Q1. Two ice skaters, initially at rest and in contact, push apart from each other.
Which line, **A** to **D**, in the table states correctly the change in the total momentum and the total kinetic energy of the two skaters?

	total momentum	**total kinetic energy**
A	unchanged	increases
B	unchanged	unchanged
C	increases	increases
D	increases	unchanged

(Total 1 mark)

Q2. Two forces of 6 N and 10 N act at a point. Which of the following could **not** be the magnitude of the result?

A 16 N ⬭

B 8 N ⬭

C 5 N ⬭

D 3 N ⬭

(Total 1 mark)

Q3. A firework rocket is fired vertically into the air and explodes at its highest point. What are the changes to the total kinetic energy of the rocket and the total momentum of the rocket as a result of the explosion?

	total kinetic energy of rocket	**total momentum of rocket**	
A	unchanged	unchanged	⬭
B	unchanged	increased	⬭
C	increased	unchanged	⬭
D	increased	increased	⬭

(Total 1 mark)

Q4. Which of the following is a scalar quantity?

A velocity ⬭

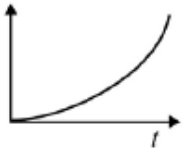
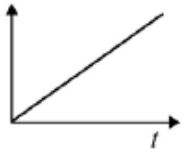
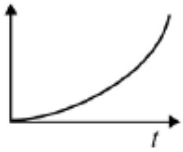
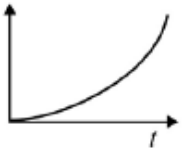
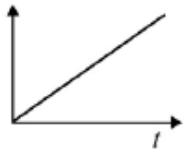
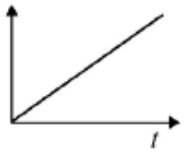
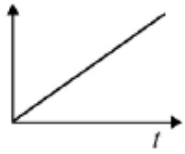
B kinetic energy ⬭

C force ⬭

D momentum ⬭

(Total 1 mark)

Q5. An object is accelerated from rest by a constant force *F* for a time *t*. Which graphs represent the variation of time with the change in the kinetic energy and the change in momentum of the object?

	Kinetic energy	**Momentum**
A		
B		
C		
D		

A ⬭

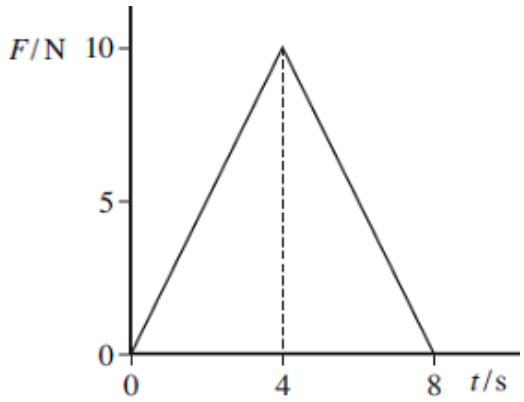
B ⬭

C ⬭

D ⬭

(Total 1 mark)

Q6. A ball of mass 2.0 kg, initially at rest, is acted on by a force *F* which varies with time *t* as shown by the graph.



What is the velocity of the ball after 8.0 s?

A 20 ms^{-1}

B 40 ms^{-1}

C 80 ms^{-1}

D 160 ms^{-1}

(Total 1 mark)

Q7. Which of the following is **not** a unit of power?

A N m s^{-1} ⬭

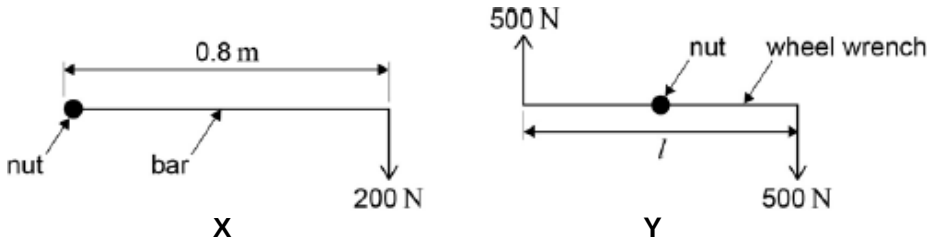
B kg m^2 s^{-3} ⬭

C J s^{-1} ⬭

D kg m^{-1} s^{-1} ⬭

(Total 1 mark)

Q8. A car wheel nut can be loosened by applying a force of 200 N on the end of a bar of length 0.8 m as in **X**. A car mechanic is capable of applying forces of 500 N simultaneously in opposite directions on the ends of a wheel wrench as in **Y**.



