AQA (GCSE Notes)

Chapter 5: Forces

Q1. State what a scalar quantity is and give one example.

Q2. Describe how a vector quantity differs from a scalar quantity.

Q3. Explain how the length of an arrow can show the magnitude of a vector.

Q4. Describe how the direction of an arrow represents the direction of a vector.

Q5. Give two examples of vector quantities found in mechanics.

Q6. Give two examples of scalar quantities found in mechanics.

Q7. Define a force in simple terms suitable for GCSE study.

Q8. Explain why force is classed as a vector quantity.

Q9. Distinguish between contact and non-contact forces with one example of each.

Q10. State what is meant by a contact force and name one situation where it acts.

Q11. State what is meant by a non-contact force and name one situation where it acts.

Q12. Name the force that opposes motion between two surfaces in contact.

Q13. Describe how air resistance acts on a falling object.

Q14. Explain the role of tension in a stretched cable supporting a load.

Q15. Define normal contact force and name a common example.

Q16. State the non-contact force that keeps planets in orbit around the Sun.

Q17. Give one everyday example of electrostatic force acting between objects.

Q18. Describe a situation where magnetic force acts without the objects touching.

Q19. Explain, using arrows, how to show two equal forces acting in opposite directions on an object.

Q20. A box rests on a table. Describe the pair of forces acting between the box and the table.

Q21. A skydiver reaches terminal velocity. Explain why the forces on the skydiver are balanced at this point.

Q22. Draw and label a force diagram for a car being towed at constant speed along a straight road.

Q23. Explain why friction is needed for a person to walk forward.

Q24. Describe what happens to the net force on an object when two equal but opposite forces act on it.

Q25. A book slides to a stop on a rough surface. Identify the force that causes it to stop and explain its effect.

Q26. Explain how you would represent a force of 5 N acting to the right using a scale diagram.

Q27. Describe the forces acting between two magnets facing like poles toward each other.

Q28. Explain the interaction between a charged balloon and a neutral wall.

Q29. State Newton’s third law and apply it to a swimmer pushing water backwards.

Q30. Describe how gravitational force varies with distance between two masses.

Q31. Explain why astronauts experience weightlessness while orbiting Earth.

Q32. Give one example of a situation where tension and weight act in opposite directions.

Q33. A cyclist moves through still air. Describe the main forces acting on the cyclist and how they affect motion.

Q34. Explain why normal contact force on an inclined plane is less than the weight of the object.

Q35. Describe how the electrostatic force between two charged objects changes when the distance between them doubles.

Q36. Explain why magnetic force is considered a non-contact force.

Q37. A rope in tug-of-war experiences two 300 N pulls in opposite directions. State the magnitude and direction of the net force on the rope.

Q38. Describe the force interaction between Earth and an apple that has just left a tree branch.

Q39. Explain how a parachute increases air resistance and the effect on the skydiver’s motion.

Q40. A box is pushed across a smooth surface with no friction. Explain what happens to its motion when the pushing force stops.

Q41. Describe how you would use vector addition to find the resultant of two forces at right angles.

Q42. Explain why the term “upthrust” is used instead of “buoyant force” in GCSE Physics.

Q43. Two students pull a sled with forces of 50 N and 30 N at the same angle to the direction of travel. Describe how to find the resultant force.

Q44. Explain how the normal contact force adjusts when additional mass is added to a stationary elevator floor.

Q45. Describe an experiment to measure frictional force between a wooden block and a surface.

Q46. Explain why gravitational force is always attractive, not repulsive.

Q47. A magnet is brought near a steel paperclip. Describe the forces acting on both objects during attraction.

Q48. Explain why air resistance increases with speed for a cyclist.

Q49. Describe how tension changes along a rope when a climber hangs motionless from its end.

Q50. Explain how action-reaction force pairs allow a rocket to accelerate in space where no air is present.

Q51. How does the weight of a 5 kg object change if the gravitational field strength doubles?

Q52. Explain why mass stays constant when an object is moved from Earth to the Moon even though its weight changes.

Q53. Describe the steps for using a spring-balance to measure the weight of a metal block in a school laboratory.

Q54. A student plots a graph of weight against mass for several objects. Explain why the graph should be a straight line through the origin.

Q55. State the SI units for weight, mass, and gravitational field strength.

Q56. A 12 kg suitcase weighs 108 N on Earth. Calculate the gravitational field strength used in this calculation.

Q57. Give a practical reason why it is useful to know the centre of mass when designing a bridge beam.

Q58. Describe how you could find the centre of mass of an irregular card shape in the classroom.

Q59. A spacecraft far from any planet has a gravitational field strength close to zero. Explain what happens to the weight of a tool inside the craft.

Q60. Explain why an astronaut's mass reading on a balance scale must be taken differently in orbit compared with on Earth.

Q61. A physics book shows the symbol $W \propto m$. Explain what this symbol statement means in words.

Q62. Describe two factors that could cause experimental error when using a spring-balance to measure weight.

Q63. A rock has a mass of 3 kg. Calculate its weight on a planet where $g = 15$ N/kg.

Q64. Explain why the reading on a calibrated spring-balance increases when additional masses are hung on it.

Q65. Discuss why weight is considered a vector while mass is not.

Q66. A technician adjusts the zero of a spring-balance before use. State why this step is important.

Q67. A bag of apples weighs 18 N on Earth. Predict its weight on Mars where $g \approx 3.7$ N/kg.

Q68. Give one reason why knowing the centre of mass helps improve the stability of a tall structure.

Q69. Describe how gravitational field strength varies with altitude above Earth's surface.

Q70. Explain why the proportionality between weight and mass makes it possible to use mass scales calibrated in newtons.

Q71. A graph of weight against gravitational field strength for a fixed mass is plotted. Describe the expected shape.

Q72. Outline a method to verify experimentally that weight is proportional to mass.

Q73. A diver underwater experiences the same mass but feels less weight. Explain this observation.

Q74. Calculate the mass of an object that weighs 44 N on a planet where g = 11 N/kg.

Q75. Explain how the concept of centre of mass is applied when designing sports equipment like javelins.

Q76. A crate weighs 500 N on Earth. Determine its mass. Assume g = 9.8 N/kg.

Q77. Explain why the weight of an object is lower at the equator than at the poles.

Q78. A science class uses different spring-balances with varied calibrations. Discuss how calibration affects accuracy.

Q79. Describe how you would modify a simple balance to measure weight instead of mass.

Q80. Explain the significance of the phrase "weight acts at the centre of mass" in free-body diagrams.

Q81. A satellite in low Earth orbit experiences microgravity. Clarify why this does not mean gravity is absent.

