

P2 – Forces Quiz

1. Explain why making a car more streamlined has an effect on its top speed.

Air resistance will decrease so a higher speed is reached before the resultant force is zero.

2. What two forces cause a motor boat to move?

The force from the water on the boat in the forward direction and the force from the propeller of the boat on the water in the opposite direction.

3. What is meant by the term resultant force?

A single force that has the same effect as all the forces combined/ the overall force

4. When an aircraft moves along the runway to take off, its acceleration decreases although the push of the engine remains constant. Why?

As speed increases, air resistance increases reducing the resultant force

5. When the motor inside a toy is switched off, the toy starts to accelerate downwards. What happens to the momentum of the toy and why?

Increases as the velocity increases.

6. Explain why a toy accelerates upwards when the fan inside the toy rotates faster.

Because there is a greater change in momentum as the velocity of the air increases so the upward force increases and is greater than the downward force.

7. Explain why objects are wrapped in polystyrene for protection.

When the object is dropped the polystyrene increases the time to stop which decreases the rate of change of momentum and therefore the force on the object.

8. How is velocity different from speed?

Velocity includes direction, velocity is a vector

9. When a tube is filled with air, a coin inside the tube will fall faster than a piece of paper. Why?

Air resistance has a greater effect on the paper.

10. The forward force on a tractor is exactly balanced by the resisting forces on the tractor. Describe the motion of the tractor.

Tractor is moving at constant speed.

11. Describe how the horizontal forces acting on a car change during the first 2 seconds of acceleration.

Driving force increases, friction forces increase, the driving force is bigger than friction

12. Using the idea of forces explain why a parachutist reaches terminal velocity.

Leaving plane: weight only force. Air resistance increases Weight > air resistance so accelerates downwards. When air resistance = weight, terminal velocity reached.

13. Using the idea of forces explain what happens when a parachutist opens his parachute.

The open parachute increases the surface area so air resistance increases as well. Air resistance is now > weight, so the velocity decreases. When weight = air resistance again a new, lower terminal velocity has been achieved.

14. Define braking distance.

The distance a vehicle travels before stopping, once the brakes are applied

15. Name two resistive forces that act on a vehicle.

Air resistance, friction between tyres and the road

16. State factors that affect thinking distance.

Tiredness, alcohol, drugs, speed, age, using a mobile phone, visibility (weather)

17. State factors that affect braking distance.

Icy or wet road, worn tyres, road surface, mass of car, speed of car, brakes are in bad condition

18. Why does applying the brakes increase the temperature of the brakes?

Friction between brakes and the wheel transfers kinetic energy to thermal energy

19. State & explain the benefits of a regenerative braking system (system that slows car down and recharges the car battery in a hybrid car).

The range of the car is increased; the efficiency of the car is increased as the decrease in kinetic energy is not converted to thermal energy but work is done to charge the battery.

20. When you slide down a slide, your speed at the bottom of the slide is much less than the calculated value. Why?

Work is done against friction as the slide is not smooth. Kinetic energy is therefore transferred to thermal energy.

21. Explain why the top speed of a car is higher than the top speed of a van.

Top speed is reached when forward force = drag force (air resistance/friction). The drag force of a car is smaller due to it being more streamlined. Drag force = forward force for the car at higher speed.

22. How can the velocity of a car change although the speed remains constant?

Because the direction is changing

23. During a collision the front end of a car becomes buckled. Why is such a collision described as inelastic?

In an inelastic collision, kinetic energy is lost. Here it does the work to crumple the car.

24. A car cannot accelerate above a certain maximum speed. Why not?

There is a maximum forward force when you push the accelerator pedal. Air resistance increases with speed until it is equal to the forward force so there is no net force.

25. In terms of force and deceleration, what would happen if a climber, who used a non-elastic rope, fell?

Deceleration would be great, because force = mass x acceleration. The force on the climber would be great. The rope might exceed its elastic limit.

26. Define direct proportionality.

Straight line through the origin

27. Which objects are storing elastic potential energy? A bent metal ruler, stretched elastic band, springs on a playground ride, moulded plastic model. Explain your answer.

Elastic band and springs because they will go back to their original shape

28. How much momentum does a car have when it stops at a traffic light?

Zero, as its velocity is zero

29. Crash test dummies are fitted with electronic sensors. Why?

To measure the forces exerted on the dummies during a collision

30. What is meant by the phrase 'momentum is conserved'?

Momentum before a collision = momentum after a collision

31. In a collision, momentum is not always conserved. Why?

An external force acts on the colliding objects

32. Explain why air bags reduce the risk of the driver sustaining serious head injuries.

Air bags reduce the time taken for the head to stop so decrease the change in momentum and reduce the force on the head

33. If the speed of a car doubles, the amount of energy transferred in a collision quadruples. Why?

Greater speed means greater kinetic energy ($\frac{1}{2} \text{ mass} \times \text{velocity}^2$). $2^2 = 4$, so the value for the kinetic energy quadruples

34. Define momentum.

Product of mass and velocity

35. Why is it easier to drag an object up a ramp instead of lifting it?

You only work against a component of gravity, not the direct force.

36. Could a skydiver ever hover in calm weather conditions?

No, as terminal velocity cannot be eliminated, only reduced.