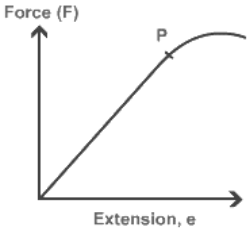
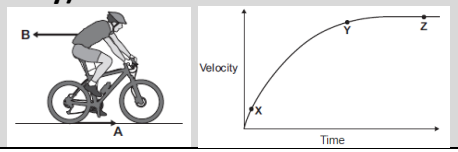
Core questions – Physics unit 5 - Forces

No.	Question	Answer
1	What is a vector quantity?	A quantity with magnitude (size) and direction
2	What examples are there of vector quantities?	Any force, velocity, displacement, acceleration, momentum
3	What is a scalar quantity?	A quantity with magnitude (size) only
4	What examples are there of scalar quantities?	Speed, distance, mass, temperature, time
5	How are vectors represented in a diagram?	With an arrow
6	How is the magnitude and direction of a force represented in a vector diagram?	The length represents the size of the quantity and the arrowhead the direction
7	What is a force?	A push or pull acting on an object
8	What is a contact force?	A force exerted when the objects are physically touching
9	What examples are there of contact forces?	Friction, air resistance, tension, normal contact force
10	What is a non-contact force?	A force exerted on objects that are physically separated
11	What examples are there of non-contact forces?	Magnetic force, gravitational force, electrostatic force
12	What happens when two objects interact?	A force is produced on both objects
13	What is an interaction pair?	Forces that are equal in size and opposite in direction
14	Which of Newton's Laws of motion is defined by an interaction pair?	Third law
15	What is a gravitational force?	An attraction force that acts between masses
16	When do we notice a gravitational force?	When one of the masses is very, very big, like a planet or star
17	What is mass?	The amount of matter an object is made of
18	What is the standard unit of mass and its unit symbol?	Kilograms, kg
19	What is weight?	A force acting on an object due to gravity
20	What is the unit for weight and all other forces and the unit symbol?	Newton, N
21	In what direction does weight always act?	Towards the surface of the planet or star (downwards in most force diagrams)
22	What does the weight of an object depend on?	The strength of the gravitational field and the mass of an object
23	What is meant by the term "centre of mass"?	An assumption that identifies a single point on object where the whole mass is concentrated
24	State the word equation that links gravitational field strength, mass and weight	Weight = mass x gravitational field strength
25	Give the symbol equation used to calculate weight	W= m x g
26	What is the relationship between weight and mass, when gravity is constant?	They are directly proportional
27	How is weight measured, practically?	Using a calibrated spring balance (a newtonmeter)

28	What is a free body diagram?	A diagram that shows all of the forces acting on an object
29	How are forces represented on a free body diagram	With an arrow, the length represents the size of the force and the arrowhead the direction of the force. (arrows always point away from the object)
30	What is a resultant force?	The overall force acting on an object
31	How do you calculate the resultant of two forces that act in a straight line?	• Add together forces that are acting in the same direction • Subtract any going in the opposite direction
32	What happens when a resultant force moves an object?	Energy is transferred between energy stores and work is done
33	What is the word equation that links distance moved, energy transferred and forces?	Work Done = Force X distance moved
34	What is the symbol equation for work done?	W = F x s
35	What are the two units which can be used for measuring work done and the link between them?	Joules or Newton-metres 1J = 1Nm i.e 1J of energy is used when a force of 1N moves an object a distance of 1m
36	How do you use a scale diagram to find a resultant force? **(HT Only)**	1. Chose a scale to represent a force e.g. 1cm = 1N 2. Draw your vertical or north pointing force first 3. Draw your horizontal force from the tip of your first arrow (pointing left for east or right for west) 4. Then add your resultant force arrow from the base to the first arrow to the tip of the second arrow 5. Measure the length of the arrow and use your scale to convert it to Newtons 6. Use a protractor to measure the bearing
37	How do you measure a bearing? **(HT Only)**	You measure clockwise from north and give it a three digit number. (the first number will be zero for any bearing smaller than 100^{o})
38	What does “resolving” a force mean? **(HT Only)**	Splitting a force into its horizontal and vertical components
39	How can you resolve a force? **(HT Only)**	1. Use a scale which converts force to centimetres 2. Draw the resultant force on the correct bearing 3. Create a right angled triangle using the resultant force as the hypotenuse 4. Measure the length of the horizontal and vertical sides and convert to Newtons using your scale
40	What is true of the forces on an object that is in equilibrium?	Forces are balanced or there is an overall resultant force of zero
41	What three deformations can happen to an elastic object when forces are applied?	Stretching, compressing and bending
42	What is an elastic deformation?	The object will return to its original size and shape when forces are removed
43	What is an inelastic deformation?	One in which the object will not return to its original size and shape when forces are removed
44	Give two examples of elastic objects	A spring and a sponge