Q82. Calculate the gravitational field strength on a moon where a 4 kg hammer weighs 8 N.

Q83. Explain why mass is taken as the same value in any physics equation regardless of location.

Q84. A climber standing on a mountain summit weighs slightly less than at sea level. Give two reasons for this difference.

Q85. Describe how proportionality can be tested by comparing the weights of identical masses at different locations on Earth.

Q86. Explain how to use a conversion factor to change a weight measurement in newtons to a mass in kilograms.

Q87. A 0.75 kg ball is taken to a planet where its weight is 6 N. Calculate the planet's gravitational field strength.

Q88. Discuss why astronauts train under water to experience reduced effective weight.

Q89. A suspended meter rule balances horizontally when a 1 N weight is 40 cm from the pivot. Explain how this relates to its centre of mass.

Q90. Describe the procedure for drawing a free-body diagram showing weight and support forces for a resting object.

Q91. A load cell sensor measures force. Explain how such a sensor could be calibrated to display weight directly.

Q92. Explain why mass readings taken with beam balances remain reliable on the Moon.

Q93. A parcel has a mass of 2.5 kg. If it is weighed on Jupiter where g ≈ 24.8 N/kg, calculate its weight.

Q94. Discuss the effect of temperature on the calibration of a metal spring-balance and its weight readings.

Q95. Explain how proportional reasoning helps predict weight changes when mass is scaled up in model testing.

Q96. A builder lifts a 200 N brick. Explain why the brick’s mass is unchanged during lifting even though the applied force varies.

Q97. State how the value of g is provided in examination questions and why students must use it consistently.

Q98. Describe why centre-of-mass calculations are important in vehicle design for safe cornering.

Q99. Explain how the weight-mass relationship aids astronauts in converting Earth-based training data to lunar conditions.

Q100. A laboratory experiment finds that doubling the extension of a spring doubles the load it supports. Relate this observation to measuring weight with a spring-balance.

Q101. Describe what is meant by the term "resultant force" and give an example involving two forces in a straight line.

Q102. A box is pushed with 8 N to the right and pulled with 5 N to the left. Calculate the resultant force and state its direction.

Q103. Explain what happens to an object when the resultant force acting on it is zero.

Q104. Draw a labelled free body diagram for a book resting on a table, showing all the forces acting.

Q105. A car is acted on by a driving force of 2000 N and a resistive force of 500 N. Calculate the resultant force on the car.

Q106. Explain how you can resolve a diagonal force into two components at right angles using a scale diagram.

Q107. A 10 N force acts at an angle. Describe how you would use a scale diagram to find the horizontal and vertical components.

Q108. Describe how a resultant force can be used to predict the motion of an isolated object.

Q109. A force of 6 N acts north and a force of 8 N acts east. Explain how to determine the resultant force using a scale drawing.

Q110. Explain the difference between balanced and unbalanced forces using a free body diagram.

Q111. Describe the motion of an object with no resultant force acting on it.

Q112. Two people pull a rope in opposite directions with equal force. Explain what happens to the rope and why.

Q113. Explain why a resultant force causes acceleration in the direction of the net force.

Q114. A force of 50 N moves an object 3 m along the floor. Calculate the work done.

Q115. Explain the energy transfer that occurs when a person lifts a box from the ground.

Q116. Describe how the work done by a force is related to the distance moved by the object in the direction of the force.

Q117. A force of 120 N moves an object 0.5 m. Calculate the work done and state the unit.

Q118. Convert 20 newton-metres into joules. Explain your reasoning.

Q119. Explain why work done against friction causes an increase in temperature.

Q120. Describe a real-life example where work is done against friction and what effect this has on the object.

Q121. A student pulls a sled with a force of 60 N over a distance of 10 m. Calculate the work done.

Q122. Explain why no work is done when a force is applied but there is no movement.

Q123. A worker pushes a crate 5 m across the floor with a constant force of 100 N. Describe the energy transfers that take place.

Q124. Describe how to use a force-distance graph to calculate work done.

Q125. A force acts on an object but at 90° to the direction of motion. Explain why no work is done in this case.

Q126. Give one example each of stretching, bending, and compressing forces acting on different objects in everyday life.

Q127. Explain why more than one force is needed to stretch a stationary object.

Q128. Describe how bending a ruler involves applying more than one force.

Q129. Explain the difference between elastic deformation and inelastic deformation.

Q130. What condition must be met for an object to return to its original shape after a force is removed?

Q131. Describe what happens to a spring when it is stretched beyond its limit of proportionality.

Q132. State the equation that links force, spring constant, and extension.

Q133. A spring stretches 0.15 m under a force of 3 N. Calculate the spring constant.

Q134. Explain why the spring constant is different for different springs.

Q135. Describe how you could investigate the relationship between force and extension for a spring in a lab.

Q136. Sketch and label a force-extension graph showing both linear and non-linear behaviour.

Q137. What is meant by a linear relationship between force and extension?

Q138. Describe what is meant by the "limit of proportionality" in a spring experiment.

Q139. Give one reason why a spring might not return to its original length after being stretched.

Q140. State the unit of the spring constant and explain what it tells you.

Q141. A spring with a spring constant of 200 N/m is stretched by 0.02 m. Calculate the force applied.

Q142. A spring is compressed by 0.04 m and has a spring constant of 250 N/m. Calculate the force needed.

Q143. Explain what happens to the energy stored in a spring when it is released.

Q144. State the equation used to calculate elastic potential energy stored in a stretched spring.

Q145. A spring with a spring constant of 100 N/m is stretched by 0.1 m. Calculate the energy stored.

Q146. Compare the energy stored in two springs with the same extension but different spring constants.

Q147. Describe how you would determine the spring constant from a force-extension graph.

Q148. A force-extension graph has a curved section. What does this tell you about the spring?

Q149. What is the energy transfer involved when compressing a spring?

Q150. Explain how compression of a spring can store energy in the form of elastic potential energy.

Q151. Describe how elastic potential energy can be used in a catapult.

Q152. A spring stretches 0.2 m when a force of 4 N is applied. Calculate the energy stored in the spring.

Q153. Explain why doubling the extension of a spring (within the proportional limit) quadruples the energy stored.

Q154. A spring is stretched but does not return to its original shape. What type of deformation has occurred?

Q155. Give one reason why it is important to know the limit of proportionality when designing a spring-loaded device.

Q156. Give one everyday example of a force causing an object to rotate around a pivot.

Q157. Define the moment of a force and state its unit.

Q158. Describe how the distance from the pivot affects the size of a moment for a fixed force.

Q159. Explain why a door handle is placed far from its hinges.

Q160. A spanner applies a 15 N force at 0.2 m from a bolt. Write the expression for its moment.