X **Y**

What is the minimum length l of the wrench which would be needed for him to loosen the nut?

A 0.16 m ⬭

B 0.32 m ⬭

C 0.48 m ⬭

D 0.64 m ⬭

(Total 1 mark)

Q9. An object is dropped from a cliff. How far does the object fall in the third second? Assume that g = 10 m s^{-2}.

A 10 m ⬭

B 20 m ⬭

C 25 m ⬭

D 45 m ⬭

(Total 1 mark)

Q10. What is the relationship between the distance y travelled by an object falling freely from rest and the time x the object has been falling?

A y is proportional to x^2 ⬭

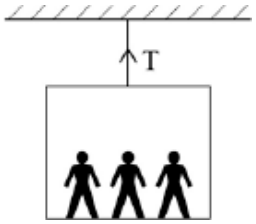
B y is proportional to $\sqrt{x}$ ⬭

C y is proportional to $\frac{1}{x}$ ⬭

D y is proportional to $\frac{1}{x^2}$ ⬭

(Total 1 mark)

Q11. A lift and its passengers with a total mass of 500 kg accelerates upwards at 2 m s^{-2} as shown. Assume that g = 10 m s^{-2}.



What is the tension in the cable?

A 1000 N ⬭

B 4000 N ⬭

C 5000 N ⬭

D 6000 N ⬭

(Total 1 mark)

Q12. A car exerts a driving force of 500 N when travelling at a constant speed of 72 km h^{-1} on a level track. What is the work done in 5 minutes?

A 3.0×10^6 J ⬭

B 2.0×10^6 J ⬭

C 2.0×10^5 J ⬭

D 1.1×10^5 J ⬭

(Total 1 mark)

Q13. A ballbearing **X** of mass $2m$ is projected vertically upwards with speed u. A ballbearing **Y** of mass m is projected at 30° to the horizontal with speed $2u$ at the same time. Air resistance is negligible. Which of the following statements is correct?

A The horizontal component of **Y**'s velocity is u. ⬭

B The maximum height reached by **Y** is half that reached by **X** ⬭

C **X** and **Y** reach the ground at the same time. ⬭

D **X** reaches the ground first. ⬭

(Total 1 mark)

Q14. An electric motor of input power 100 W raises a mass of 10 kg vertically at a steady speed of 0.5 m s^{-1}. What is the efficiency of the system?

A 5% ⬭

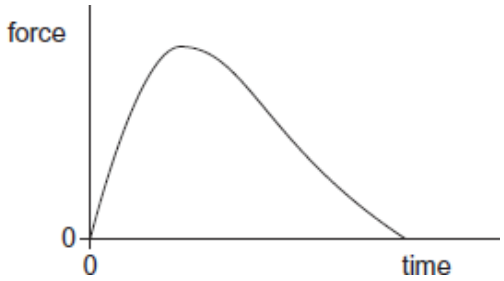
B 12% ⬭

C 50% ⬭

D 100% ⬭

(Total 1 mark)

Q15. The graph shows how the force acting on a rocket varies with time.



Which one of the following is represented by the area under the graph?

A distance travelled

B gain in kinetic energy

C change in velocity

D change in momentum

(Total 1 mark)

Q16. An object falls freely from rest. After falling a distance d its velocity is v. What is its velocity after it has fallen a distance $2d$?

A $2\,v$ ⬭

B $4\,v$ ⬭

C $2\,v^2$ ⬭

D $\sqrt{2}\,v$ ⬭

(Total 1 mark)

Q17. A golf club strikes a stationary golf ball of mass 4.8×10^{-2} kg and the ball leaves the club with a speed of 95 m s^{-1}. If the average force exerted on the ball is 7800 N, how long are the ball and club in contact?

A 5.8×10^{-4} s

B 1.2×10^{-2} s

C 0.51 s

D 0.58 s

(Total 1 mark)

Q18. Water of density 1000 kg m^{-3} flows out of a garden hose of cross-sectional area 7.2×10^{-4} m^2 at a rate of 2.0×10^{-4} m^3 per second. How much momentum is carried by the water leaving the hose per second?

