1. A driving force $F$ acts on a car which moves with constant velocity $v$. The quantity $Fv$ is equivalent to the
   A. useful power developed by the engine of the car.
   B. work done by the car against resistive forces.
   C. energy of the car.
   D. rate of change of momentum of the car.

**Markscheme**

A

2. An object is thrown upwards leaving the thrower’s hand at time $t=0$. Which graph shows how speed $v$ varies with $t$ as the object rises and falls?

**Markscheme**

A

3. A ball of mass $m$ travels horizontally with speed $v$ before colliding with a vertical wall. The ball rebounds at speed $v$ in a direction opposite to its initial direction. What is the magnitude of the change in momentum of the ball?
   A. 0
   B. $\frac{mv}{2}$
   C. $mv$
   D. $2mv$
4. A block rests on a plane inclined at an angle $\theta$ to the horizontal. Which of the following gives the relationships for the normal reaction $N$ and the frictional force $F$ with the weight $W$?

![Diagram of a block on an inclined plane with forces $N$, $F$, and $W$.]

\[
\begin{array}{|c|c|}
\hline
N & F \\
\hline
A. & W\sin\theta & W\sin\theta \\
B. & W\sin\theta & W\cos\theta \\
C. & W\cos\theta & W\sin\theta \\
D. & W\cos\theta & W\cos\theta \\
\hline
\end{array}
\]

5. Three coplanar forces of 5 N, 6 N and 7 N act on an object. Which force could not be the resultant of these three forces? [1 mark]

A. 0 N
B. 11 N
C. 13 N
D. 19 N
6. A ball is released at time \( t=0 \) above a horizontal surface. The graph shows the variation of velocity \( v \) with time. Which of the following shows the highest point of the ball after one bounce?

![Diagram of velocity-time graph with points A, B, C, and D labeled.]

---

**Markscheme**

D

---

7. Balls X and Y are at the same height. X is projected horizontally at the same time that Y is dropped. Y is the same size as X but has half its mass.

![Diagram of balls X and Y at the same height, with X projected horizontally and Y dropped.]

Ignoring air resistance, which statement is true?

A. Y will hit the ground before X.
B. Y will hit the ground after X.
C. Y will hit the ground at the same time as X.
D. The outcome can only be determined if the initial speed of X is known.

---

**Markscheme**

C
8. A speed boat tows a water skier so that the skier accelerates. The magnitude of the force exerted on the skier by the tow rope must be

I. greater than the magnitude of the total resistive force acting on the skier
II. equal to the magnitude of the force exerted on the tow rope by the skier
III. equal to the magnitude of the force causing the boat to accelerate.

Which of the above factors is/are correct?
A. I and II only
B. I and III only
C. II only
D. III only

Markscheme
A

9. The velocity–time graph for an accelerating object that is traveling in a straight line is shown below.

Which of the following is the change in displacement of the object in the first 5.0 seconds?
A. 25.0 m
B. 12.5 m
C. 5.0 m
D. 1.0 m

Markscheme
B
An object falls vertically from rest. Air resistance acts on the object and it reaches a terminal speed. Which of the following is the distance–time graph for its motion?

A. 

B. 

C. 

D.
A block of mass $m$ is moving at constant velocity $v$ along a frictionless surface that is height $h$ above the ground. Which expression gives the work necessary to maintain the constant velocity?

A. $mgh$
B. $\frac{1}{2}mv^2$
C. $mgh + \frac{1}{2}mv^2$
D. zero

Which of the following is an elastic collision?

A. Two railway trucks collide and they link together.
B. Two railway trucks collide and they do not link together.
C. Two gas molecules collide and each changes direction.
D. Two gas molecules collide and a bond is formed between them.
13. The graph shows the acceleration $a$ of an object as time $t$ varies. What is the magnitude of the change in the velocity of the object between 0 and 3 seconds?