Q161. State the condition needed for an object to be in rotational equilibrium.

Q162. Describe how you could find an unknown force on a balanced seesaw using moments.

Q163. Explain what is meant by the perpendicular distance in the moment equation.

Q164. Give one reason why long-handled tools make tasks easier.

Q165. Explain how a crowbar acts as a lever to lift a heavy object.

Q166. Name the three classes of levers and give an example of each.

Q167. Describe how gears can change the direction of rotation.

Q168. Explain why a small gear driving a large gear increases turning effect.

Q169. State two differences between a simple lever and a gear system.

Q170. Describe how bicycle gears help a cyclist climb a steep hill.

Q171. Explain how a screwdriver lid opener uses the principle of moments.

Q172. A child sits 2 m from the pivot on a seesaw with a weight of 300 N. Write the moment produced.

Q173. A plank balances on a pivot. Explain how moving a weight closer to the pivot affects balance.

Q174. Describe an experiment to verify that clockwise and anticlockwise moments are equal for a balanced metre rule.

Q175. Explain why a spanner slips less when the force is applied perpendicular to the handle.

Q176. Define pressure in fluids and state its unit.

Q177. Explain why a fluid exerts pressure at right angles to any surface.

Q178. State the equation that links pressure, force, and area.

Q179. Describe how changing the area of contact affects pressure for a constant force.

Q180. Explain why snowshoes stop a person sinking into soft snow.

Q181. A force of 500 N acts on an area of 2 m^2. Write the expression for the pressure.

Q182. Describe how hydraulic brakes use pressure in a fluid to operate.

Q183. Explain why dam walls are thicker at the base than at the top.

Q184. Give one example where high pressure is useful and one where low pressure is useful.

Q185. Explain how a drawing pin applies a large pressure with a small force on the paper.

Q186. Describe how pressure varies with depth in a liquid.

Q187. Explain why a balloon expands as it rises through the atmosphere.

Q188. State how gas pressure in a container changes when the same amount of gas is compressed into half the volume.

Q189. A hydraulic press multiplies an input force. Explain the role of different piston areas in this device.

Q190. Describe how a dentist's chair uses hydraulics to lift a patient smoothly.

Q191. Explain why sharp knives cut better than blunt knives of the same weight.

Q192. A 200 N force acts on a surface area of 0.04 m^2. Write the expression to find the pressure.

Q193. Explain how tyre pressure supports the weight of a car.

Q194. Describe a method to measure the pressure at the bottom of a water tank.

Q195. Explain why divers must equalise pressure as they descend underwater.

Q196. Give one safety reason for storing gas cylinders upright.

Q197. Explain the effect on pressure if the force on a piston doubles but the area stays the same.

Q198. A hydraulic jack applies a 25 N force on a small piston of area 0.01 m^2. State the pressure transmitted through the fluid.

Q199. Describe how atmospheric pressure changes with altitude and give one consequence for aircraft cabins.

Q200. Explain why large tankers have many small compartments instead of one big tank to reduce stress on the hull.

Q201. Explain how the height of a liquid column affects the pressure at the base of the column.

Q202. A diver descends to 15 m in seawater. State the factors that determine the pressure acting on the diver at that depth.

Q203. Describe why the pressure at a given depth is greater in mercury than in water.

Q204. Use the idea of particle weight to explain why atmospheric pressure decreases with altitude.

Q205. A submarine moves from 50 m to 150 m depth. State how this change affects the pressure on its hull and why.

Q206. Explain in terms of upthrust why a steel ship floats while a steel block of the same mass sinks.

Q207. Describe how the density of a liquid influences the upthrust on a floating object.

Q208. A balloon rises until the atmospheric pressure outside equals the pressure inside. Explain why it stops rising at this point.

Q209. State the equation linking pressure, density, gravitational field strength, and height in a liquid column.

Q210. Explain why pressure measured at the bottom of a freshwater lake differs from pressure at the same depth in the sea.

Q211. Describe how a submarine crew can calculate the external pressure at depth without a depth gauge, using density data.

Q212. A diver's ear experiences discomfort as they descend. Use pressure concepts to explain this effect.

Q213. Explain why the upthrust on a completely submerged object is equal to the weight of the fluid displaced.

Q214. Describe how a hydrometer uses floating principles to measure the density of a liquid.

Q215. Explain why a sealed plastic bottle appears crushed when brought down from a mountain to sea level.

Q216. A hydraulic dam has sensors at different depths. Explain why the readings increase with depth even though the liquid is the same.

Q217. Describe the changes in atmospheric pressure a passenger experiences during a rapid airplane ascent.

Q218. Explain why divers use specialised gas mixtures at great depth rather than normal air.

Q219. A wooden block floats with two-thirds of its volume submerged. Explain what this indicates about the density of the wood.

Q220. Describe how trapped air under a swimmer's wetsuit reduces effective density and increases buoyancy.

Q221. Explain why the pressure difference between two depths in a liquid depends only on the vertical distance, not the container shape.

Q222. A deep-sea probe measures pressure as 40 MPa. Explain how to estimate the depth using typical seawater density.

Q223. Describe how barometer readings help weather forecasters predict changing weather patterns.

Q224. Explain why mountain climbers may develop altitude sickness using the concept of reduced atmospheric pressure.

Q225. Discuss how submarines adjust their buoyancy by changing the density of water in ballast tanks.

Q226. Define distance and explain why it is a scalar quantity.

Q227. Define displacement and explain why it is considered a vector quantity.

Q228. A runner completes a 400 m track lap and finishes at the starting point. What is their displacement and why?

Q229. How is displacement different from distance when describing a journey with turns?

Q230. Give an example of a situation where the distance travelled is greater than the displacement.

Q231. Describe how you would measure the displacement of a hiker walking through a forest with twists and turns.

Q232. A cyclist moves 5 km north, then 5 km south. What is the total distance travelled and the displacement?

Q233. Why can displacement have a negative value while distance cannot?

Q234. Explain what is meant by the magnitude of displacement.

Q235. A plane flies 100 km east then 100 km north. How would you determine its total displacement?

Q236. What does it mean to express displacement in terms of both magnitude and direction?

Q237. Why is speed described as a scalar quantity, unlike velocity?

Q238. Define average speed and explain how it differs from constant speed.

Q239. A person walks at 1.5 m/s for 10 minutes. Calculate the distance travelled.

Q240. Explain how fitness and terrain can affect a person's walking speed.

Q241. State typical values of walking, running, and cycling speeds in m/s.

Q242. A train covers 600 m in 20 s. What is its average speed?

Q243. Explain why the speed of a moving vehicle is rarely constant.

Q244. Describe a method for measuring the speed of a toy car on a ramp in a lab.

