Read 5.1 → 5.2

Mon: HW 4 due by 5pm

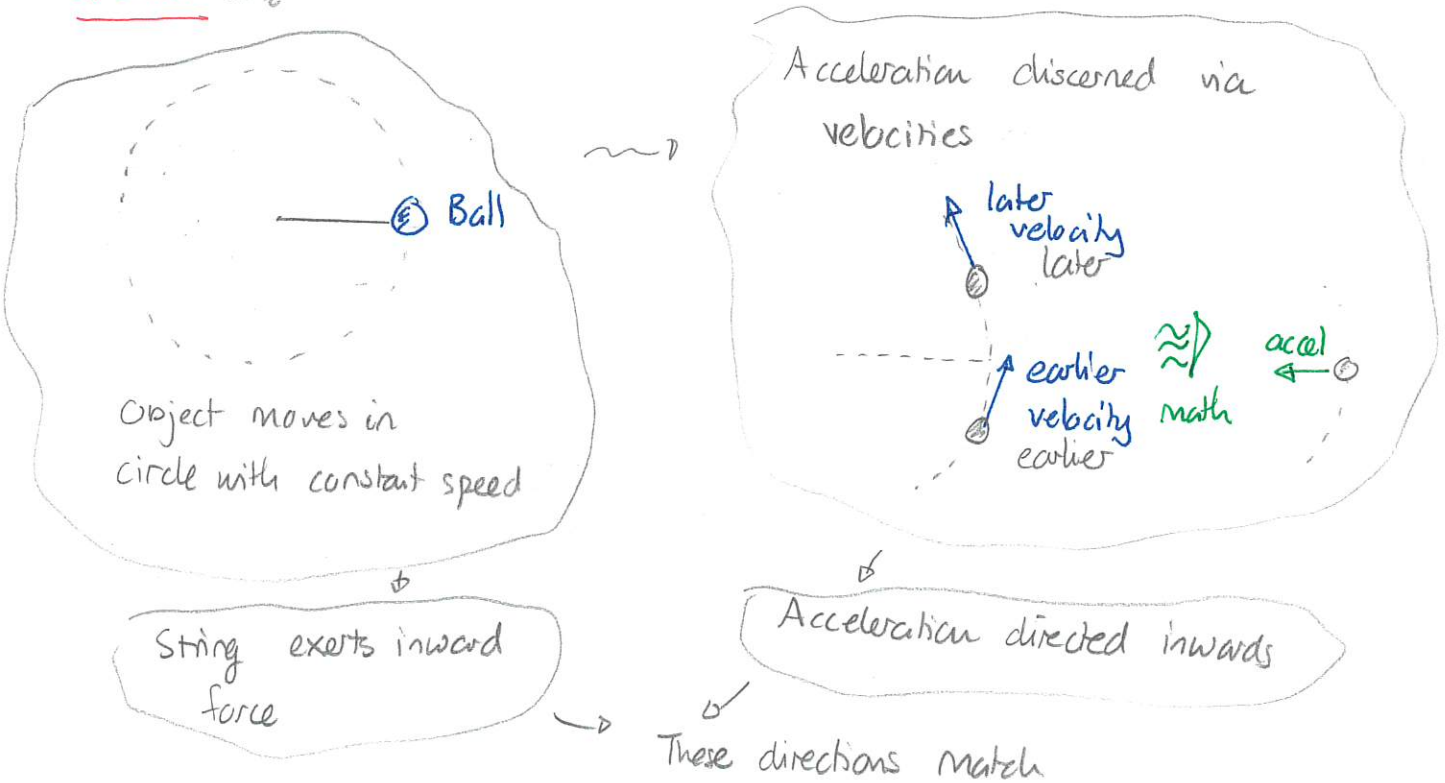
Weds: Review

Fri: Test 1

Circular motion

Newton's mechanics can be applied to objects that move in circles. This was, in fact, one of the original applications of Newtons mechanics. Consider an object that moves in a circle with constant speed.

Quiz 1 60%

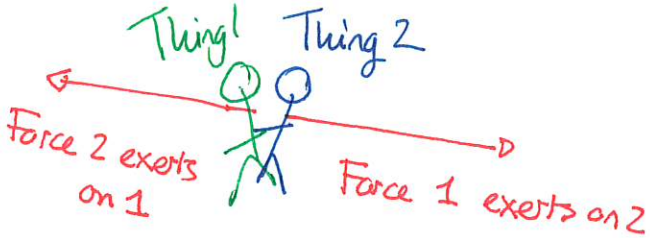


Quiz 2 80%

Newton's Third Law

Newton's third law describes mutual interactions between objects in terms of pairs of forces

If object 1 exerts a force on object 2 then object 2 exerts a force on object 1



The sizes of the forces are the same but their directions are exactly opposite.

