# Movement and speed

VOCABULARY PRACTICE

ADVANCED | C1

**Name:** _____ **Date:** _____

## 1 Match each advanced mechanics concept with its meaning.

| | | |
|---|---|---|
| 1 inertial frame | ____ | a change in momentum produced by force over time |
| 2 non-inertial frame | ____ | b motion described with respect to another observer or object |
| 3 centripetal acceleration | ____ | c smooth fluid motion in parallel layers |
| 4 tangential velocity | ____ | d condition restricting possible movement |
| 5 relative motion | ____ | e acceleration directed towards the centre of circular motion |
| 6 impulse | ____ | f reference frame accelerating or rotating |
| 7 coefficient of drag | ____ | g dimensionless measure of aerodynamic resistance |
| 8 laminar flow | ____ | h chaotic fluid motion with eddies and mixing |
| 9 turbulent flow | ____ | i reference frame with no acceleration |
| 10 kinematic constraint | ____ | j instantaneous velocity along the tangent to a curved path |

## 2 Complete the advanced mechanics collocations.

**constraint** | **drag** | **frame** | **impulse** | **motion** | **trajectory** | **velocity** | **flow**

**1** an inertial _____

**2** relative _____

**3** tangential _____

**4** apply an _____

**5** a kinematic _____

**6** predict the _____

**7** reduce aerodynamic _____

**8** maintain laminar _____

## 3 Choose the concept that best captures the distinction.

**1** A non-accelerating reference system: *inertial / non-inertial frame*.

**2** A rotating reference system: *non-inertial / inertial frame*.

**3** Acceleration points inward in circular motion: *centripetal / tangential*.

**4** Force applied briefly changes momentum: *impulse / drag coefficient*.

**5** Smooth layered fluid motion: *laminar / turbulent flow*.

**6** Motion depends on the observer: *relative motion / constraint*.

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## 4 Complete the mechanics review with terms from the box.

**centripetal acceleration | coefficient of drag | impulse | inertial frame | kinematic constraint | laminar flow | non-inertial frame | relative motion | tangential velocity | turbulent flow**

In an **1** _____, an object continues uniformly unless a force acts. An accelerating observer uses a **2** _____. Differences between observers are analysed as **3** _____. In circular motion, inward **4** _____ changes direction while **5** _____ lies along the path. A short force produces an **6** _____. Aerodynamic resistance depends partly on the **7** _____. Smooth layers form **8** _____, whereas chaotic eddies indicate **9** _____. A **10** _____ limits the allowed motion of a system.

## 5 Read the text and answer the questions concisely.

**Relative speed and observation**

Motion is measured relative to a reference frame. A passenger walking forwards at 2 m/s inside a train moving at 20 m/s has a speed of 22 m/s relative to the ground if both motions are aligned. Relative to the train, however, the passenger still moves at only 2 m/s. This simple addition works at ordinary speeds in aligned inertial frames; more complex directions require vector addition, and speeds near that of light require relativity.

**1** What is motion measured relative to? _____

**2** How fast does the passenger walk inside the train? _____

**3** What is the ground-relative speed? _____

**4** What is the train-relative speed? _____

**5** When does simple addition work? _____

**6** What do complex directions require? _____

## 6 Paraphrase using the expression in capitals.

**1** The brief force changed the object's momentum. **IMPULSE** _

**2** Fluid moved smoothly in parallel layers. **LAMINAR** _____

**3** Rotation produced inward acceleration. **CENTRIPETAL** ___

**4** The joint restricted the possible movement. **CONSTRAINT** _

## OVER TO YOU

Write a **160-190 word** explanation of a complex motion problem. Address reference frame, velocity, acceleration, forces and modelling limits.

[ ] Use at least ten target terms or collocations. [ ] Specify the reference frame. [ ] Qualify assumptions precisely.

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## ANSWER KEY

### 1 Advanced mechanics concepts

1 **i** 2 **f** 3 **e** 4 **j** 5 **b** 6 **a** 7 **g** 8 **c** 9 **h** 10 **d**

### 2 Advanced mechanics collocations

1 **frame** 2 **motion** 3 **velocity** 4 **impulse** 5 **constraint** 6 **trajectory** 7 **drag** 8 **flow**

### 3 Conceptual distinctions

1 **inertial frame** 2 **non-inertial frame** 3 **centripetal acceleration**
4 **impulse** 5 **laminar flow** 6 **relative motion**

### 4 Mechanics review

1 **inertial frame** 2 **non-inertial frame** 3 **relative motion** 4 **centripetal acceleration** 5 **tangential velocity**
6 **impulse** 7 **coefficient of drag** 8 **laminar flow** 9 **turbulent flow** 10 **kinematic constraint**

### 5 Reading - suggested answers

1 A reference frame. 2 2 m/s. 3 22 m/s. 4 2 m/s.
5 At ordinary speeds in aligned inertial frames. 6 Vector addition.

### 6 Paraphrasing - possible answers

1 The force delivered an **impulse**. 2 The fluid showed **laminar flow**. 3 There was **centripetal acceleration**. 4 The joint imposed a kinematic **constraint**.

**Over to you:** Answers will vary. Check reference frames, vector reasoning, mechanisms and assumptions.