done and elastic potential energy?	Force = N, Spring constant = N/m, Extension = m Compression = m, Work done = J, Elastic potential energy = J
<b>Speed and acceleration</b>	
29. What is the difference between distance and displacement?	Distance is only how far an object move and does not involve direction (displacement does)
30. What sort of quantity is displacement?	Vector
31. What sort of quantity is speed?	Scalar
32. What does the speed at which a person can walk, run or cycle depend on?	<b><u>D</u>istance travelled, <u>A</u>ge, <u>F</u>itness and <u>T</u>errain (DAFT)</b>
33. Give the typical speeds for... a. Walking, b. Running, c. Cycling d. Motorway driving, e. High speed train f. Aircraft, g. Speed of sound in air	a. 1.5 m/s, b. 3 m/s, c. 6 m/s, d. 30 m/s e. 75 m/s, f. 250 m/s, g. 330 m/s
34. Do sound and wind travel at constant speeds?	No
35. What is the equation, with units, used to calculate distance travelled using speed and time? (2 marks)	Distance (m) = speed (m/s) X time (s)
36. How do you calculate average speed for non- uniform motion (when the speed varies)?	Add up all of the distances travelled Add up all of the times Average speed = total distance/ total time
37. Define 'acceleration'	When an object speeds up
38. Define 'deceleration'	When an object slows down
39. Define terminal velocity	When an object travels at a constant velocity Because resultant force equals 0 N (the forces are balanced)
40. Why does an object falling through a fluid (eg air) initially accelerate?	The force of gravity acts upon it
41. Give the acceleration of an object falling freely under gravity near Earth's surface	9.8 m/s <sup>2</sup>

<b>Distance time (DT) graphs and velocity time (VT) graphs</b>	
42. What does a straight line going up mean on each graph?	DT = Moving away at constant speed VT = Constant acceleration
43. What does a curved line going up mean on each graph?	DT = Moving away and either accelerating or decelerating VT = Rate of acceleration is increasing or decreasing
44. What does a horizontal line on each graph mean?	DT = Object is stationary VT = Object is travelling at a constant velocity
45. What can be calculated using the gradient of a line on each graph?	DT = Speed VT = Acceleration
46. What does a straight line going down mean on each graph?	DT = Moving back to start at a constant speed VT = Constant deceleration
47. What does a curved line going down mean on each graph?	DT = Moving back to the start and either accelerating or decelerating VT = Rate of deceleration is increasing or decreasing
48. What is the equation, with units, used to calculate acceleration using change in velocity and time taken? (2 marks)	Acceleration ( $\text{m/s}^2$ ) = change in velocity ( $\text{m/s}$ ) $\div$ time taken (s)
<b>Newton's laws</b>	
49. State Newton's first law	If the resultant force acting on an object is 0N and: <ul style="list-style-type: none"> <li>- The object is stationary, it remains stationary</li> <li>- The object is moving, it continues to move at the same speed and direction (same velocity)</li> </ul>
50. What happens to an object that is stationary if the resultant force is zero?	It remains stationary
51. What happens to a moving object when the resultant force is zero?	It continues moving at the same speed in the same direction (same velocity)
52. Describe the forces acting on a vehicle travelling at a constant speed	The resistive forces = the driving force
53. When will the velocity of an object change?	When there is a resultant force of not 0N acting on it
54. What will happen to a stationary object when a force of not 0N is applied to it?	It will move
55. What will happen to a moving object when a force of not 0N is applied to it?	It will accelerate, decelerate or change direction
56. Why do falling objects reach their terminal velocity?	<ol style="list-style-type: none"> <li>1. As velocity increases, resistive forces increase</li> <li>2. This decreases the acceleration of the object</li> <li>3. Resistive forces increase until they equal weight</li> <li>4. Resultant force then equals 0N</li> </ol>
57. State Newton's second law	The acceleration of an object is... Proportional to the resultant force acting on it Inversely proportional to the mass of it
58. What is the equation, with units, used to calculate resultant force using mass and acceleration? (2 marks)	Resultant force (N) = mass (kg) X acceleration ( $\text{m/s}^2$ )
59. What happens to acceleration when you increase the resultant force acting on the object?	It increases
60. What happens to acceleration when you increase the mass of the object?	It decreases
61. State Newton's third law	Whenever two objects interact The forces they exert on each other are equal and