A 5.6×10^{-5} N s

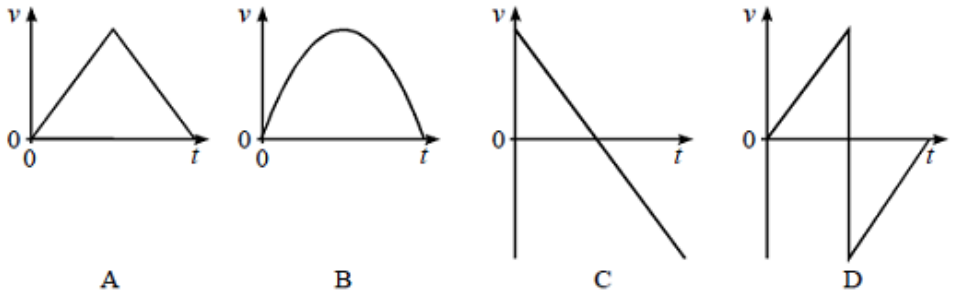
B 5.6×10^{-2} N s

C 0.20 N s

D 0.72 N s

(Total 1 mark)

Q19. A perfectly elastic rubber ball falls vertically from rest and rebounds from the floor. Which one of the following velocity-time, v–t, graphs best represents the motion from the moment of release to the top of the first rebound?



(Total 1 mark)

Q20. The diagram shows a strobe photograph of a mark on a trolley **X**, moving from right to left, in collision with another trolley **Y** which had no mark on it.

After the collision both trolleys are in motion together.

Which **one** of the following is consistent with the photograph?

A Trolley **Y** has the same mass as trolley **X** and was initially stationary

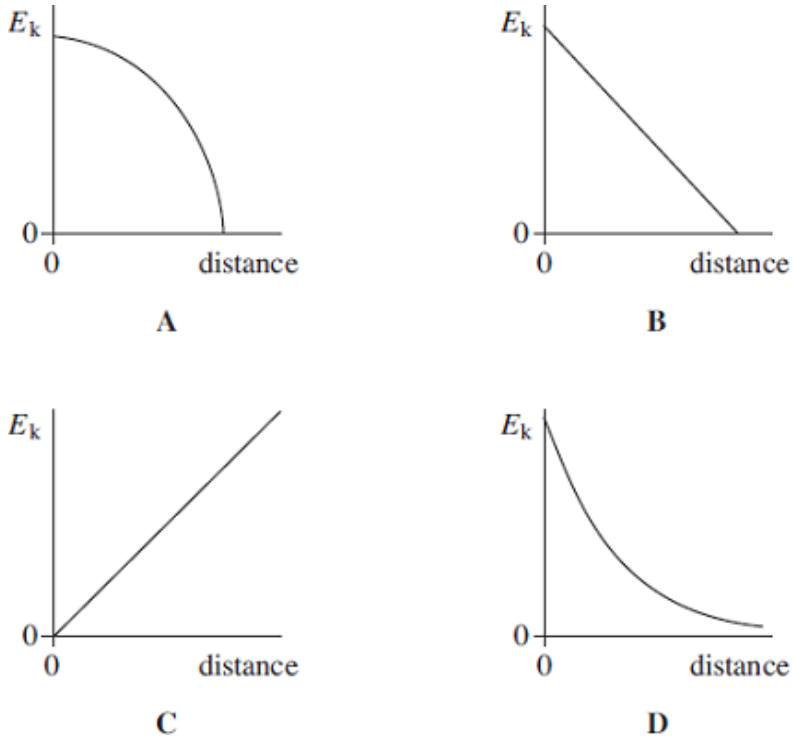
B Trolley **Y** had a smaller mass than **X** and was moving from right to left

C Trolley **Y** had the same mass and was initially moving left to right at the same speed as trolley **X**

D Trolley **Y** had the same mass and was initially moving left to right at a higher speed than trolley **X**

(Total 1 mark)

Q21. A body executes simple harmonic motion. Which one of the graphs, **A** to **D**, best shows the relationship between the kinetic energy, E_k, of the body and its distance from the centre of oscillation?



(Total 1 mark)

Q22. Which one of the following is a possible unit of impulse?

