Higher Momentum and Impulse Answers

1. $p = 752 kgms^{-1}$.

2. $v = 12ms^{-1}$.

3. $v = 350ms^{-1}$.

4. $u = 100ms^{-1}$.

5. Percentage uncertainity in the speed of the pellet = ± 5%.

6.

Type of Collision	Total Momentum	Total Energy	Kinetic Energy
Elastic	Conserved	Conserved	Conserved
Inelastic	Conserved	Conserved	Not Conserved
Explosion	Conserved	Conserved	Gained

7. a) $v = - 0.3ms^{-1}$.

b) Gain in $E_K = 0.43J$. It is an explosion.

8. a) $v = 0.87ms^{-1}$ in the original direction of the 1400kg car.

b) Loss in $E_K = 431.6kJ$. It is an Inelastic Collision.

9. a) $u_{bullet} = 595ms^{-1}$.

b) $v_{gun} = - 1.19ms^{-1}$.

c) Gain in $E_K = 1419J$. It is an explosion.

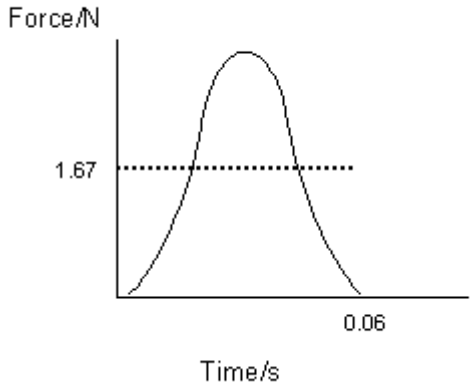
10. E_K before = 0.036J.

E_K after = 0.027J.

It is an Inelastic Collision.

11. a) F = 1.67N.

b)



12. a) Total momentum before the collision is equal to the total momentum after the collision.

This is providing that no external forces are acting.

b) i) $U_A = 20ms^{-1}$.

ii) $F_{FR} = - 1.35 \times 10^4 N$.

iii) Most of the kinetic energy will be converted into heat energy.

13. a) $v = 0.5ms^{-1}$.

b) i) Total momentum before the collision is equal to the total momentum after the collision.

This is providing that no external forces are acting.

ii) $u_{pellet} = 100.5ms^{-1}$.

c) Reducing the mass of the lump of putty will mean that after the collision the pellet embedded in the putty will travel a greater horizontal distance.

14. a) Total momentum before the collision is equal to the total momentum after the collision.

This is providing that no external forces are acting.

b) i) Δ Momentum B = $- 0.315kgms^{-1}$.

ii) E_K before = 0.25J.

E_K after = 0.16J.

It is an Inelastic Collision.

15. a) i) $v_{box} = 1.4ms^{-1}$.

ii) $u_{bullet} = 560ms^{-1}$.

b) The change in momentum of the bullet in this collision will be greater than in the first experiment.

To conserve momentum this means that the change in momentum of the box of sand will also be greater.

The only way that this change in momentum can be increased is if the box moves off with a greater velocity.

The box thus has a greater initial kinetic energy that will be transferred into potential energy resulting in the box reaching a greater height.

16. a) Impulse = 44Ns.

b) Δ Momentum = $44kgms^{-1}$.

c) $v = 12.3ms^{-1}$.

17. F = 8000N.

18. a) m = 0.33kg.

b) F = 200N.

19. a) i) $v = 0.4ms^{-1}$.

ii) F = 3.6N.

b) Time of contact between the club and the ball = ± 20%.

c) F = (3.6 ± 0.7)N.

20. a) i) A) Impulse = 1.5×10^{-3}Ns.

B) $v = 60ms^{-1}$.

ii) $v = 30ms^{-1}$. Find the area under the Force - time graph first to find V.

b) $v = 40.3ms^{-1}$.

21. a) Δ Momentum = 91kgms^{-1}.

b) t = 0.70s.

c) v = 0.51ms^{-1}.

d) E_K before = 223J.

E_K after = 409J.

E_K is gained.

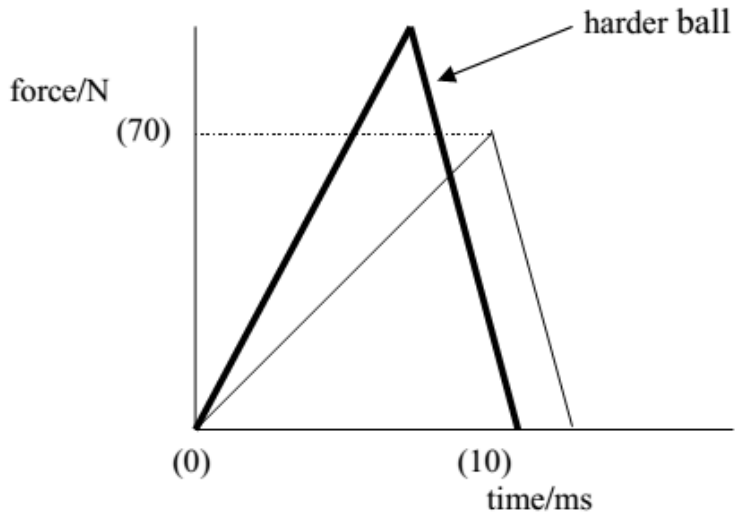
It is an explosion.

22. a) i) Impulse = Area under the F-t graph = 0.35Ns.

ii) Δ Momentum = 0.35kgms^{-1} upwards.

iii) v = 1.4ms^{-1}.

b)



23. a) i) A) Mean = 255μs.

B) Random uncertainty = ± 3μs.

ii) t = (255 ± 3) μs. The club does not reach the standard.

b) i) F = 5000N.

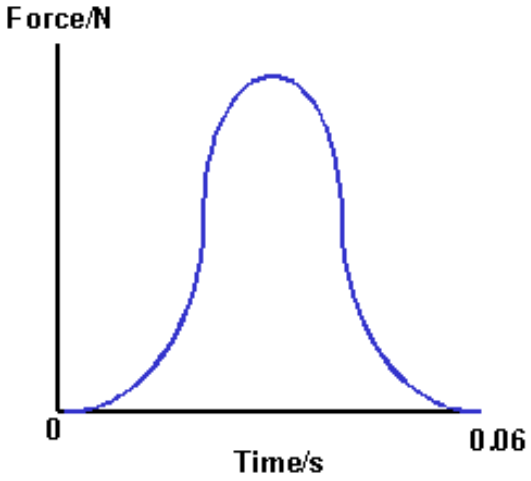
ii) Impulse or the change in momentum is greater.

24. a) V = - 0.1ms^{-1} to the left. Use the conservation of momentum equation.

b) Δ Momentum = - 0.12kgms^{-1}.

c) i) F = – 2N.

ii)



25. Δ Momentum = 35kgms^{-1}.