	opposite
62. When two objects interact the forces they exert on each other are .....	Equal and opposite
<b>Stopping distances and braking</b>	
63. What is stopping distance?	The sum of the distance the vehicle travels during the thinking distance and braking distance
64. Define 'thinking distance'	The distance the vehicle travels during the driver's reaction time
65. Define 'braking distance'	The distance the vehicle travels under the braking force
66. For a given braking force, what happens to stopping distance when speed is increased?	It increases
67. Give a typical reaction time for a human	0.2 – 0.9s
68. How could you measure a person's reaction time?	The ruler drop test Use a computer programme where a person pushes a button in response to a light or sound
69. State two things that can affect a driver's reaction time and therefore the thinking distance	Tiredness, drugs, alcohol, distractions
70. State two things that can affect the braking distance	Adverse road conditions (wet/icy), poor brakes or tyres
71. Describe what happens when force is applied to the brakes of a moving vehicle (2 marks)	<ul style="list-style-type: none"> <li>• Work done by the friction force</li> <li>• Between the brakes and the wheel</li> <li>• Reduces kinetic energy of the vehicle</li> <li>• The temperature of the brakes increases</li> </ul>
72. What is the link between speed, braking force and distance?	The greater the speed of a vehicle the greater the braking force needed to stop the vehicle in a certain distance
73. What can large decelerations lead to?	Brakes overheating and loss of control of the vehicle Injury due to large forces acting on the people in the vehicle
<b>Skills (Don't forget to include units)</b>	
74. Calculate weight if mass is 6kg and gravitational field strength is 10.5 N/kg	$6 \times 10.5 = 63\text{N}$
75. A thrust force of 100N acts on a bike. Air resistance of 60N acts in the opposite direction. Calculate the resultant force.	$100\text{N} - 60\text{N} = 40\text{N}$ forward
76. Calculate work done if Dave pushes a box 8 metres along the floor with 4N of force	$8 \times 4 = 32\text{J}$
77. Calculate the extension of a spring with a spring constant of 4N/m to which a force of 9N is applied	$9/4 = 2.25\text{m}$
78. Calculate the distance a bus travels if it travels at a speed of 0.5m/s in 5 seconds	$0.5 \times 5 = 2.5\text{m}$
79. A car travels 30m in 20s, stops for 5s and then travels 50m in 15s. Calculate the average speed.	Total distance = $30\text{m} + 50\text{m} = 80\text{m}$ , Total time = $20\text{s} + 5\text{s} + 15\text{s} = 40\text{s}$ . $80/40 = 2\text{ m/s}$
80. Calculate the acceleration of bike that has an initial velocity of 10m/s, a final velocity of 15m/s over 10 seconds	$5/10 = 0.5\text{m/s}^2$
81. Calculate the resultant force of a horse with a mass of 200kg and acceleration of $10\text{m/s}^2$	$200 \times 10 = 2000\text{N}$

Higher tier	
82. How do you determine the resultant of 2 forces that are acting at right angles to each other?	<ol style="list-style-type: none"> <li>1. Draw the 2 forces on graph paper to scale</li> <li>2. Convert the 2 lines into a rectangle</li> <li>3. Draw on the resultant force line (with arrow head) in the correct direction</li> <li>4. Use length of line (and scale from point 1) to determine size of resultant force</li> </ol>
83. How do you resolve a single force on a vector diagram into 2 components that act at right angles to each other?	<ol style="list-style-type: none"> <li>1. Use resultant force line to draw a right-angled triangle</li> <li>2. Put arrow heads on the lines to show direction</li> <li>3. Determine scale used on resultant force line</li> <li>4. Use scale to determine the size of the 2 forces that act at right angles</li> </ol>
84. Describe motion in a circle in terms of speed and velocity	The speed is constant but the velocity changes
85. How do you calculate instantaneous speed from a distance time graph with a curved line?	<p>Draw a tangent on the curve</p> <p>Calculate the gradient of the tangent</p>
86. How can you determine distance travelled/ displacement from a velocity time graph?	By calculating the area under the line
87. What is inertial mass a measure of?	How difficult it is to change the velocity of an object
88. How do you determine inertial mass?	Force/ acceleration
89. What is the equation, with units, used to calculate momentum using mass and velocity? (2 marks)	Momentum (kg m/s) = mass (kg) X velocity (m/s)
90. Calculate the momentum of a cat with a mass of 10kg and a velocity of 1m/s	$10 \times 1 = 10 \text{ kg m/s}$