Q245. A child runs 30 m in 10 s. Calculate their average speed.

Q246. Give a typical value for the speed of sound in air and explain why it can vary.

Q247. What instruments are needed to measure the speed of a moving object accurately?

Q248. How can you use a stopwatch and a metre ruler to calculate walking speed?

Q249. A person cycles 9 km in 30 minutes. Convert units and calculate average speed in m/s.

Q250. What are the SI units for distance, speed, and time?

Q251. A horse runs at 8 m/s for 15 s. What is the total distance it covers?

Q252. A person walks 1.2 km in 20 minutes. Find their average speed in m/s.

Q253. Why might two people running the same distance take different times?

Q254. If a sprinter accelerates and then decelerates, how would you calculate their average speed over the race?

Q255. A car travels at 60 km/h for 2 hours. What is the total distance in km and m?

Q256. A drone flies 300 m east and 400 m north. Calculate its displacement using Pythagoras' theorem.

Q257. Explain why knowing displacement is important in navigation systems.

Q258. How do you determine the direction of displacement on a graph?

Q259. A bird flies in a straight line for 2.5 km south. What is the displacement and distance?

Q260. Explain how ratio reasoning can be used to convert km/h to m/s.

Q261. Convert a speed of 72 km/h to m/s using proportional reasoning.

Q262. A vehicle covers 100 m in 8 s. Calculate its speed.

Q263. A person jogs at 2.5 m/s for 12 minutes. What is the total distance covered in metres and kilometres?

Q264. Compare the distance and displacement of a person walking in a circle back to the start.

Q265. Describe a real-life scenario where displacement remains zero but distance is large.

Q266. A car travels north for 10 km, then turns east for 10 km. Find its displacement.

Q267. How would you estimate the speed of a cyclist using a GPS device?

Q268. A moving object travels 120 m in 12 s, then 60 m in 4 s. Calculate the total average speed.

Q269. Describe how wind speed can affect the ground speed of an aircraft.

Q270. Why do scientists prefer SI units when calculating speed and distance?

Q271. A truck moves 800 m in 40 s, then stops for 20 s, then moves 400 m in 20 s. Find average speed over entire time.

Q272. If the speed of sound is 330 m/s, how far does sound travel in 3 seconds?

Q273. A ship sails 100 km in 5 hours. What is its speed in m/s?

Q274. Explain how to use a distance-time graph to determine speed.

Q275. Describe how the concept of vector and scalar quantities applies to displacement and speed.

Q276. Explain the difference between velocity and speed using an example.

Q277. Why is velocity considered a vector quantity while speed is not?

Q278. Describe how displacement differs from distance, using a real-life example.

Q279. A car travels in a straight line and returns to its starting point. What is its displacement and how does it differ from the distance travelled?

Q280. How can an object have constant speed but changing velocity?

Q281. A person walks around a circular track at constant speed. Explain why their velocity is not constant.

Q282. Give one example of a situation where speed remains the same but velocity changes.

Q283. Why is direction important when calculating velocity?

Q284. A cyclist moves north at 5 m/s and another moves south at 5 m/s. Explain whether their velocities are the same.

Q285. Describe a situation where an object's velocity is zero but it still has a speed.

Q286. What does the slope of a straight line on a distance–time graph represent?

Q287. Explain how to find the speed of an object from a distance–time graph.

Q288. How would the distance–time graph look for an object that is stationary?

Q289. A distance–time graph has a steep slope. What does that tell you about the object's speed?

Q290. What would a curved line on a distance–time graph indicate?

Q291. How can you use a tangent on a curved distance–time graph to find speed at a certain point?

Q292. Describe how to draw a distance–time graph from a set of time and distance measurements.

Q293. Why is it important to label axes correctly on a distance–time graph?

Q294. What information can be gathered by interpreting the shape of a distance–time graph?

Q295. How would the graph look for an object that moves away and then comes back to the starting point?

Q296. A student measures the time taken to walk different distances. How should they use this data to draw a distance–time graph?

Q297. How does the gradient of a distance–time graph relate to the object's motion?

Q298. Why does motion in a circle count as acceleration even if speed is constant?

Q299. Describe how distance–time graphs can help compare the motion of two different objects.

Q300. What does a horizontal line on a distance–time graph tell you about the object’s motion?

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Q301. Define acceleration and state its SI unit.

Q302. A car increases its velocity from 10 m/s to 30 m/s in 5 seconds. Write an equation to calculate its acceleration.

Q303. How is deceleration different from acceleration?

Q304. Describe how you would estimate the acceleration of a cyclist moving from rest to top speed in a few seconds.

Q305. What does a straight sloping line on a velocity–time graph show about an object's motion?

Q306. A train slows down from 25 m/s to 5 m/s in 10 seconds. What type of acceleration is this and how would you calculate it?

Q307. Explain how to find acceleration from a velocity–time graph.

Q308. What is the significance of a horizontal line on a velocity–time graph?

Q309. Describe how to draw a velocity–time graph for an object that starts from rest and accelerates uniformly.

Q310. Explain how to calculate the distance travelled using the area under a velocity–time graph.

Q311. What does the area under a straight sloping line in a velocity–time graph represent?

Q312. A body accelerates uniformly from 0 to 20 m/s in 4 seconds. How would you calculate its acceleration and distance covered?

Q313. State the equation used to calculate distance when an object has uniform acceleration and describe what each symbol represents.

Q314. How can you use the equation v2−u2=2asv^2 - u^2 = 2asv2−u2=2as to calculate the distance travelled by an object?

Q315. Describe a situation in which an object falls freely and reaches terminal velocity.

Q316. What is terminal velocity and when does it occur during a fall?

Q317. Why does a falling object eventually stop accelerating in a fluid like air or water?

Q318. Sketch and describe the velocity–time graph of a skydiver before and after opening the parachute.

Q319. Explain how air resistance affects the motion of a falling object.

Q320. What forces act on an object falling freely under gravity and how do they change as it falls?

Q321. Why does acceleration remain constant during free fall near the Earth’s surface in the absence of air resistance?

Q322. Describe how to conduct a simple experiment to show the effect of air resistance on falling objects.

Q323. What measurements would you take to calculate acceleration during an experiment with a model parachute?

Q324. What is the value of acceleration due to gravity on Earth and how is it used in calculations?

Q325. How can you tell from a velocity–time graph when an object has reached terminal velocity?

Q326. State Newton’s First Law in your own words.

Q327. A cyclist travels at a steady speed along a level road. What can you say about the forces acting on the cyclist?

Q328. Explain why a book resting on a table stays still even though gravity acts on it.

Q329. Describe what happens to the motion of a car if the driving force equals the resistive forces.