45	What type of energy is stored in a stretched spring?	Elastic potential energy
46	How do you calculate the extension of a spring?	Length of spring with force applied – original length of spring
47	How is the extension of a spring related to the force added?	Extension is directly proportional to the force added (up to a limit)
48	What word equation links the extension of a spring, force applied and the spring constant?	Force Applied= Spring constant x extension
49	What letter represent the spring constant in an equation?	k
50	What does the spring constant depend on?	The stiffness of the spring
51	If you increase the stiffness of a spring what happens to the size of the spring constant?	It increases
52	On the following graph what does the letter P represent? 	The limit of proportionality or the elastic limit of a spring
53	How can you calculate the spring constant from a force-extension graph?	Calculate the gradient of the linear part (straight part) of the graph
54	On a force-extension graph, what does a steeper line represent?	A stiffer spring with a larger spring constant
55	When measuring a spring with a ruler, why must the ruler be parallel?	To increase the accuracy of the reading
56	When reading a vertical scale, what is meant by a parallax error?	The reading changes depending on where you are looking from
57	How do you prevent a parallax error from occurring?	Always read the measurement at eye level
58	Give two reasons to do a pilot or preliminary experiment	To find an appropriate interval size for the independent variable i.e one that gives measurable results. To check that the method works
59	What type of quantity is distance?	Scalar
60	What type of quantity is displacement?	Vector
61	How is displacement different to distance?	Displacement is a vector quantity, measuring the distance **and** direction in a straight line from the starting point
62	What is the difference between speed and velocity?	Speed is a scalar quantity and velocity is a vector quantity
63	What two quantities do you need to measure to calculate speed?	Distance travelled and time taken
64	State the word equation used to calculate speed	Speed = distance ÷ time
65	What symbol is used to represent distance?	s
66	What is the standard unit and unit symbol of distance?	Metres, m
67	What symbol is used to represent speed (velocity) and	v

68	What is the standard unit and unit symbol of velocity?	Metres per second, m/s
69	Give the symbol equation linking distance, speed and time	s = v x t
70	Why are most speeds said to be average speeds?	Objects rarely travel at a constant speed, they speed up and slow down.
71	What is the typical average speed for a person walking?	1.5 m/s
72	What is the typical average speed for a person running?	3.0 m/s
73	What is the typical average speed for a person cycling?	6 m/s
74	What is the typical average speed for a car?	25 m/s
75	What is the typical average speed for a train?	55 m/s
76	What is the typical average speed for a plane?	250 m/s
77	What is the speed of sound in air?	330 m/s
78	What is meant by acceleration?	Change in velocity in a certain amount of time
79	What happens to an objects velocity when it is travelling in a circle? **(HT only)**	It is constantly changing
80	Why is travelling at a constant speed in a circle considered to be an example of constant acceleration? **(HT only)**	Velocity is constantly changing due to the direction constantly changing
81	What equation is used to calculate average acceleration?	Acceleration = change in velocity/ time taken
82	What is the standard unit and unit symbol for acceleration?	Metres per second squared, m/s^2
83	What is meant by uniform acceleration?	constant acceleration
84	What is the word equation for uniform acceleration?	Final velocity – initial velocity = 2 x acceleration x distance travelled
85	State the symbol equation for uniform acceleration?	$v^2 - u^2 = 2as$
86	What is the acceleration due to gravity near the Earth's surface?	9.8 m/s^2
87	On a distance-tine graph what does a straight line with a gradient represent?	Constant speed
88	What does a horizontal line on a distance-time graph represent?	The object is stationary
89	What does a curve represent on a distance-time graph?	Acceleration or deceleration
90	How can you calculate the acceleration from a curve on a distance-time graph? **(HT only)**	Draw a tangent to the curve and calculate the gradient
91	On a velocity-time graph what does a straight line with a gradient represent?	Constant acceleration
92	What does a horizontal line on a velocity-time graph show?	Constant speed
93	What is different about the lines on a velocity-time graph which show acceleration and deceleration?	Acceleration is a line moving up the graph, deceleration is a line moving down the graph
94	How do you use a velocity-time graph to calculate the distance travelled by an object? **(HT only)**	Calculate the area under the graph
95	Which force always acts in the opposite direction to motion?	Friction