A Ns^{-1}

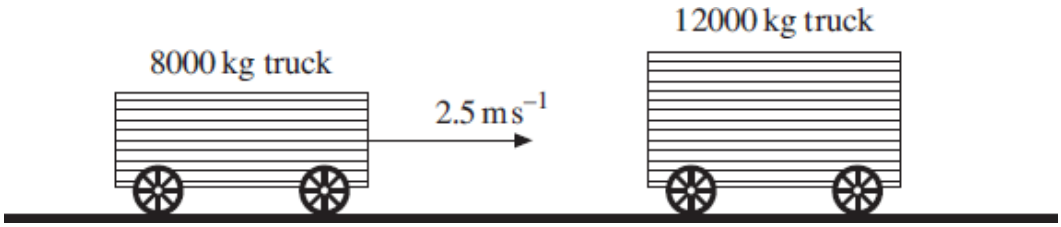
B $kg\ ms^{-1}$

C $kg\ ms^{-2}$

D sN^{-1}

(Total 1 mark)

Q23. A railway truck of mass 8000 kg travels along a level track at a velocity of 2.5 ms^{-1} and collides with a stationary truck of mass 12000 kg. The two trucks move together at the same velocity after the collision.



What is the change in momentum of the 8000 kg truck due to the impact?

A 8000 N s

B 12000 N s

C 20000 N s

D 25000 N s

(Total 1 mark)

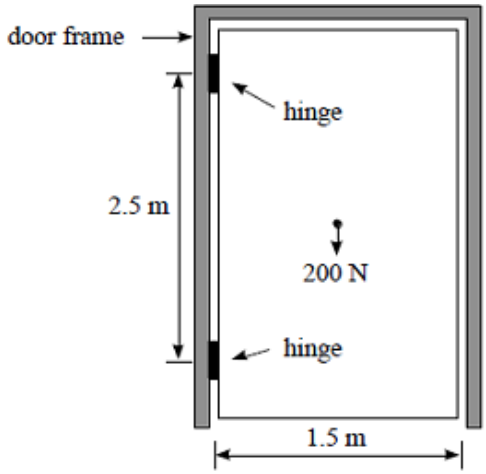
Q24. A body X moving with a velocity *v* makes an elastic collision with a stationary body Y of equal mass on a smooth horizontal surface.

Which line, **A** to **D**, in the table gives the velocities of the two bodies after the collision?

	velocity of X	**velocity of Y**
A	$\frac{v}{2}$	$-\frac{v}{2}$
B	$-\frac{v}{2}$	$\frac{v}{2}$
C	v	0
D	0	v

(Total 1 mark)

Q25. The diagram shows a uniform door hanging from two hinges 2.5 m apart.



The moment of the couple that the hinges exert on the door is

A 150 N m

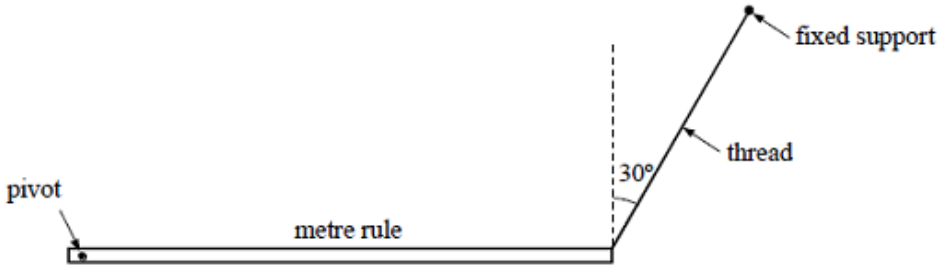
B 200 N m

C 250 N m

D 500 N m

(Total 1 mark)

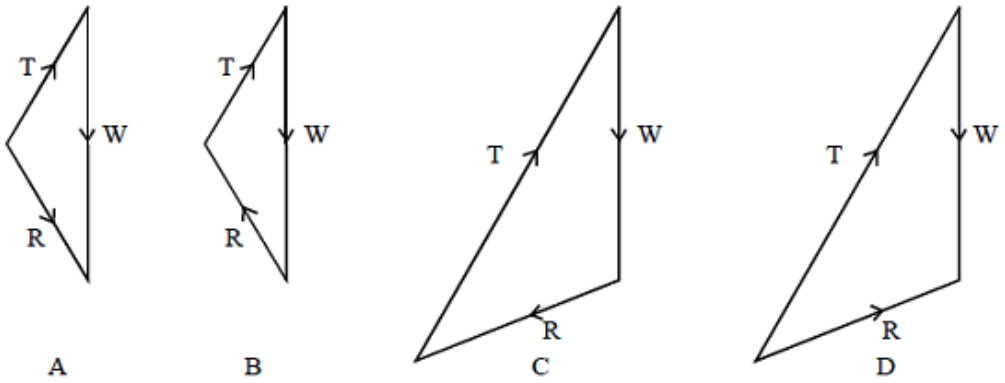
Q26. A pivoted metre rule is supported in equilibrium horizontally by a thread inclined at 30° to the vertical.