A. 5 ms$^{-1}$  
B. 10 ms$^{-1}$  
C. 20 ms$^{-1}$  
D. 30 ms$^{-1}$

**Markscheme**

C

14. A force $F$ acts on a block at an angle $\theta$ with respect to a horizontal surface. The block is moving with a constant velocity $v$ along the surface. A resistive force acts on the block. Which of the following correctly represents the forces acting on the block?

A. reaction force $F$  
B. reaction force $F$  
C. reaction force $F$  
D. reaction force $F$

**Markscheme**

D
15. The momentum of a particle stays constant provided that
   A. it moves in a circle with constant speed.
   B. its acceleration is uniform.
   C. the net internal force acting on it is zero.
   D. the net external force acting on it is zero.

   Markscheme
   D

16. A student makes three statements about situations in which no work is done on an object.
   I. The object is moving with uniform circular motion.
   II. A force is applied to the object in the direction of its velocity.
   III. A force is applied to the object in a direction opposite to its motion.

   Which of the above statements is/are correct?
   A. I only
   B. I and II only
   C. I and III only
   D. III only.

   Markscheme
   A
A block is attached to a stretched spring and then released. It moves from X to Y along a horizontal frictionless surface in the direction shown. The mass of the spring is negligible.

The equilibrium position of the system is P.

Which of the following is correct with respect to the changes in kinetic energy and potential energy of the block and of the spring as the block moves from X to Y?

<table>
<thead>
<tr>
<th>Block</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. kinetic energy decreases</td>
<td>potential energy increases</td>
</tr>
<tr>
<td>B. kinetic energy increases</td>
<td>potential energy decreases</td>
</tr>
<tr>
<td>C. potential energy decreases</td>
<td>kinetic energy increases</td>
</tr>
<tr>
<td>D. potential energy increases</td>
<td>kinetic energy decreases</td>
</tr>
</tbody>
</table>

Markscheme

B

A gun fires a bullet of mass $m$ at a horizontal velocity of $v$. Air resistance on the bullet is negligible. A change in which of the following will affect the time for the bullet to hit the ground?

A. $m$ only
B. $v$ only
C. $m$ and $v$
D. neither $m$ nor $v$
19. The momentum of an object changes by $\Delta p$ in a time $\Delta t$. What is the impulse acting on the object during this change? [1 mark]

A. $\Delta p$
B. $\Delta p \Delta t$
C. $\frac{\Delta p}{\Delta t}$
D. zero

Markscheme

A

20. A tennis ball is dropped from the top of a high building. Air resistance cannot be neglected. Which graph represents the variation with time $t$ of the magnitude of the acceleration $a$ of the ball before it hits the ground? [1 mark]

A. 

B. 

C. 

D. 

Markscheme

B
21. A model plane flies with constant velocity at constant height. Which diagram represents the forces acting on the plane? [1 mark]

A.  
B.  
C.  
D.  

Markscheme
D

22. The net force on a body is \( F \). The impulse of \( F \) is equal to the  
A. change in momentum of the body.  
B. rate of change of momentum of the body.  
C. change of kinetic energy of the body.  
D. change of total energy of the body. [1 mark]

Markscheme
A

23. In an inelastic collision  
A. momentum and kinetic energy are both conserved.  
B. momentum is conserved but kinetic energy is not.  
C. kinetic energy is conserved but momentum is not.  
D. neither momentum nor kinetic energy are conserved. [1 mark]

Markscheme
A

24. A force which increases uniformly from 0 to a maximum value of \( F \) is applied to an object. The object does not move until the force exceeds \( 0.5F \). As the force increases from \( 0.5F \) to \( F \) the object moves a distance \( x \) in the direction of the force. What is the work done by this force?  
A. \( 0.25Fx \)  
B. \( 0.5Fx \)  
C. \( 0.75Fx \)  
D. \( Fx \) [1 mark]

Markscheme
C
A ball is thrown from the top of a cliff. The initial magnitude of the velocity of the ball at time $t=0$ is $V$. The ball hits the sea at time $t=T$. Air resistance is negligible.