96	What other name is given to the force of friction due to objects moving through a fluid?	Drag
97	What must be true about the driving force and friction on an object moving at a constant speed?	They are the same size They are balanced The resultant force is zero
98	When an object speeds up, what happens to the friction/drag force?	Increases
99	How can you reduce the effect of drag on a moving object?	Make it more streamlined
100	What force causes a falling object to accelerate?	Gravity
101	What force acts against gravity?	Drag/friction
102	What is meant by the terminal velocity of a falling object?	Maximum constant velocity
103	When does a falling object reach terminal velocity?	When the weight of the object is equal to the force of drag so the resultant force is zero
104	Why do objects fall at different speeds on earth when they have the same acceleration force due to gravity?	Friction forces due to air resistance depends on the shape and surface area of the object
105	If a bike is travelling forwards with a force A, and force B is opposing the motion, describe what is happening at each stage on this graph? **(Triple only)** 	**Between X and Y:** Force A is greater than force B (but force B is increasing) Cyclist accelerates (but the rate of acceleration slows down) **Between Y and Z:** Force B becomes equal to force A (resultant force = 0) Cyclists acceleration stops and they reach terminal velocity (constant speed)
106	State Newton's First Law	A resultant force is needed to make an object start moving, speed up, slow down or change direction.
107	What are the two possible conditions of an object with a resultant force of zero?	It must be stationary **or** moving at a constant velocity
108	State Newton's Second Law	The acceleration of an object is directly proportional to the force applied
109	State the word equation used to represent Newton's Second Law?	Force = mass x acceleration
110	State the symbol equation used to represent Newton's Second Law?	F = m x a
111	What is inertia? **(HT only)**	The tendency of an object to continue in their state of rest or of uniform motion
112	What is inertial mass and how is it calculated? **(HT only)**	Measure of how difficult it is to change the velocity of an object, m= F ÷a
113	State Newton's Third Law	Whenever two objects interact, the forces they exert on each other are equal and opposite
114	What symbol represent 'approximately'	~
115	What is meant by the "Stopping Distance" of a car?	The **total distance travelled** by a car in an emergency
116	State the two components of the total stopping distance of a car	Thinking distance and braking distance

117	What is the thinking distance?	The **distance** a car travels between seeing a hazard and the brakes being applied (the drivers reaction time)
118	What does typical human reaction time range between?	0.2s to 0.9s
119	What two key factors affect the thinking distance of a car?	The speed the car is travelling and the reaction time of the driver
120	What factors will increase the time it takes for a driver to react?	Alcohol, distractions, tiredness
121	What factors will increase the braking distance of a car?	Worn tyres, poor brakes, slippery roads (wet or icy)
122	What happens to the overall stopping distance as speed increases?	It increases
123	Why does the thinking distance increase at faster speeds when the driver's reaction time stays the same?	At higher speeds a car travels further in the same length of time
124	What is the relationship between thinking distance and speed?	Proportional, linear
125	What happens when a force is applied to the brakes of a vehicle?	Work done by the friction force between the brakes and the wheel reduces the kinetic energy of the vehicle
126	What is the kinetic energy store of the car transferred into when the brakes are applied?	The thermal energy store in the brake discs (the brakes get hotter)
127	What needs to happen to the braking force for a vehicle to stop in the same distance at a greater speed?	Increase
128	What happens to the rate of deceleration if the braking force increases?	Increases
129	What might happen if the deceleration of a vehicle is too high?	Brakes may overheat and/or loss of control
130	What happens to the kinetic energy of a car if the speed doubles?	It increases by a factor of 4
131	What happens to the work done to stop a car if speed doubles?	It increases by a factor of 4
132	If braking force remains constant, what is the link between work done by the brakes and the distance the car travels when stopping?	They are directly proportional (Work done $\propto$ distance)
133	What is momentum? **(HT only)**	The tendency of a moving object to keep moving in the same direction
134	What two factors affect the momentum of an object? **(HT only)**	Its mass and velocity
135	What is the word equation for calculating momentum? **(HT only)**	Momentum= mass x velocity
136	What is the symbol equation for momentum? **(HT only)**	p = m X v
137	What is the principle of "conservation of momentum"? **(HT only)**	The total momentum before an event is equal to the total momentum after the event
138	What is true about the momentum before and after an explosion? **(HT only)**	It is zero
139	What is meant by the word recoil? **(HT only)**	The movement backwards of a gun when it is fired
140	Why is the velocity of a gun's recoil action negative compared to the bullets velocity? **(HT only)**	It is moving in the opposite direction (velocity is a vector quantity)
141	What causes a change of momentum? **(Triple only)**	A resultant force acting on a moving object

142	What equation can be used to calculate changes in velocity during a collision? **(Triple only)**	Momentum before = momentum after $M_1V_1 = M_2V_2$
143	What equation links force, time and velocity? **(Triple only)**	Force applied = $\frac{\text{change in velocity}}{\text{change in time}}$
144	What two things would cause a big change in momentum? **(Triple only)**	A large change of velocity A very short period of time
145	How do safety features in cars reduce the chance of injuries during a crash? **(Triple only)**	They increase the time taken to slowdown during a collision and this reduces the force
146	What safety features are designed to increases the rate of change of momentum? **(Triple only)**	Air bags, seat belts, gym crash mats, cycle helmets, cushioned surfaces in playgrounds
147	How do light gates work?	An object interrupts a beam of light and starts a timer, when the beam is interrupted again the timer stops. The distance between the objects is used to calculate speed.
148	How can light gates be used to calculate acceleration?	Use two light gates, a known distance apart and measure the speed of a moving object at the two different points
149	State two factors affecting the acceleration of a moving object that can be investigated using light gates.	The mass of the object, the force applied to an object.
150	Describe a simple experiment used to investigate Newton's Second Law	A trolley is attached to a piece of string that goes over pulley, Masses are adding to the end of the string to make the trolley move The trolley has a card attached which passes through two light gates
151	Describe a simple experiment used to measure reaction time.	Drop a ruler through the hand of a person and measure how far the ruler falls.