

Year 11 Physics

Term1 Week 9 Review Test

Q2

A bus that is traveling at 30.0 km/h speeds up at a constant rate of 3.5 m/s^2 .
What velocity does it reach 6.8 s later?

Q3

If a car accelerates from rest at a constant 5.5 m/s^2 , how long will it take for the car to reach a velocity of 28 m/s ?

Q4

A car slows from 22 m/s to 3.0 m/s at a constant rate of 2.1 m/s^2 . How many seconds are required before the car is traveling at 3.0 m/s?

Q5

A race car travels on a racetrack at 44 m/s and slows at a constant rate to a velocity of 22 m/s over 11 s. How far does it move during this time?

Q6

- A woman driving at a speed of 23 m/s sees a deer on the road ahead and applies the brakes when she is 210 m from the deer. If the deer does not move and the car stops right before it hits the deer, what is the acceleration provided by the car's brakes?

Q7

Final Velocity An airplane accelerated uniformly from rest at the rate of 5.0 m/s^2 for 14 s. What final velocity did it attain?

Q8

- A construction worker accidentally drops a brick from a high scaffold.
- **a.** What is the velocity of the brick after 4.0 s?

- **b.** How far does the brick fall during this time?

Q9

- A student drops a ball from a window 3.5 m above the sidewalk. How fast is it moving when it hits the sidewalk?

Q10

- The driver of a car going 90.0 km/h suddenly sees the lights of a barrier 40.0 m ahead. It takes the driver 0.75 s to apply the brakes, and the average acceleration during braking is 10.0 m/s^2 .
- a. Determine whether the car hits the barrier.

Q11

The driver of a vehicle travelling at 8 m s^{-1} applies the brakes for 30 s and reduces the velocity of the vehicle to 2 m s^{-1} • Calculate the deceleration of the vehicle during this time.

Q12

- Two horizontal forces, 225 N and 165 N, are exerted on a canoe. If these forces are applied in the same direction, find the net horizontal force on the canoe.

Q13

- What is the net force acting on a 1.0-kg ball in free-fall?

Q14

A car of mass 2300 kg slows down at a rate of 3.0 m/s^2 when approaching a stop sign. What is the magnitude of the net force causing it to slow down?

Q15

A grocery sack can withstand a maximum of 230 N before it rips. Will a bag holding 15 kg of groceries that is lifted from the checkout counter at an acceleration of 7.0 m/s^2 hold?

Q16

A space vehicle moving towards a docking station at a velocity of 2.5 ms^{-1} is 26m from the docking station when its reverse thrust motors are switched on to slow it down and stop it when it reaches the station. The vehicle decelerates uniformly until it comes to rest at the docking station when its motors are switched off.

Calculate a) its deceleration, b) how long it takes to stop.

Q17

A driver of a vehicle travelling at a speed of 30 m s^{-1} on a freeway brakes sharply to a standstill in a distance of 100 m . Calculate the deceleration of the vehicle.

Q18

- A car is driven 125.0 km due west, then 65.0 km due south. What is the magnitude of its displacement?

Q19

- You walk 30 m south and 30 m east. Find the magnitude and direction of the resultant displacement

Q20

- A force of 40.0 N accelerates a 5.0-kg block at 6.0 m/s^2 along a horizontal surface. How large is the frictional force?

Q20

A coin was released at rest at the top of a well. It took 1.6s to hit the bottom of the well. Assuming air resistance is negligible calculate a) the distance fallen by the coin, b its speed just before impact.

Q23

- Two goods wagons cars, each with a mass of 3.0×10^5 kg, collide and stick together. One was initially moving at 2.2 m/s, and the other was at rest. What is their final speed?

Q24

- In a ballistics test at the police department, Officer Dafney fires a 6.0-g bullet at 350 m/s into a container that stops it in 1.8 ms. What is the average force that stops the bullet?

Q25

- A 95-kg fullback, running at 8.2 m/s, collides in mid-air with a 128-kg defensive tackle moving in the opposite direction. Both players end up with zero speed.

What was the fullback's momentum before the collision?

What was the change in the fullback's momentum?

Q26

- A constant force of 6.00 N acts on a 3.00-kg object for 10.0 s. What are the changes in the object's momentum and velocity?

Q27

- A box that weighs 575 N is lifted a distance of 20.0 m straight up by a cable attached to a motor. The job is done in 10.0 s. What power is developed by the motor in W and kW?

Q28

- A forklift raises a box 1.2 m and does 7.0 kJ of work on it. What is the mass of the box?

Q29

- A force of 300.0 N is used to push a 145-kg mass 30.0 m horizontally in 3.00 s.
- **a.** Calculate the work done on the mass.