Which graph shows how the vertical component of the velocity $v$ of the ball varies with $t$ as it falls to the sea?

A. \[ \begin{array}{c}
\text{Graph A} \\
\begin{array}{c}
\text{Graph B} \\
\begin{array}{c}
\text{Graph C} \\
\begin{array}{c}
\text{Graph D}
\end{array}
\end{array}
\end{array}
\end{array} \]

Markscheme

D

An object, initially at rest, travels a distance $d$ in a time $t$ at a constant acceleration. What is the time taken for the object to travel $16d$ from rest at the same acceleration?

A. $16t$  
B. $8t$  
C. $4t$  
D. $2t$
27. An object is released above the surface of Earth. Which of the following correctly describes the speed and acceleration before it reaches terminal speed? [1 mark]

<table>
<thead>
<tr>
<th>Speed</th>
<th>Acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. increases</td>
<td>remains constant</td>
</tr>
<tr>
<td>B. increases</td>
<td>decreases</td>
</tr>
<tr>
<td>C. remains constant</td>
<td>remains constant</td>
</tr>
<tr>
<td>D. remains constant</td>
<td>decreases</td>
</tr>
</tbody>
</table>

**Markscheme**

B
An object of mass $m$ is connected via a frictionless pulley to an object of mass $M$, where $M > m$. $M$ rests on a horizontal frictionless surface.

What is the acceleration of the system?

A. \( \frac{mg}{(M + m)} \)

B. \( \frac{(M + m)g}{m} \)

C. \( \frac{gm}{M} \)

D. Zero

**Markscheme**

A
The graph shows the variation with distance $x$ of the magnitude of the net force $F$ acting on a body initially at rest. [1 mark]

Which of the following describes how the kinetic energy and the acceleration of the body change with distance?

<table>
<thead>
<tr>
<th>Kinetic energy</th>
<th>Acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. decrease</td>
<td>decrease</td>
</tr>
<tr>
<td>B. decrease</td>
<td>increase</td>
</tr>
<tr>
<td>C. increase</td>
<td>decrease</td>
</tr>
<tr>
<td>D. increase</td>
<td>increase</td>
</tr>
</tbody>
</table>

**Markscheme**

C
30. A ball of mass 0.40 kg travels horizontally and strikes a vertical wall with a speed of 5.0 m s\(^{-1}\). It rebounds horizontally with a speed of 3.0 m s\(^{-1}\). The ball is in contact with the wall for a time of 0.20 s.

What is the average magnitude of the force exerted by the ball on the wall?

A. 0.16 N  
B. 0.64 N  
C. 4 N  
D. 16 N

**Markscheme**

D

31. Two identical balls are dropped from a tall building, one a few seconds after the other. Air resistance is **not** negligible. As the balls fall, the distance between the balls will

A. decrease.  
B. increase.  
C. increase then remain constant.  
D. remain constant.

**Markscheme**

C
A ball of mass \( m \) is thrown horizontally from a cliff with initial velocity \( u \). Air resistance is negligible.

A change in which of the following will affect the horizontal distance travelled?

A. \( m \) only
B. \( u \) only
C. both \( m \) and \( u \)
D. neither \( m \) nor \( u \)

**Markscheme**

B

Which of the following is always true for an object moving in a straight line at constant speed?

A. No forces act on the object.
B. No resultant force acts on the object.
C. The momentum of the object is zero.
D. No work is being done on the object.

**Markscheme**

B

Which of the following is necessary for an object to be in translational equilibrium?

A. The object must be stationary.
B. The object must move with a constant speed.
C. The resultant force acting on the object must be zero.
D. No forces must act on the object.

**Markscheme**

C
An object is thrown horizontally from the edge of a high crater on the Moon. The Moon has no atmosphere. Which of the following describes the changes, if any, to the horizontal and vertical components of the velocity of the object?

