MOTION (source: www.wikipedia.org, Kelly, Kurt: Science)

1. **Read the text below and complete it with appropriate words from the list below. There are three words too many.**

*firm, position, absolute, time-invariant, place, occupying, force, acceleration, conservation, adopting, quantum particle, stationary, mass*

In [physics](http://en.wikipedia.org/wiki/Physics), motion is a change in 1\_\_\_\_\_\_\_\_\_\_\_\_of an object with respect to time. Motion is typically described in terms of [velocity](http://en.wikipedia.org/wiki/Velocity), 2\_\_\_\_\_\_\_\_\_\_\_, [displacement](http://en.wikipedia.org/wiki/Displacement_%28vector%29), and [time](http://en.wikipedia.org/wiki/Time). Motion is observed by attaching a [frame of reference](http://en.wikipedia.org/wiki/Frame_of_reference) to a body and measuring its change in position relative to another reference frame.

A body which does not move is said to be at rest, motionless, immobile, 3*\_\_\_\_\_\_\_\_\_\_\_\_\_\_*, or to have constant (4\_\_\_\_\_\_\_\_\_\_\_\_\_) position. An object's motion cannot change unless it is acted upon by a 5\_\_\_\_\_\_\_\_\_\_\_, as described by [Newton's first law](http://en.wikipedia.org/wiki/Newton%27s_laws_of_motion). An object's [momentum](http://en.wikipedia.org/wiki/Momentum) is directly related to the object's 6\_\_\_\_\_\_\_\_\_\_\_ and [velocity](http://en.wikipedia.org/wiki/Velocity), and the total momentum of all objects in a [closed system](http://en.wikipedia.org/wiki/Closed_system) (one not affected by external forces) does not change with time, as described by the [law of 7\_\_\_\_\_\_\_\_\_\_\_\_\_of momentum](http://en.wikipedia.org/wiki/Law_of_conservation_of_momentum).

As there is no absolute frame of reference, *8\_\_\_\_\_\_\_\_\_\_\_\_* motion cannot be determined. Thus, everything in the universe can be considered to be moving.

More generally, the term motion signifies a continuous change in the configuration of a physical system. For example, one can talk about motion of a wave or a 9\_\_\_\_\_\_\_\_\_\_\_\_ (or any other [field](http://en.wikipedia.org/wiki/Field_%28physics%29)) where the configuration consists of probabilities of 10\_\_\_\_\_\_\_\_\_\_\_\_\_specific positions.

1. **Read „Laws of Motion“ and decide which words correspond with the ones given:**

*known- obviously- opposing-*

*torpedoes- while- characterized-*

**Laws of Motion**

In physics, motion in the universe is described through two sets of apparently contradictory [laws](http://en.wikipedia.org/wiki/Scientific_law) of [mechanics](http://en.wikipedia.org/wiki/Mechanics). Motions of all large scale and familiar objects in the universe (such as [projectiles](http://en.wikipedia.org/wiki/Projectile), [planets](http://en.wikipedia.org/wiki/Planet), [cells](http://en.wikipedia.org/wiki/Cell_%28biology%29), and [humans](http://en.wikipedia.org/wiki/Human)) are described by [classical mechanics](http://en.wikipedia.org/wiki/Classical_mechanics). Whereas the motion of very small [atomic](http://en.wikipedia.org/wiki/Atom) and [sub-atomic](http://en.wikipedia.org/wiki/Subatomic_particle) objects is described by [quantum mechanics](http://en.wikipedia.org/wiki/Quantum_mechanic).

1. **Read the text on classical mechanics and decide where to put the phrases from under the text**

**Classical mechanics**

Classical mechanics is used for describing the motion of [macroscopic](http://en.wikipedia.org/wiki/Macroscopic) objects, from [projectiles](http://en.wikipedia.org/wiki/Projectiles) to parts of [machinery](http://en.wikipedia.org/wiki/Machinery), as well as [astronomical objects](http://en.wikipedia.org/wiki/Astronomical_objects), 1\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and [galaxies](http://en.wikipedia.org/wiki/Galaxies). It produces very accurate results within these domains, and is one of the oldest and largest subjects in [science](http://en.wikipedia.org/wiki/Science), [engineering](http://en.wikipedia.org/wiki/Engineering), and [technology](http://en.wikipedia.org/wiki/Technology).

