N5 : DYNAMICS & SPACE KEY AREAS

1. Velocity and displacement — vectors and scalars

Vector and scalar quantities: force, speed, velocity, distance, displacement, acceleration, mass, time and energy.

Calculation of the resultant of two vector quantities in one dimension or at right angles.

Determination of displacement and/or distance using scale diagram or calculation.

Use of appropriate relationships to calculate velocity in one dimension

1. Large ships are often helped into port by using two tug boats – one either side of the ship.

April 5, 1989 **(Anchorage Daily News / Erik Hill)**

Using your knowledge of physics, comment on the challenges faced by the two tug-boats to ensure that the ship is docked safely.

A runner runs a marathon distance, starting from his own house. He finishes the 26·1 mile run but is only 1 mile from his house.

Using your knowledge of physics, comment on why this is possible.

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2. Velocity–time graphs

Velocity–time graphs for objects from recorded or experimental data.

Interpretation of velocity–time graph to describe the motion of an object.

Displacement from a velocity–time graph.

2. A trolley is at rest on a slope. It is pushed up the slope then released. The velocity–time graph shows the resultant motion of the trolley.

Use your knowledge of physics to comment on the shape of the graph.

N5 : DYNAMICS & SPACE KEY AREAS
3. Acceleration

Acceleration of a vehicle between two points using appropriate relationships with initial and final velocity and time for change.

Acceleration from a velocity–time graph.

3. A class of S4 students launched water-rockets from the playground in their school. The rockets accelerate upwards, but it is noted that the acceleration of the rockets is not constant.

   Using your knowledge of physics, comment on why the acceleration of the rockets is not constant.

   The acceleration of a trolley running down a slope can be measured in two ways.

   1 – single mask and two light gates connected 2 – double mask and single light gate connected to a computer set to calculate acceleration to a computer set to calculate acceleration

   The light gates and masks are used to calculate two different velocities of the trolley. These velocities are then used to calculate the acceleration of the trolley.

   Using your knowledge of physics, comment on the reliability of the two methods used to calculate the acceleration of the trolley down the slope.

N5 : DYNAMICS & SPACE KEY AREAS
4. Newton's laws
Applications of Newton's laws and balanced forces to explain constant velocity, making reference to frictional forces. Calculations involving the relationship between unbalanced force, mass and acceleration for situations where more than one force is acting. Calculations involving the relationship between work done, unbalanced force and distance/displacement. Calculations involving the relationship between weight, mass and gravitational field strength including on different planets. Newton's second law including its application to space travel, including rocket launch and landing. Newton's third law and its application to explain motion resulting from a 'reaction' force. Use of Newton's laws to explain free-fall and terminal velocity.

4. This astronaut aboard the International Space Station has let go a set of juggling balls.

Use your knowledge of physics to **explain** why the juggling balls appear to stay still and float in the same position.

Two ice hockey players are standing on the ice in their ice hockey skates, and then one pushes the other away.

Using your knowledge of physics, comment on the motion of the ice hockey players afterwards.

5. On a theme park ride, visitors sit in a car which is raised to a height in a lift and then released, allowing the car to fall to the ground.

EITHER: The operators of the ride have called it "Zero G". Using your knowledge of physics, comment on why they may have chosen this name for the ride.

OR: Using your knowledge of physics, comment on the forces experienced by the visitors during this ride.

N5 : DYNAMICS & SPACE KEY AREAS
5. Projectile Motion

Explanation of projectile motion.

Calculations of projectile motion from a horizontal launch using appropriate relationships and graphs.

Explanation of satellite orbits in terms of projectile motion.

N5 : DYNAMICS & SPACE KEY AREAS
6. Space Exploration

Evidence to support current understanding of the universe from telescopes and space exploration.

Impact of space exploration on our understanding of planet Earth, including use of satellites.

The potential benefits of space exploration including associated technologies and theimpact on everyday life.

Risks and benefits associated with space exploration, including challenges of re-entry to a planet's atmosphere.

6. Recently, one of the first space probes launched by NASA in 1977 has now left our Solar System.

   EITHER: Using your knowledge of physics, explain how this space probe was able to reach the outer planets.

   OR: Using your knowledge of physics, explain how NASA might **know** that the probe has now left our Solar System.

   OR: Using your knowledge of physics, comment on what happens next for this space probe.

7. The Brian Cox Fan Club says that the reason that he is such a great astronomer is that his eyes are so big.

   Using your knowledge of physics, comment on the accuracy of this statement.

N5 : DYNAMICS & SPACE KEY AREAS
7. Cosmology

Use of the term 'light year' and conversion between light years and metres.

Observable universe — description, origin and age of universe.

The use of different parts of the electromagnetic spectrum in obtaining information about astronomical objects.

Identification of continuous and line spectra.

Use of spectral data for known elements, to identify the elements present in stars.

8. An astronomer is observing one particular star in the night sky, and states that the star is moving away from the Earth.

   Using your knowledge of physics, comment on what evidence the astronomer might need to confirm his findings.