<table>
<thead>
<tr>
<th>Horizontal velocity</th>
<th>Vertical velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. stays constant</td>
<td>increases at a constant rate</td>
</tr>
<tr>
<td>B. decreases</td>
<td>increases at a constant rate</td>
</tr>
<tr>
<td>C. stays constant</td>
<td>increases at a non-constant rate</td>
</tr>
<tr>
<td>D. decreases</td>
<td>increases at a non-constant rate</td>
</tr>
</tbody>
</table>

**Markscheme**

A

An object is dropped from rest above the Earth’s surface. Air resistance acts on the object. What is the variation of acceleration $a$ with time $t$ for the object?

A. \[
\begin{array}{c}
| t | \hline
| \hline
\end{array}
\]

B. \[
\begin{array}{c}
| t | \hline
| \hline
\end{array}
\]

C. \[
\begin{array}{c}
| t | \hline
| \hline
\end{array}
\]

D. \[
\begin{array}{c}
| t | \hline
| \hline
\end{array}
\]

**Markscheme**

D
37. Which of the following is a condition for an object to be in translational equilibrium?
   A. The object must be moving at constant speed.
   B. The velocity of the object in any direction must be zero.
   C. The forces acting horizontally on the object must equal the forces acting vertically on the object.
   D. The resultant force acting on the object must be zero.

   **Markscheme**
   D

38. An object rotates in a horizontal circle when acted on by a centripetal force $F$. What is the centripetal force acting on the object when the radius of the circle doubles and the kinetic energy of the object halves?
   A. $\frac{F}{2}$
   B. $\frac{F}{4}$
   C. $F$
   D. $4F$

   **Markscheme**
   A

39. No external forces act on a given system during an inelastic collision. For this system, which is correct about the conservation of kinetic energy and the conservation of linear momentum?

<table>
<thead>
<tr>
<th>Kinetic energy</th>
<th>Linear momentum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. must be conserved</td>
<td>may be conserved</td>
</tr>
<tr>
<td>B. must be conserved</td>
<td>must be conserved</td>
</tr>
<tr>
<td>C. is not conserved</td>
<td>may be conserved</td>
</tr>
<tr>
<td>D. is not conserved</td>
<td>must be conserved</td>
</tr>
</tbody>
</table>

   **Markscheme**
   D
An object of mass $m_1$ has a kinetic energy $E_1$. Another object has a mass $m_2$ and kinetic energy $E_2$. The objects have the same momentum. What is the ratio $\frac{E_1}{E_2}$?

A. 1  
B. $\frac{m_2}{m_1}$  
C. $\frac{m_2}{m_1}$  
D. $\left(\frac{m_2}{m_1}\right)^2$

**Markscheme**

C

A metal sphere is at rest on a bench. According to Newton's third law of motion, what is a possible action-reaction pair for this situation?

<table>
<thead>
<tr>
<th>Action</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. downwards gravitational force of Earth on the sphere</td>
<td>upwards gravitational force of the sphere on Earth</td>
</tr>
<tr>
<td>B. upwards gravitational force of Earth on the sphere</td>
<td>downwards gravitational force of the sphere on Earth</td>
</tr>
<tr>
<td>C. upwards electrostatic force acting on the sphere due to the atoms in the bench surface</td>
<td>upwards gravitational force of the sphere on Earth</td>
</tr>
<tr>
<td>D. upwards electrostatic force acting on the sphere due to the atoms in the bench surface</td>
<td>downwards gravitational force of the sphere on Earth</td>
</tr>
</tbody>
</table>

**Markscheme**

A
42. The diagram shows the trajectory of an object projected in the absence of air resistance. The object is then projected with the same initial conditions but air resistance is taken into account. Which of the following is the trajectory when air resistance is taken into account? The original trajectory is shown as a dotted line.