Q330. Give one everyday example where an object keeps moving at the same speed and direction because no resultant force acts on it.

Q331. What is inertia, and how does it relate to Newton’s First Law?

Q332. How would you show with a simple experiment that motion continues without a push once friction is removed?

Q333. Explain why passengers feel pushed back into their seats when a bus starts moving suddenly.

Q334. A hockey puck slides across smooth ice and slows down. Which force causes the puck to break Newton’s First Law?

Q335. Write the equation that links force, mass, and acceleration, and name each quantity with its unit.

Q336. If the mass of an object doubles and the force stays the same, how does its acceleration change?

Q337. A van of mass 1 500 kg accelerates at 2 m/s². Calculate the resultant force needed.

Q338. Explain why a lighter car can accelerate faster than a heavier truck when the same force is applied.

Q339. Define inertial mass, and write the formula that shows how it is measured.

Q340. A scooter rider says, “My bike feels heavier when I carry a passenger.” Explain this using the idea of inertial mass.

Q341. Give an example of a situation on the road where a large acceleration is needed, and estimate the forces involved.

Q342. A bus has a mass of 8 000 kg and needs to reach 20 m/s in 10 s. Estimate the size of the driving force, showing your method.

Q343. A sports car can go from 0 m/s to 30 m/s in 4 s. Explain why the force engine designers can supply must be high.

Q344. How does using the symbol ∝ help show the link between acceleration and force in Newton's Second Law?

Q345. An object has a mass of 5 kg and accelerates at 0.5 m/s². Estimate the force acting on it using the approximate sign ~.

Q346. Describe how you could use motion sensors to test Newton's Second Law in a classroom.

Q347. Why do large lorries need more powerful brakes than small cars? Answer in terms of force and mass.

Q348. A skateboarder pushes off the ground and quickly speeds up. Use Newton's Second Law to explain the change in motion.

Q349. Explain how seat belts help passengers obey Newton's First Law during a sudden stop.

Q350. Describe what happens to the forces on a skydiver just after they jump and before reaching terminal velocity.

Q351. Two friends on skateboards push against each other and roll apart. Explain why they move in opposite directions with equal force.

Q352. A swimmer pushes the water backwards while swimming. Describe the force that makes the swimmer move forwards.

Q353. A gun recoils when it fires a bullet. State and explain the pair of forces involved.

Q354. How does Newton's Third Law apply when a book rests on a table?

Q355. A car of mass 1 200 kg brakes with a constant force of 6 000 N. Calculate the car's deceleration.

Q356. Explain why increasing a car's speed increases its braking distance for the same braking force.

Q357. Describe what is meant by the thinking distance of a driver.

Q358. A driver has a reaction time of 0.8 s and is travelling at 25 m/s. Calculate the thinking distance.

Q359. List two factors that can increase a driver's reaction time.

Q360. A wet road surface can double the braking distance. Explain why.

Q361. A van stops in 60 m from 30 m/s. If the thinking distance is 18 m, find the braking distance.

Q362. Draw and label the forces acting on a cyclist who is moving at a steady speed.

Q363. Explain how the forces on a parachutist change from jumping out of a plane to reaching terminal speed.

Q364. A truck travelling at 20 m/s needs to stop in an emergency. Give two ways the stopping distance could be reduced without lowering speed.

Q365. Describe a simple school experiment to measure human reaction time using a ruler drop test.

Q366. Explain why drinking alcohol before driving is dangerous using the idea of reaction time.

Q367. A bicycle and a lorry collide. Use Newton's Third Law to describe the forces on each vehicle during the collision.

Q368. A 65 kg runner pushes the ground with a force of 700 N. What force does the ground exert on the runner?

Q369. Explain why passengers lean forwards when a bus brakes suddenly.

Q370. A car travels at 15 m/s and has a total stopping distance of 25 m. Estimate the stopping distance if the speed doubles, assuming similar conditions.

Q371. Describe how mobile phone use can affect the thinking distance of a driver.

Q372. Explain the purpose of anti-lock braking systems in cars in terms of stopping distance.

Q373. A driver spots an obstacle 40 m ahead while driving at 22 m/s. The braking distance at this speed is 27 m. Calculate the minimum reaction time the driver must have to avoid a crash.

Q374. Give two reasons why older tyres can increase braking distance.

Q375. A ball is thrown at a wall and bounces back. Use Newton's Third Law to explain the ball's change of direction.

Q376. State what is meant by an action–reaction force pair, giving one everyday example.

Q377. Explain why heavy trucks need longer distances to stop compared with small cars at the same speed.

Q378. A traffic safety chart shows speed on the x-axis and total stopping distance on the y-axis. Describe how you would find the thinking distance from the graph at a given speed.

Q379. Why does driving while tired pose a similar risk to driving under the influence of alcohol?

Q380. Describe how rain on the windscreen can indirectly increase a car's stopping distance.

Q381. A student's reaction time is measured three times: 0.32 s, 0.35 s, and 0.30 s. Calculate the mean reaction time.

Q382. Explain why a seat belt reduces injuries using ideas of stopping distance and force.

Q383. A vehicle of mass 900 kg stops in 5 s from 18 m/s. Calculate the average braking force.

Q384. Suggest one reason why a graph of speed versus braking distance is nonlinear.

Q385. Describe how loose gravel on a road affects both thinking and braking distance.

Q386. Explain why reaction times measured with a computer test might differ from those using a ruler drop test.

Q387. A car’s stopping distance increases from 45 m to 63 m in heavy rain. Calculate the percentage increase.

Q388. State two safety features in modern cars that reduce the force on passengers during a crash.

Q389. A child pushes a toy car and it moves forwards 2 m. Explain, using Newton’s Third Law, the interaction between the child’s hand and the car.

Q390. A driver is distracted for 1.1 s while travelling at 28 m/s. How far does the car move during this distraction?

Q391. Describe one way to investigate the effect of music volume on student reaction time in a classroom.

Q392. Explain why snowy conditions can increase braking distance but may not affect thinking distance.

Q393. A cyclist traveling downhill squeezes the brakes harder than on level ground. Explain why greater braking force is needed to stop in the same distance.

Q394. Suggest a reason why some drivers underestimate their stopping distance at night.

Q395. Explain how cruise control might influence a driver’s reaction time during a long journey.

Q396. A motorbike decelerates at 6 m/s^2 from 24 m/s. Calculate the stopping time under braking.

Q397. In an experiment, a beep signals students to press a button. Describe how the setup could be modified to test the effect of lighting on reaction time.

Q398. Give one example where long reaction time could be beneficial rather than harmful.

Q399. Explain how passengers jumping off a small boat can unexpectedly move the boat backwards.

