JAF02 Unit 3 Motion II

Revision

1. Describe Galileo´s famous experiment
2. What are the collocations of ´hypothesis´?

Task 1 Reading

Newton Explains Motion

Although many scientists studied motion, it was the great Sir Isaac Newton who formulated the theories of motion, verifying and **extending** the earlier work of Galileo and Copernicus. Newton studied horizontal and vertical motion.

First Newton studied the quality of inertia, or the tendency of a body to resist change in its state of motion or direction. A tennis ball, for example, has little inertia; it is easy to get it to move, stop or change direction. A truck, on the other hand, has a great deal of inertia. Newton concluded that a body at rest will remain at rest and that a body in motion will remain in motion **unless** some outside force acts on it. The principle is called the law of inertia, or Newton´s first law of motion.

But Newton´s curiosity was not satisfied. He wondered what causes a change in motion. Why does a body at rest begin to move or a body in motion change its direction? He determined that if a body is at rest, no force is acting on it; however, when a force acts on a body, the force will speed up, slow down, or change the direction of that body.

Moreover, Newton discovered that there is a relationship between force and acceleration. If you push a swing gently, it will move slowly. If you push it harder, it will go faster. Newton noted that if you **discount** the friction involved, the amount of force is directly related to the amount of acceleration.

The acceleration is also related to the mass of the object. Mass, which is the quantity of matter in a body, also determines the amount of inertia an object has. A truck has a great deal of mass, a bicycle has much less. If you use an equal amount of force to push a bicycle or a truck, the bicycle will go much faster than the truck. The larger the mass, the less the acceleration. In fact, the acceleration of a body is **inversely** proportional to its mass. Newton´s second law of motion states that the acceleration of a body is directly related to the force acting on it and inversely proportional to its mass. The direction of the acceleration is in the direction of the applied force.

Finally, Newton explored the question of the source of force. He observed that the force acting on a body comes from another body. But this idea by itself was not **consistent** with his view of a balanced and symmetrical universe. He therefore concluded that whenever there is a force pushing in one direction, there is another force pushing back. This concept may be difficult to imagine, but try pulling on a rubber band and you will feel it pulling back on you. Also notice what happens to your finger when you press it against a table. Objects can exert a force because all materials are elastic to some extent, although the elasticity of walls and tables may be slight. When you push off against the wall of a swimming pool, for example, you start to move away from the wall. The wall is exerting a force on you that causes you to move in the opposite direction. And if you think the floor does not push back against your feet, why do your shoes wear out, and why do your feet hurt after you have been on them for a long time? Why do automobile tires wear out? Thus Newton **stated** his third law: whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first.

The movement of a rocket is also based on this law. The rocket expels gases, which then exert an equal and opposite force **propelling** the rocket forward. In space, a vehicle can alter its speed or direction by expelling rockets in the opposite direction.

Newton´s laws are applicable everywhere in the universe and **synthesise** both vertical and horizontal motion. The concept that the universe functions according to logical, orderly natural laws influenced not only the scientific world but also the social, political, and philosophical thinking of the Western world for two hundred years.

Understanding the reading

A. Indicate whether each of the following sentences is true or false according to the information in the passage above.

1. Although many scientists studied motion, Newton was the first.
2. Galileo´s ideas were based on Newton´s work.
3. Newton´s third law is the law of inertia.
4. Acceleration is proportional to mass.
5. Pushing off against the side of a swimming pool is an example of Newton´s second law.
6. A rocket functions on the principle of action and reaction.
7. Newton´s ideas influenced world thinking in fields other than science.

B. Can you guess the meaning of the words in bold? Study them in the context and then fill them into the gaps. You may have to change the form of the words.

1. The facts are clearly ……. in the report.
2. We have to ……. evidence from a number of intervention programmes.
3. The faculty is …… the range of subjects taught.
4. Solar energy and high-intensity light are converted to electrical energy to supply electrical power for …… vehicles in an efficient manner.
5. We cannot …… the possibility of further technical problems.
6. The results are entirely …….. with our earlier research.
7. ……something unexpected happens, we will submit the paper tomorrow.
8. We regard health as …… related to social class.

Task 2 The parallel change

The larger the mass, the less the acceleration

We use a reduced clause in each part of a *The more..., the ...* expression. It is a paired construction in which each part is syntactically alike. A comma separates the two clauses. The meaning varies from cause-effect actions to simply same-time occurrences.

Study the examples below.

The sooner, the better.
The more, the merrier.
The better the sleep, the more rested the mind.
The better we sleep, the more rested our minds.

What might these sayings refer to?

a) The stronger, the better. b) The more you give, the more you receive.

Complete the gaps.

a) The more you learn, the ……. you earn.
b) The more you pay, the …… quality you get.
c) The older we get, the …….. we are.

Rewrite the sentences using *The …, the…* structures.

a) As voltage increases, current increases.
b) As area increases, pressure decreases.
c) As period gets shorter, frequency gets higher.

Task 2 Listening – Newton´s Explanation of Gravity

(http://dsc.discovery.com/tv-shows/other-shows/videos/assignment-discovery-shorts-newtons-laws-of-motion.htm)

Watch the video and complete the summarising sentences

1. Gravity is one of the …… forces in the universe.
2. Newton understood that gravity …….. various phenomena.
3. An object changes its motion when a force is ……. to it.
4. Newton ……. the explanation that eluded Galileo.
5. Newton´s law of gravity …… that the gravitational force between two objects is proportional to the quantity of their masses and …… proportional to the square of the distance between them.
6. Newton …… the tool known as calculus.
7. Newton´s followers were able to …… the motion of the planets and …….. new problems.
8. Newtonian physics ……..many mysteries of the universe.
9. Later, Albert Einstein introduced theories that ……. the limits of scientific thought.

Now watch Dan Cobley giving a talk at TED about physics and marketing. What are the parallels he draws?

http://www.ted.com/talks/dan_cobley_what_physics_taught_me_about_marketing.html

Task 3 Vocabulary

Circle the letter of the answer that best matches the meaning of the italicized word as it is used in each of these sentences.

1. Gravity keeps the moon in its *orbit* around the earth.
   a) path b) position
2. Scientists are still *speculating* about the origin of the universe.
   a) thinking b) experimenting
3. Objects fall downward because of the earth´s *gravity*.
   a) pull b) movement
4. Your weight *varies* from day to day.
   a) changes b) increases
5. Astronauts experience *weightlessness* when travelling in space.
   a) heaviness b) no weight
6. We see the moon in different *phases*, such as the quarter-moon and half-moon.
   a) places b) stages

(Task 1 and 4 adapted from Zimmerman F. *English For Science.* Prentice Hall Regents, 1989.)