Quiz 3 95%

Concepts of Physics: Class 15

22 September 2023

1 Bob and Earth

Bob has mass 81.6 kg and the Earth has mass 6.0×10^{24} kg. Bob jumps off a table and drops to the Earth's surface.

a) Determine the gravitational force exerted by Earth on Bob.

b) Determine Bob's acceleration.

c) Determine the force exerted by ~~Earth~~ Bob on ~~Bob~~ Earth.

d) Determine Earth's acceleration.

e) Do you expect that the force exerted by Bob on Earth will have much effect on Earth?

Answer

a) Grav force = mass x 9.8

= 81.6 kg x 9.8 m/s²

= 800N

b) $\text{accel} = \frac{\text{force}}{\text{mass}} = \frac{800\ \text{N}}{81.6\ \text{kg}} = 9.8\ \text{m/s}^2$

c) Force = 800 N

d) $\text{accel} = \frac{800\text{N}}{6.0 \times 10^{24}\ \text{kg}} = 1.3 \times 10^{-22}\ \text{kg}$

e) This is miniscule compared to Bob's accel.

Rocket propulsion

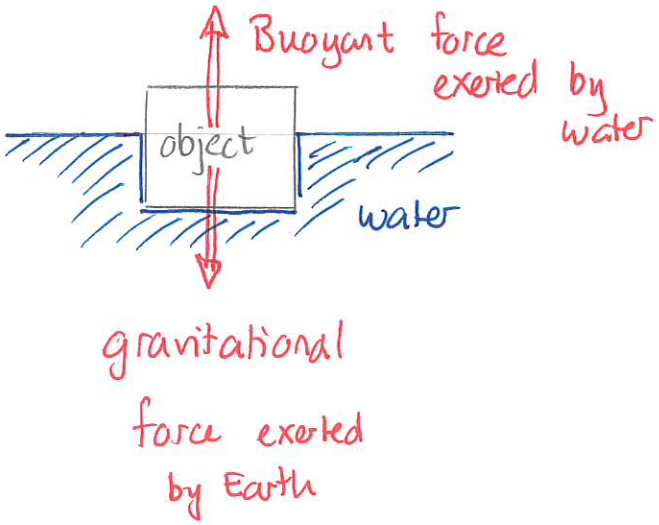
Newton's Third Law explains rocket propulsion. Recall that rockets can be fired through the air and also empty space.

1) the rocket expels hot gas
2) the rocket exerts a force on the hot gas
3) by Newton's Third Law the hot gas exerts a force on the rocket. This will accelerate the rocket.

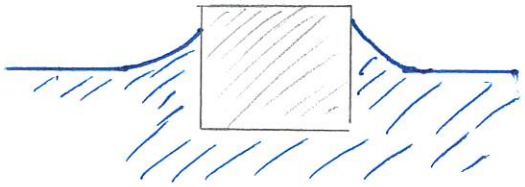
DEMO: Mentos Skateboard Rocket.

Cheerios Effect

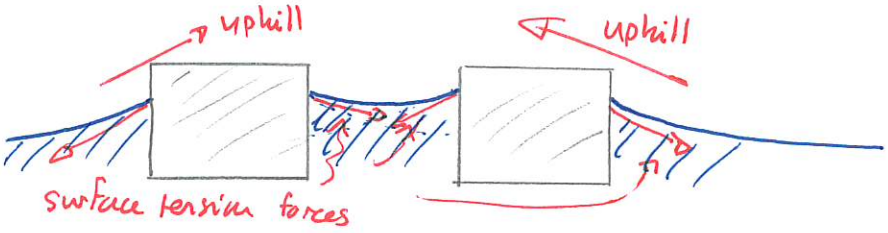
Why do Cheerios attract each other in water? We can explain this using forces and some information about fluids. Consider an object floating in water. At a first approximation the interface would appear as illustrated



This however is not what actually happens. The water curves up to form a meniscus.



Now consider two nearby objects



The distortion is illustrated and the objects tend to float uphill. They will therefore appear to attract each other. A detailed analysis considers surface tension forces and buoyancy