Q400. Outline why reducing speed limits in busy streets can greatly lower accident severity, using ideas of stopping distance.

Q401. Explain why a car needs a longer braking distance on an icy road than on a dry road.

Q402. Describe how worn-out brake pads can change the distance a van takes to stop in an emergency.

Q403. Explain what happens to the kinetic energy of a car when its brakes are applied and the car stops.

Q404. A vehicle travelling at 30 m/s stops in 50 m. State how the braking force would have to change to stop the same vehicle in 25 m.

Q405. Explain why very large decelerations during braking can cause a driver to lose control of the vehicle.

Q406. Describe two dangers that can occur if the brakes of a lorry overheat on a long downhill road.

Q407. A cyclist doubles their speed while keeping the same brakes. Explain how the required braking distance changes.

Q408. A car skids when the driver brakes sharply on a wet surface. Explain why the friction force is not enough to prevent the skid.

Q409. A mass of 1 500 kg is moving at 20 m/s. Write an expression for its momentum and calculate the value.

Q410. Explain how tyre tread depth influences the ability of a car to stop safely in heavy rain.

Q411. A motorcycle slows from 25 m/s to rest in 4 s. Estimate the average braking force on the motorcycle if its mass is 220 kg.

Q412. State why the temperature of disc brakes rises after repeated hard braking on a race track.

Q413. Give one reason why anti-lock braking systems can help reduce the dangers of large decelerations.

Q414. A van and a small car travel at the same speed. Use the idea of work done by friction to explain why the van may need a larger braking force to stop in the same distance.

Q415. A bus driver claims that halving the speed will quarter the braking distance on the same road. Explain whether this claim is reasonable.

Q416. A car of mass 1 200 kg experiences a braking force of 4 800 N. Calculate its deceleration.

Q417. Describe how icy road conditions can affect both the braking force available and the risk of losing control.

Q418. Explain why momentum is always zero for an object at rest, even if it has a large mass.

Q419. A 900 kg car travelling at 15 m/s collides with a stationary barrier and stops in 0.3 s. Estimate the average force exerted on the car.

Q420. Explain the link between kinetic energy removed during braking and the risk of brake fade on a steep mountain pass.

Q421. A driver notices a vibration when braking hard. Give two possible reasons related to the brake condition.

Q422. A lorry's tyres are under-inflated. Explain how this could change its stopping distance in an emergency.

Q423. State the equation that links momentum, mass and velocity, and explain how it can be used to compare two vehicles travelling at the same speed.

Q424. Explain why the braking distance increases more quickly than thinking distance as speed rises.

Q425. Describe the safety implications of underestimating the forces involved when planning stopping zones on a public road.

Q426. Two trolleys collide on a smooth surface and stick together. Explain how the law of conservation of momentum applies to this collision.

Q427. A 5 kg trolley moving at 2 m/s collides with a stationary 3 kg trolley. After the collision, the trolleys stick together. Calculate their velocity after the collision.

Q428. Describe what is meant by the conservation of momentum in your own words and give an example.

Q429. A car crashes into a wall and comes to rest. Use the idea of change in momentum to explain how an airbag reduces injury.

Q430. A footballer kicks a stationary ball of mass 0.5 kg and gives it a velocity of 20 m/s. Calculate the change in momentum of the ball.

Q431. Two ice skaters push off each other and move in opposite directions. Explain how their movements show conservation of momentum.

Q432. A car of mass 1 000 kg slows from 25 m/s to 5 m/s in 4 seconds. Calculate the average braking force acting on the car.

Q433. Describe an experiment using light gates to investigate the conservation of momentum during a collision between two trolleys.

Q434. Explain how cycle helmets reduce head injuries using the idea of rate of change of momentum.

Q435. A lorry of mass 3 000 kg travelling at 10 m/s collides with a stationary car of mass 1 200 kg. Calculate the total momentum before the collision.

Q436. A cricket ball is hit back in the opposite direction with greater speed than it was bowled. Explain the change in momentum of the ball.

Q437. Describe how cushioned surfaces in playgrounds reduce the risk of injury in terms of force and time.

Q438. A ball bounces off a wall with no loss in speed but in the opposite direction. Describe the change in its momentum.

Q439. A driver wearing a seatbelt is involved in a crash. Explain how the seatbelt helps to reduce the force on the driver.

Q440. A 60 kg person jumps off a boat and moves at 2 m/s. Explain why the boat moves in the opposite direction.

Q441. A rocket in space expels gas backwards. Use conservation of momentum to explain how this makes the rocket move forwards.

Q442. A 2 kg trolley moving at 3 m/s hits another 2 kg trolley moving at 1 m/s in the same direction. If they stick together, calculate their velocity after the collision.

Q443. A gymnast lands on a crash mat. Explain why landing on a mat causes less injury than landing on a hard floor.

Q444. Explain how momentum changes when a bullet is fired from a gun and how this leads to recoil.

Q445. A force of 500 N acts on a 50 kg object for 2 s. Calculate the change in momentum.

Q446. Describe the relationship between force and the rate of change of momentum.

Q447. A motorbike of mass 150 kg increases its velocity from 8 m/s to 20 m/s in 4 s. Calculate the average resultant force acting on it.

Q448. Explain how the time taken to stop a moving object affects the size of the force experienced by it.

Q449. Two identical trolleys are pushed towards each other with equal speed and collide head-on. Describe what happens to their motion after the collision.

Q450. Explain why gymnasts perform landings with bent knees in terms of momentum and force.

Q451. Define velocity and explain how it differs from speed.

Q452. Give two examples of scalar quantities and two examples of vector quantities in physics.

Q453. A car travels 100 m north and then 100 m south. What is its total displacement?

Q454. A runner completes a circular track of 400 m in 60 seconds. Explain why the velocity is not constant.

Q455. What does the gradient of a distance–time graph represent?

Q456. A student walks 300 m in 150 seconds. Calculate their average speed.

Q457. A car moves in a circle at a constant speed. Explain why its velocity is changing.

Q458. Describe how to use a tangent to find the speed of an accelerating object from a distance–time graph.

Q459. Sketch a distance–time graph for an object at rest and describe its features.

Q460. Sketch a distance–time graph for an object moving at a constant speed and explain the shape.

Q461. Sketch a distance–time graph for an object that is speeding up and explain the shape.

Q462. What is the difference between distance and displacement?

Q463. A car travels 600 m in 60 seconds. Then it stops for 30 seconds. Sketch a distance–time graph for this journey.

Q464. Explain how to determine the speed of an object from a curved distance–time graph.

Q465. An object moves along a straight road and comes to rest. How is this shown on a distance–time graph?

Q466. A cyclist travels 4 km north, then 3 km east. Explain how to calculate their displacement.