Classical mechanics is fundamentally based on [Newton's Laws of Motion](http://en.wikipedia.org/wiki/Newton%27s_Laws_of_Motion). 2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_They were first compiled by [Sir Isaac Newton](http://en.wikipedia.org/wiki/Isaac_Newton) in his work [*Philosophiæ Naturalis Principia Mathematica*](http://en.wikipedia.org/wiki/Philosophi%C3%A6_Naturalis_Principia_Mathematica), first published on July 5, 1687. His three laws are:

1. In the absence of a net external [force](http://en.wikipedia.org/wiki/Force), a [body](http://en.wikipedia.org/wiki/Physical_body) either is at rest or moves with constant velocity.
2. The net external force on a body is equal to the [mass](http://en.wikipedia.org/wiki/Mass) of that body times its [acceleration](http://en.wikipedia.org/wiki/Acceleration); **F** = *m***a**. Alternatively, the acceleration is directly proportional to the force causing it, 3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Whenever one body exerts a force **F** onto a second body, the second body exerts the force −**F** on the first body. **F** and −**F** are equal in magnitude 4\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Newton's three laws of motion, 5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ , explain [Kepler's laws of planetary motion](http://en.wikipedia.org/wiki/Kepler%27s_laws_of_planetary_motion), which were the first to accurately provide a mathematical model or understanding [orbiting](http://en.wikipedia.org/wiki/Orbit) bodies in [outer space](http://en.wikipedia.org/wiki/Outer_space). This explanation unified the motion of celestial bodies and motion of objects on earth.

Classical mechanics was later further enhanced by [Albert Einstein's](http://en.wikipedia.org/wiki/Albert_Einstein) [special relativity](http://en.wikipedia.org/wiki/Special_relativity) and [general relativity](http://en.wikipedia.org/wiki/General_relativity). Special relativity explains the motion of objects with a high [velocity](http://en.wikipedia.org/wiki/Velocity), 6\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; [general relativity](http://en.wikipedia.org/wiki/General_relativity) is employed to handle [gravitation](http://en.wikipedia.org/wiki/Gravitation) motion at a deeper level.

*These laws describe the relationship between the forces acting on a body and the motion of that body.*

*and inversely proportional to the mass.*

*such as* [*spacecraft*](http://en.wikipedia.org/wiki/Spacecraft)*,* [*planets*](http://en.wikipedia.org/wiki/Planets)*,* [*stars*](http://en.wikipedia.org/wiki/Star)*,*

*approaching the* [*speed of light*](http://en.wikipedia.org/wiki/Speed_of_light)

*along with his* [*law of universal gravitation*](http://en.wikipedia.org/wiki/Newton%27s_law_of_universal_gravitation)

*and opposite in sense.*

1. **Read the text below and look for mistakes (there is maximum one mistake in each line, some lines may be without mistakes at all. If so, put a tick next to the line)**

**Quantum mechanics**

[Quantum mechanics](http://en.wikipedia.org/wiki/Quantum_mechanics) is a set of principles in describing [physical reality](http://en.wikipedia.org/wiki/Physical_systems) at the atomic level of matter ([molecules](http://en.wikipedia.org/wiki/Molecules) and [atoms](http://en.wikipedia.org/wiki/Atoms)) and the [subatomic](http://en.wikipedia.org/wiki/Subatomic) ([electrons](http://en.wikipedia.org/wiki/Electrons), [protons](http://en.wikipedia.org/wiki/Protons), and even smaller [particles](http://en.wikipedia.org/wiki/Subatomic_particle)). These descriptions include for the simultaneous wave-like and particle-like behaviour of both [matter](http://en.wikipedia.org/wiki/Matter) and [radiation](http://en.wikipedia.org/wiki/Radiation) energy, this described in the [wave–particle duality](http://en.wikipedia.org/wiki/Wave%E2%80%93particle_duality).

In contrast to classical mechanics, where accurate [measurements](http://en.wikipedia.org/wiki/Measurement) and [predictions](http://en.wikipedia.org/wiki/Prediction) can be calculated about [location](http://en.wikipedia.org/wiki/Absolute_location) and [velocity](http://en.wikipedia.org/wiki/Velocity), in the quantum mechanics of a subatomic particle, one can never specify its state, such as its simultaneous location and velocity, with completed certainty (this is called the [Heisenberg uncertainty principle](http://en.wikipedia.org/wiki/Uncertainty_principle)).

In addition to describing the motion of atomic level phenomenas, quantum mechanics is useful in understanding some large scale phenomenon such as [superfluidity](http://en.wikipedia.org/wiki/Superfluidity), [superconductivity](http://en.wikipedia.org/wiki/Superconductivity), and [biological systems](http://en.wikipedia.org/wiki/Biological_systems), including the function of [smell receptors](http://en.wikipedia.org/wiki/Smell_receptors) and the [structures of proteins](http://en.wikipedia.org/wiki/Protein_structure).

1. **Listen to the recording and complete the text with words or phrases you can hear**

A football, rolling along the ground, slows down and stops. Freewheeling along a level road on your bicycle, you slow down and stop. Both the football and the bicycle have 1\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or slowed down and so a force must have acted on them. The force that opposes motion is called 2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It is caused by the roughness of the surface. Even a surface that looks smooth will have tiny 3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that cause it. There are two types of this kind of forces. 4\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the force that prevents a stationary object from moving. 5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ acts to slow a moving object. The amount of both depends on factors like 6\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The nature of the surface, whether it is smooth or rough is also important. Smooth and streamlined objects will produce 7\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. However, the speed of an object is also important: the faster it moves, the greater its 8\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. **Match the beginnings of the sentences below with their endings**