The three forces acting on the rule are:

its weight W;
the tension T in the thread;
the reaction force R at the pivot.

Which one of these diagrams, drawn to scale, represents the magnitudes and directions of these three forces?



(Total 1 mark)

Q27. A gas molecule of mass *m* in a container moves with velocity *v*. If it makes an elastic collision at right angles to the walls of the container, what is the change in momentum of the molecule?

A zero

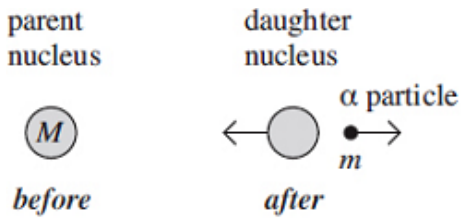
B $\frac{1}{2}mv$

C mv

D $2mv$

(Total 1 mark)

Q28. A stationary unstable nucleus of mass *M* emits an α particle of mass *m* with kinetic energy *E*.



What is the speed of recoil of the daughter nucleus?

A $\frac{\sqrt{2mE}}{(M-m)}$

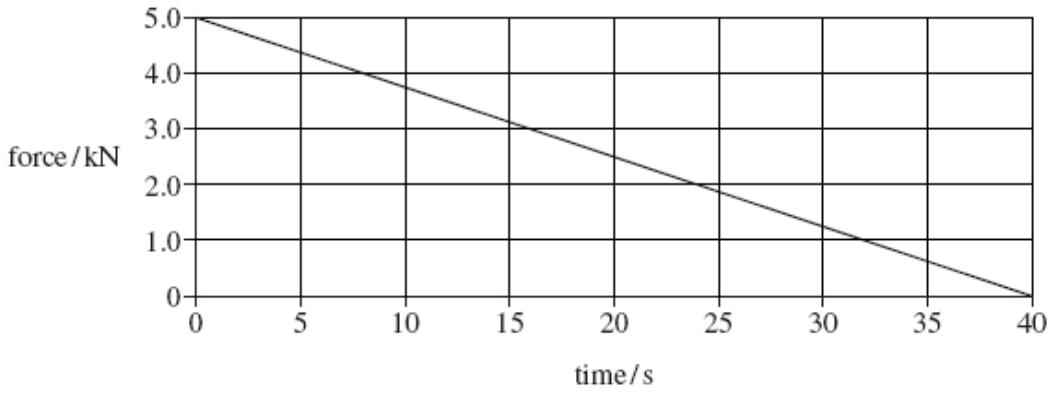
B $\frac{\sqrt{2mE}}{M}$

C $\frac{(M-m)}{\sqrt{2mE}}$

D $\frac{2mE}{(M-m)^2}$

(Total 1 mark)

Q29. The graph shows how the force on a glider of mass 2000 kg changes with time as it is launched from a level track using a catapult.



Assuming the glider starts at rest what is its velocity after 40 s?

A 2.5 m s^{-1}

B 10 m s^{-1}

C 50 m s^{-1}

D 100 m s^{-1}

(Total 1 mark)

Q30. A rail truck X travels along a level track and collides with a stationary truck Y. The two trucks move together at the same velocity after the collision.

Which line, **A** to **D**, in the table states how the total momentum and the total kinetic energy of the trucks change as a result of the impact.

	total momentum	**total kinetic energy**
A	unchanged	unchanged
B	unchanged	decreases
C	decreases	decreases
D	decreases	unchanged

(Total 1 mark)

M1. A

[1]

M2. D

[1]

M3. C

[1]

M4. B

[1]

M5. A

[1]

M6. A

[1]

M7. D

[1]

M8. B

[1]

M9. C

[1]

M10. A

[1]

M11. D

[1]

M12. C

[1]

M13. C

[1]

M14. C

[1]

M15. D

[1]

M16. D

[1]

M17. A

[1]

M18. B

[1]

M19. D

[1]

M20. A

[1]

M21. A

[1]

M22. B

[1]

M23. B

[1]

M24. D

[1]

M25. A

[1]

M26. B

[1]

M27. D

[1]

M28. A

[1]

M29. C

[1]

M30. B

[1]