Q467. A distance–time graph has a steep straight line. What does this indicate about the object's speed?

Q468. A line on a distance–time graph curves upwards. What does this tell you about the object's motion?

Q469. How can you tell from a distance–time graph that an object is moving at constant speed?

Q470. Describe a method to draw a distance–time graph from experimental data.

Q471. Explain why speed is a scalar quantity but velocity is a vector quantity.

Q472. A student walks 1.2 km in 15 minutes. What is their average speed in m/s?

Q473. A bus accelerates along a straight road. How would this appear on a distance–time graph?

Q474. A ball rolls down a hill and speeds up. How would its distance–time graph change?

Q475. What information is needed to calculate speed from a distance–time graph?

Q476. A person jogs 500 m east and 500 m west. What is the displacement and total distance travelled?

Q477. Explain how a curved distance–time graph shows acceleration.

Q478. A vehicle's distance–time graph has a horizontal line. What does this mean?

Q479. How do you convert a distance–time graph into a speed–time graph?

Q480. A train travels at a steady speed for 10 minutes. Describe how its distance–time graph would look.

Q481. A runner's distance–time graph is a curve getting steeper. What does this mean?

Q482. A swimmer swims 100 m in 80 seconds. What is their average speed?

Q483. Describe how to measure the gradient of a straight line on a graph.

Q484. How do you use a distance–time graph to identify when an object is stationary?

Q485. A runner covers 100 m in 12.5 seconds. Sketch a distance–time graph for this run.

Q486. What is the SI unit of velocity and how is it expressed?

Q487. A car moves 2 km north, then 2 km south in 10 minutes. What is the displacement?

Q488. A distance–time graph shows a changing gradient. What does this mean?

Q489. Why is it important to label axes correctly on a distance–time graph?

Q490. Describe one real-world example where an object travels at constant speed but changing velocity.

Q491. How would you calculate instantaneous speed from a curved distance–time graph?

Q492. What is the key difference between average speed and instantaneous speed?

Q493. A cyclist moves at 5 m/s for 120 seconds. How far does the cyclist travel?

Q494. Explain how displacement can be zero even when distance travelled is not.

Q495. Describe how you would plot a distance–time graph using data from a motion sensor.

Q496. How does motion in a circle show the link between speed, velocity, and acceleration?

Q497. A student plots a distance–time graph with wobbly curves. What does this suggest about their motion?

Q498. Describe how the direction of travel affects velocity but not speed.

Q499. What graph shape would you expect from a car that speeds up and then slows down?

Q500. Compare the motion shown by two different distance–time graphs: one with a constant gradient, and one with a curved line.

Q501. A car accelerates from rest to 25 m/s in 8 s; using the average-acceleration equation, calculate its acceleration and give the correct SI units.

Q502. A cyclist slows from 12 m/s to 4 m/s in 3 s; show that this is a deceleration and work out its value.

Q503. Give one everyday situation where a typical acceleration is about 3 m/s^2 and explain clearly how you would estimate that figure.

Q504. Describe step by step how you would draw a velocity–time graph from a set of velocity readings taken every second during a trolley experiment.

Q505. A velocity–time graph for a motorbike is a straight line rising from 0 to 30 m/s in 6 s; explain how its gradient shows the bike's acceleration.

Q506. For the graph in Q505, calculate the distance travelled in those 6 s by finding the area under the line.

Q507. An athlete runs with uniform acceleration from 4 m/s to 10 m/s over a distance of 48 m; use $v^2 - u^2 = 2as$ to find the acceleration and the time taken.

Q508. Explain why an object falling freely near Earth's surface has an acceleration close to 9.8 m/s^2 and discuss two factors that might cause small variations in this value.

Q509. A stone is dropped from a cliff and reaches terminal velocity after 4 s; sketch and describe the main features of its velocity–time graph, marking where acceleration becomes zero.

Q510. Describe the sequence of vertical forces acting on a skydiver from leaving the aircraft to reaching terminal velocity with an open parachute.

Q511. Outline a practical method, using a motion sensor, to measure the effect of air resistance on a model parachute and collect data suitable for a velocity–time graph.

Q512. Explain how you would use the counting-squares technique to find the distance travelled during the curved part of a velocity–time graph obtained for a rolling ball.

Q513. A train travels at 20 m/s for 15 s, then accelerates uniformly to 32 m/s in the next 10 s; draw the velocity–time graph and calculate the total distance covered.

Q514. State the difference between instantaneous acceleration and average acceleration, and give one example of how each could be measured in the laboratory.

Q515. A student assumes uniform acceleration when applying $v^2 - u^2 = 2as$ to a runner who actually changes acceleration halfway through the race; discuss how this assumption affects the accuracy of the result.

Q516. Describe how a force–time graph could be used alongside a velocity–time graph to give a fuller picture of the motion of a bungee jumper.

Q517. A lift rises, slows to a stop, then descends at constant speed; sketch its velocity–time graph and label the sections of positive, zero, and negative acceleration.

Q518. Two cars have the same change in velocity, but one does so in half the time of the other; compare their accelerations and explain why this difference matters for passenger comfort.

Q519. Give one reason why estimating acceleration from a velocity–time graph can be less reliable when the data points are widely spaced in time.

Q520. Explain why an object moving in a circle at constant speed has a non-zero acceleration even though its speed does not change.

Q521. A ball is thrown vertically upward with an initial velocity of 18 m/s; using suitable equations, determine its velocity after 1.5 s and the height reached at that instant.

Q522. Discuss how the terminal velocity of an object depends on both its weight and its cross-sectional area when falling through air.

Q523. Describe one improvement you would make to reduce uncertainties when using light gates to measure the acceleration of a trolley on an inclined ramp.

Q524. Explain why the area under a velocity–time graph gives displacement and describe what a negative area represents.

Q525. Evaluate the limitations of using squared paper and manual counting of squares to estimate the area under a complex velocity–time graph obtained in a classroom experiment.

Q526. State Newton's Third Law and describe what happens when a person pushes against a wall.

Q527. Explain how Newton's Third Law applies when a book rests on a table.

Q528. Describe how Newton's Third Law is involved when a rocket takes off from the ground.

Q529. Two ice skaters push off from each other on a frictionless surface. Explain how their motions relate to Newton's Third Law.

Q530. A bird pushes down on the air with its wings to fly. Use Newton’s Third Law to explain how this allows the bird to move upwards.

Q531. A car tire pushes backwards on the road. Explain how Newton’s Third Law explains the forward motion of the car.

Q532. Describe what is meant by equilibrium in terms of forces and how Newton’s Third Law applies in such a situation.