- **b.** Calculate the power developed.

Q30

- A boy lifts a 2.2-kg book from his desk, which is 0.80 m high, to a bookshelf that is 2.10 m high. What is the potential energy of the book relative to the desk?

Q31 continued

- (b) When catching the ball, the cricketer moves his hands for a short distance in the direction of travel of the ball as it makes contact with his hands. Explain why this technique results in less force being exerted on the cricketer's hands.

Q32

A car accelerates at a steady rate of 2.5 m s^{-2} along a straight, level road. The mass of the car is $1.3 \times 10^3 \text{ kg}$.

- (a) Calculate the magnitude of the resultant force acting on the car.
- (b) When the accelerating car reaches a speed of 2.2 m s^{-1} , the total force opposing the motion of the car is 410 N .
- (ii) the power delivered to the wheels of the car.

Q33

A girl kicks a ball along the ground at a wall 2.0 m away. The ball strikes the wall normally at a velocity of 8.0 m s^{-1} and rebounds in the opposite direction with an initial velocity of 6.0 m s^{-1} . The girl, who has not moved, stops the ball a short time later.

- (a) Explain why the final displacement of the ball is not 4.0 m.

- (b) Explain why the average velocity of the ball is different from its average speed.

Q33 continued

(c) The ball has a mass of 0.45 kg and is in contact with the wall for 0.10 s. For the period of time the ball is in contact with the wall,

(i) calculate the average acceleration of the ball.

(ii) calculate the average force acting on the ball.

(iii) state the direction of the average force acting on the ball.

Q34

A constant resultant horizontal force of $1.8 \times 10^3 \text{ N}$ acts on a car of mass 900 kg , initially at rest on a level road.

(a) Calculate

(i) the acceleration of the car,

(ii) the speed of the car after 8.0 s ,

Q34 continued

(iii) the momentum of the car after 8.0 s,

(iv) the distance travelled by the car in the first 8.0 s of its motion,

(v) the work done by the resultant horizontal force during the first 8.0 s.

Q35

A ball is released from a height of 0.85 m above a bed of sand, and creates an impression in the sand of depth 0.025 m. For directions, let + represent upwards and - represent downwards

Q36

A vehicle of mass 900kg, travelling on a level road at a speed of 15 m s⁻¹, can be brought to a standstill without skidding by a braking force equal to 0.5 x its weight. Calculate a the deceleration of the vehicle, b the braking distance.

Q37

A ball of mass 0.63kg initially at rest was struck by a bat which gave it a velocity of 35 ms^{-1} . The contact time between the bat and ball was 25 ms . Calculate:
a the momentum gained by the ball b the average force of impact on the ball.

Q38

A tennis ball of mass 0.20 kg moving at a speed of 18 m s^{-1} was hit by a bat, causing the ball to go back in the direction it came from at a speed of 15 m s^{-1} . The contact time was 0.12 s . Calculate:

a) the change of momentum of the ball b) the impact force on the ball.

Q39

A rail wagon C of mass 4500 kg moving along a level track at a speed of 3.0 ms⁻¹ collides with and couples to a second rail wagon D of mass 3000 kg which is initially stationary. Calculate the speed of the two wagons immediately after the collision.

Q40

A railway wagon of mass 8000kg moving at 3.0ms⁻¹ collides with an initially stationary wagon of mass 5000 kg. The two wagons separate after the collision. The 8000 kg wagon moves at a speed of 1.0ms⁻¹ without change of direction after the collision. Calculate:
a) the speed and direction of the 5000 kg wagon after the collision
b) the loss of kinetic energy due to the collision.

Q41

On a fairground ride, the track descends by a vertical drop of 55m over a distance of 120m along the track. A train of mass 2500 kg on the track reaches a speed of 30 m s⁻¹ at the bottom of the descent after being at rest at the top. Calculate a) the loss of potential energy of the train, b) its gain of kinetic energy, c) the average frictional force on the train during the descent.

Q42

A fairground ride ends with a car moving up a ramp at a slope of 30° to the horizontal.

- (a) The car and its passengers have a total weight of $7.2 \times 10^3 \text{ N}$. Show that the component of the weight parallel to the ramp is $3.6 \times 10^3 \text{ N}$.
- (b) Calculate the deceleration of the car assuming the only force causing the car to decelerate is that calculated in part (a).
- (c) The car enters at the bottom of the ramp at 18 ms^{-1} . Calculate the minimum length of the ramp for the car to stop before it reaches the end. The length of the car should be neglected.
- (d) Explain why the stopping distance is, in practice, shorter than the value calculated in part (c).