**Markscheme**

B

43. Which of the following is a condition for an object to be in translational equilibrium?

A. The object must be moving at constant speed.
B. The velocity of the object in any direction must be zero.
C. The forces acting horizontally on the object must equal the forces acting vertically on the object.
D. The resultant force acting on the object must be zero.

**Markscheme**

D
44. The resultant force acting on an object of mass 5.0kg varies with time as shown. The object is initially at rest.

What is the speed of the object after 1.0 s?

A. 0.50ms⁻¹
B. 1.0ms⁻¹
C. 1.5ms⁻¹
D. 2.0ms⁻¹

**Markscheme**

C

---

45. A body moves on a straight line. The graphs show the variation of displacement with time. Which graph shows motion with negative acceleration?
The graph shows how the net force $F$ that acts on a body varies with the distance $x$ that the body has travelled.

46. After travelling 6 m, the change in the kinetic energy of the body is

A. 0 J.
B. 20 J.
C. 30 J.
D. 60 J.

47. A constant force of 12 N is applied for 3.0 s to a body initially at rest. The final velocity of the body is 6.0 m s$^{-1}$. What is the mass of the body?

A. 1.5 kg
B. 6.0 kg
C. 24 kg
D. 36 kg
48. A cart of mass 4.0 kg is being pulled with a force of 24 N. The cart accelerates at 3.0 m s\(^{-2}\). What is the net force on the cart? [1 mark]

A. 6.0 N  
B. 8.0 N  
C. 12 N  
D. 24 N

**Markscheme**

C

49. Each side of a metal cube is measured to be 2.0 cm ± 0.20 cm. What is the absolute uncertainty in the calculated volume of the cube? [1 mark]

A. ± 0.08 cm\(^3\)  
B. ± 0.60 cm\(^3\)  
C. ± 0.80 cm\(^3\)  
D. ± 2.4 cm\(^3\)

**Markscheme**

D
A particle accelerates from rest. The graph shows how the acceleration $a$ of the particle varies with time $t$.

What is the speed of the particle at $t=6.0\,\text{s}$?

A. $0.5\,\text{ms}^{-1}$  
B. $2.0\,\text{ms}^{-1}$  
C. $9.0\,\text{ms}^{-1}$  
D. $18\,\text{ms}^{-1}$

**Markscheme**

C
A block slides down an inclined plane at constant speed. Which diagram represents the free-body diagram of the forces acting on the block?

A. 

B. 

C. 

D. 

Markscheme

B
52. In the collision between two bodies, Newton’s third law
A. only applies if momentum is conserved in the collision.
B. only applies if energy is conserved in the collision.
C. only applies if both momentum and energy are conserved in the collision.
D. always applies.

**Markscheme**

D

53. A ball X moving horizontally collides with an identical ball Y that is at rest.

X strikes Y with speed \( v \).

What is a possible outcome of the collision?

A. stationary \( v \) \( v \)
B. \( \frac{1}{2}v \) \( \frac{1}{2}v \)
C. \( v \) \( v \)
D. \( v \) \( v \)

**Markscheme**

A
A ball is moving horizontally and strikes a vertical wall from which it rebounds horizontally. The sketch graph shows how the contact force $F$ between ball and wall varies with time of contact $t$. The maximum value of $F$ is $F_0$ and the total time of contact between ball and wall is $T$.

What is the change in momentum of the ball?

A. $\frac{F_0 T}{2}$
B. $F_0 T$
C. $\frac{F_0}{2}$
D. $\frac{F_0}{T}$

**Markscheme**

A

An insect of mass $m$ jumps vertically from rest to a height $h$. The insect releases the energy needed for the jump in time $\Delta t$. What is the estimate for the power developed by the insect?

A. $mgh \Delta t$
B. $mh \Delta t$
C. $\frac{mgh}{\Delta t}$
D. $\frac{mh}{\Delta t}$

**Markscheme**

C
A ball of mass \( m \) is projected horizontally with speed \( v \) from a height \( h \) above the floor. Air resistance is negligible.