Q533. A person leans against a wall without moving. Explain the forces acting and how they relate to Newton’s Third Law.

Q534. Explain the difference between the action and reaction forces when a swimmer pushes against the wall of a pool.

Q535. A hammer hits a nail into wood. Identify the action and reaction forces involved and describe how they are equal and opposite.

Q536. Define stopping distance and list its two main components.

Q537. Explain how the stopping distance of a vehicle is affected when the speed of the vehicle doubles.

Q538. Describe what is meant by thinking distance and state two factors that can increase it.

Q539. Explain how braking distance is affected by the condition of the road and the tires.

Q540. A vehicle is travelling at a high speed. Explain how this affects both thinking distance and braking distance.

Q541. Describe how graphs of speed versus stopping distance can be used to compare the performance of different vehicles.

Q542. A graph shows the stopping distance of a car at different speeds. Describe the shape of the graph and explain why it looks like that.

Q543. Explain why the stopping distance increases more rapidly than speed.

Q544. Describe a method you could use in a school lab to estimate a person’s reaction time using a falling ruler.

Q545. A student repeats the ruler drop test three times and gets different results. Explain why this might happen and how to improve reliability.

Q546. Compare the advantages and limitations of using computer-based methods to measure reaction time versus manual methods.

Q547. Give three examples of how distractions might affect a driver’s reaction time and explain the possible consequences.

Q548. Explain how alcohol affects reaction time and how this would change the thinking distance of a driver.

Q549. A driver's reaction time is 0.7 seconds. If their speed is 20 m/s, calculate their thinking distance and explain how this contributes to total stopping distance.

Q550. Evaluate how road safety campaigns can help reduce stopping distances and save lives by targeting factors that affect reaction time.

Q551. Describe how wet or icy road conditions affect the braking distance of a vehicle and explain why.

Q552. Explain how worn-out tyres can increase the braking distance of a car.

Q553. A car is travelling on a dry road and then moves onto a wet surface. Predict how the braking distance will change and why.

Q554. Explain how faulty brakes can affect both the braking distance and overall safety of a vehicle.

Q555. Discuss why it is important to check tyre pressure regularly in relation to stopping distances.

Q556. A driver increases their speed from 30 mph to 60 mph. Explain how the stopping distance changes and why.

Q557. Describe how the braking force needed to stop a vehicle changes with the speed of the vehicle.

Q558. Explain how the condition of the road surface affects the friction between the tyres and the road.

Q559. Describe the role of friction in braking and what happens if friction is too low.

Q560. A vehicle comes to a stop over 25 m on a dry road. Estimate how the stopping distance might change if the road is icy and explain why.

Q561. Explain what is meant by work done in the braking process and what energy transfer occurs.

Q562. Describe how the kinetic energy of a moving vehicle is reduced during braking.

Q563. A lorry and a car are travelling at the same speed. Explain which one would require more braking force to stop and why.

Q564. Describe the possible consequences of applying a very large braking force suddenly while driving at high speed.

Q565. Explain why brakes can overheat if a vehicle decelerates rapidly and repeatedly.

Q566. Describe how high deceleration can lead to a driver losing control of the vehicle.

Q567. A car decelerates at $6\ m/s^2$ over 4 seconds. Estimate the braking force if the car has a mass of 1000 kg.

Q568. Describe the safety features in modern cars that help to reduce the risk of skidding during emergency braking.

Q569. Explain the link between speed, braking force, and deceleration when stopping a vehicle.

Q570. Estimate how long it would take a car to stop if it decelerates at 5 m/s² from an initial speed of 25 m/s.

Q571. Discuss the dangers of excessive braking on a steep slope.

Q572. Describe how an anti-lock braking system (ABS) helps maintain control during braking.

Q573. A driver applies the brakes and the temperature of the brake pads increases. Explain the energy transfer involved.

Q574. Explain why it is dangerous to follow another car too closely in bad weather conditions.

Q575. Evaluate how driving habits can influence braking distances and road safety.

Q576. State the equation that links momentum, mass, and velocity, and define each quantity's SI unit.

Q577. A 2 kg toy car travels at 3 m/s. Calculate its momentum.

Q578. Explain what is meant by a closed system when discussing conservation of momentum.

Q579. Two ice skaters push off from each other on frictionless ice. Describe how their momenta compare before and after they separate.

Q580. A 1 kg ball moving at 4 m/s strikes and sticks to a 3 kg ball at rest. Calculate the common velocity after the collision.

Q581. Explain why momentum is conserved in a collision between two trolleys if no external forces act.

Q582. A 1.5 kg skateboard moves at 2 m/s and collides elastically with a 0.5 kg ball at rest. Describe how you would calculate their velocities after the collision.

Q583. Describe an experiment using light gates to measure the momentum before and after two trolleys collide.

Q584. A 1200 kg car moving at 10 m/s crashes into a stationary 1000 kg car and they lock together. Find their joint velocity immediately after impact.

Q585. State the equation that links force, change in momentum, and time, and explain each term briefly.

Q586. A force of 600 N acts for 0.2 s on a 1 kg football. Calculate the change in velocity of the ball.

Q587. Explain why increasing the time over which a force acts reduces the size of the force needed to change an object's momentum.

Q588. Describe how an air bag in a car helps reduce injuries during a crash using the concept of rate of change of momentum.

Q589. A steel ball of mass 0.2 kg rebounds from a wall. Its incoming velocity is 5 m/s, and its outgoing velocity is −4 m/s. Calculate the impulse delivered by the wall.

Q590. Explain how gym crash mats help protect athletes from injury when landing from height.

Q591. A rugby player of mass 90 kg running at 8 m/s is stopped in 0.4 s. Calculate the average force exerted on him.

Q592. Discuss how cushioned playground surfaces reduce the risk of head injuries for children.

Q593. A 50 g bullet leaves a gun barrel at 300 m/s. Calculate the recoil velocity of a 3 kg gun.

Q594. Explain why wearing a cycle helmet reduces the force on the skull during an impact.

Q595. Two carts of equal mass approach each other at 2 m/s each and stick together. Show how the final momentum of the system is zero.

Q596. A train wagon of mass 5000 kg moving at 1.2 m/s couples with a stationary wagon of 3000 kg. Calculate the loss of kinetic energy in the system.

Q597. Describe why elastic collisions conserve kinetic energy as well as momentum, while inelastic collisions do not.

Q598. Explain how seat belts reduce the risk of chest injury in a collision, using the idea of impulse.

Q599. A toy rocket of mass 0.4 kg expels 0.05 kg of gas backwards at 40 m/s. Calculate the forward velocity gained by the rocket.

Q600. Discuss one real-world situation where ignoring external forces would lead to an incorrect conclusion about momentum conservation.