The horizontal distance travelled by the ball to the point where it lands on the floor depends on

A. \( m \) and \( h \) only.
B. \( m \) and \( v \) only.
C. \( h \) and \( v \) only.
D. \( m \), \( h \) and \( v \).

Markscheme

C

A truck is pulled up an inclined plane at constant speed by an electric motor. The gain in potential energy of the truck is 48 kJ. The efficiency of the electric motor is \( \frac{2}{3} \).

How much energy is dissipated in pulling the truck up the plane?

A. 16 kJ
B. 24 kJ
C. 32 kJ
D. 64 kJ

Markscheme

B

A projectile is fired from level ground with speed \( v \) at an angle \( \theta \) to the ground. Ignoring air resistance, which of the following is a correct expression for the maximum height reached by the projectile?

A. \( \frac{v^2 \sin^2 \theta}{2g} \)
B. \( \frac{v^2 \cos^2 \theta}{2g} \)
C. \( \frac{v \sin \theta}{g} \)
D. \( \frac{v \cos \theta}{g} \)
An object is at rest at time $t = 0$. The variation with $t$ of the acceleration $a$ of the object is shown from $t = 0$ to $t = 20$ s. [1 mark]

What is the speed of the object when $t = 15$ s?

A. $25 \text{ m/s}^{-1}$  
B. $50 \text{ m/s}^{-1}$  
C. $75 \text{ m/s}^{-1}$  
D. $100 \text{ m/s}^{-1}$

Which of the following is proportional to the net external force acting on a body? [1 mark]

A. Speed  
B. Velocity  
C. Rate of change of speed  
D. Rate of change of velocity

Markscheme

D
61. A small positively charged sphere is suspended from a thread and placed close to a negatively charged rod. When the thread is at 45° to the vertical the system is in equilibrium. The weight of the sphere is $W$ and the magnitude of the electrostatic force between the rod and the sphere is $F$.

What is the magnitude of $W$ compared with the magnitude of $F$?

A. $W = \sqrt{2}F$
B. $F < W < \sqrt{2}F$
C. $W = F$
D. $W > F$

**Markscheme**
C

62. An object of mass $m$ is initially at rest. When an impulse $I$ acts on the object its final kinetic energy is $E_K$. What is the final kinetic energy when an impulse of $2I$ acts on an object of mass $2m$ initially at rest?

A. $\frac{E_K}{2}$
B. $E_K$
C. $2E_K$
D. $4E_K$

**Markscheme**
C

63. A heat engine does 300 J of work during one cycle. In this cycle 900 J of energy is wasted. What is the efficiency of the engine?

A. 0.25
B. 0.33
C. 0.50
D. 0.75

**Markscheme**
A

64. An object is dropped from rest. Air resistance is not negligible. What is the acceleration of the object at the start of the motion?

A. Zero
B. Increasing
C. Decreasing
D. Constant
A student throws a stone with velocity $v$ at an angle $\theta$ to the vertical from the surface of a lake. Air resistance can be ignored. The acceleration due to gravity is $g$. What is the time taken for the stone to hit the surface of the lake?

A. \( \frac{\sin \theta}{g} \)
B. \( \frac{\cos \theta}{g} \)
C. \( \frac{2\sin \theta}{g} \)
D. \( \frac{2\cos \theta}{g} \)

A tennis ball is released from rest and falls vertically through a small distance in air. What is the change in the speed of the ball and the change in the acceleration of the ball as it falls?

<table>
<thead>
<tr>
<th>Speed of the ball</th>
<th>Acceleration of the ball</th>
</tr>
</thead>
<tbody>
<tr>
<td>increases</td>
<td>decreases</td>
</tr>
<tr>
<td>decreases</td>
<td>increases</td>
</tr>
<tr>
<td>increases</td>
<td>increases</td>
</tr>
<tr>
<td>decreases</td>
<td>decreases</td>
</tr>
</tbody>
</table>

A tennis ball is released from rest and falls vertically through a small distance in air. What is the change in the speed of the ball and the change in the acceleration of the ball as it falls?
The graph below shows the variation with time $t$ of the velocity $v$ of a car travelling in a straight line.

Which graph shows the variation with $t$ of the displacement $s$ of the car?

A.  

B.  

C.  

D.  

Markscheme

C

Which statement applies to an object in translational equilibrium?

A. The object must be stationary.
B. The object must be moving with constant acceleration.
C. The resultant force acting on the object must be zero.
D. There must be no external forces acting on the object.
A constant horizontal force $F$ is applied to a block Y. Block Y is in contact with a separate block X.

The blocks remain in contact as they accelerate along a horizontal frictionless surface. Y has a greater mass than X. Air resistance is negligible.

Which statement is correct?
A. The force $F$ is equal to the product of the mass of Y and the acceleration of Y.
B. The force that Y exerts on X is less than $F$.
C. The force that Y exerts on X is less than the force that X exerts on Y.
D. The force that Y exerts on X is equal to $F$.

The spheres undergo a head-on elastic collision.

Which statement correctly describes the spheres after the collision?
A. The total momentum of the spheres is $2mv$.
B. Each sphere has zero momentum.
C. The total kinetic energy of the spheres is $mv^2$.
D. Each sphere has zero kinetic energy.
A body moves in a straight line. In order for the equations for uniformly accelerated motion to be applied, which condition must be true? 

A. A constant net force acts on the body of fixed mass. 
B. A constant net force acts on the body. 
C. The body falls towards the surface of a planet. 
D. The body has an initial velocity of zero. 

**Markscheme**

A

The graph shows the variation with time of the velocity of a truck of fixed mass.

What can be deduced from the graph? 

A. The truck is always accelerating. 
B. The truck is always moving. 
C. The truck is always moving in one direction. 
D. The displacement of the truck after time $t$ is zero. 

**Markscheme**

A
73. A student of mass $m$ is in an elevator which is accelerating downwards at an acceleration $a$. [1 mark]

What is the reading on the force meter?
A. $mg$
B. $mg - ma$
C. $mg + ma$
D. $ma - mg$

**Markscheme**

B

74. A tennis ball is dropped from the top of a tall building. Air resistance is not negligible. Which graph shows the variation with time $t$ of the displacement $s$ of the ball? [1 mark]

A. ![Graph A]
B. ![Graph B]
C. ![Graph C]
D. ![Graph D]
A ball is thrown from point X and follows path XYZ. Air resistance is negligible. Which quantity is zero when the ball is at the highest point Y of the path?

A. The horizontal component of the ball’s acceleration
B. The vertical component of the ball’s acceleration
C. The horizontal component of the ball’s velocity
D. The kinetic energy of the ball

Two isolated spherical planets have the same gravitational potential at their surfaces. Which ratio must also be the same for the two planets?

A. \( \frac{\text{radius}^3}{\text{mass}} \)
B. \( \frac{\text{radius}^2}{\text{mass}} \)
C. \( \frac{\text{radius}}{\text{mass}} \)
D. radius

Which statement applies to an object in translational equilibrium?

A. The object must be stationary.
B. The object must be moving with constant acceleration.
C. The resultant force acting on the object must be zero.
D. There must be no external forces acting on the object.
The horizontal component $v_h$ and the vertical component $v_v$ of velocity of an object are shown on the graphs. Air resistance is negligible.

These graphs could represent the motion of an object fired from a cliff

A. vertically upwards.
B. at an angle above the horizontal.
C. horizontally.
D. at an angle below the horizontal.

**Markscheme**

B
A girl is standing on a moving skateboard. She pushes backwards on the ground at intervals as shown on the graph.

How much kinetic energy is gained by the girl during the period represented on the graph? Frictional forces are negligible.

A. 200 J  
B. 400 J  
C. 600 J  
D. 1200 J  

**Markscheme**  
C