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PAPER: **EXERCISE PHYSIOLOGY**

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**QNO. 1 IF YOU LIFTED A 10-KILOGRAM (kg) WEIGHT UPWARD OVER THE DISTANCE OF 2 METES (m) THE WORK PERFORMED WOULD BE? CALCULATE WORK.**

**ANS:-** **solution:-**

Work done is converted into P.E

So P.E= mgh

m= 10kg

g= 9.8m2

h= 2m

so P.E= 10x9.8x2

= 10x98/10x2

**ANS= 196J**

**QNO2: ENLIST BASIC PRINCIPLES OF THE TRAINING?**

**ANS:-** **BASIC PRINCIPLES OF TRAINING:-**

**TRAINING:-**

Training to improve an athlete’s performance obeys the principles of training: specificity, overload, rest, adaptation and reversibility

**PRINCIPLES OF TRAINING:-**

There are four basic principles of training

1. Overload
2. Specificity
3. Progression
4. Reversibility
5. **OVERLOAD:-**

* Overload refer to the observation that a system or tissue must be exercised at a level beyond which it is accustomed in order for a training effects to occur.
* The system or tissue gradually adapts to this overload.
* Overload leads to training gains.
* The higher the level of conditioning the greater the overload required.
* By varying frequency, duration, and intensity we can apply we can overload.

1. **SPECIFICITY:-**

* You get what you train for
* **You should train the:**
* Energy system
* Muscles groups
* Specific to the sport/ activity being played
* **The training effect is specific to the:**
* The principles energy system involved (aerobic versus anaerobic)
* The velocity of contraction
* The type of muscle contraction
* Fiber types recruited
* Specificity also refers to the types of adaptation occurring in muscle as a result of training.
* The training must be suitable to the particular sport or aspect of fitness.
* If a muscle is engaged in endurance types of exercise, the primary adaptation are in capillary and mitochondria number, which increase the capacity of the muscle to produce energy aerobically
* If a muscle is engaged in heavy resistance training, the primary adaptation is an increase in the quantity of the contractile proteins the mitochondrial and capillary densities may actually decrease.

1. **PROGRESSION:-**

* As the body adapts training needs to be more progressive so that greater demands are made on it.
* Progression is all about small increments. It is not a case of doing a two hour walk one day and a five hours walk a couple of days later. You should only progress gradually, by around 5-10 %at a time. To safest approach is to increase your weekly activity by no more than five %.

1. **REVERSIBILITY:-**

* Loss of improvement when training is decreased or stopped.
* Conversely, it also means that detraining effects can be reversed when athletes resume training.
* The longer the buildup, the slower the loss.

**QNO 3. DESCRIBE PRELOAD AND AFTERLOAD IN SIMPLE WORDS.**

**ANS:-preload:-**

In [cardiac](https://en.wikipedia.org/wiki/Cardiology) [physiology](https://en.wikipedia.org/wiki/Physiology), **preload** is the amount of [sarcomere](https://en.wikipedia.org/wiki/Sarcomere) stretch experienced by [cardiac muscle](https://en.wikipedia.org/wiki/Cardiac_muscle) cells, called [cardiomyocytes](https://en.wikipedia.org/wiki/Cardiac_muscle_cell), at the end of ventricular filling during [diastole](https://en.wikipedia.org/wiki/Diastole).[[1]](https://en.wikipedia.org/wiki/Preload_(cardiology)#cite_note-1) Preload is directly related to ventricular filling. As the relaxed ventricle fills during diastole, the walls are stretched and the length of sarcomeres increases. Sarcomere length can be [approximated](https://en.wikipedia.org/wiki/Approximation) by the volume of the ventricle because each shape has a conserved [surface-area-to-volume ratio](https://en.wikipedia.org/wiki/Surface-area-to-volume_ratio). This is useful clinically because measuring the [sarcomere](https://en.wikipedia.org/wiki/Sarcomere) length is destructive to heart tissue. It requires cutting out a piece of cardiac muscle to look at the sarcomeres under a microscope. It is currently not possible to directly measure preload in the beating heart of a living animal. Preload is estimated from end-diastolic ventricular pressure and is measured in [millimeters of mercury (mmHg)](https://en.wikipedia.org/wiki/Millimeters_of_mercury).

**AFTERLOAD:-**

**Afterload** is the pressure that the heart must work against to eject blood during [systole](https://en.wikipedia.org/wiki/Systole) (ventricular contraction). Afterload is proportional to the average arterial pressure.[[1]](https://en.wikipedia.org/wiki/Afterload#cite_note-:0-1) As aortic and pulmonary pressures increase, the afterload increases on the left and right ventricles respectively. Afterload changes to adapt to the continually changing demands on an animal's [cardiovascular system](https://en.wikipedia.org/wiki/Circulatory_system).[[1]](https://en.wikipedia.org/wiki/Afterload#cite_note-:0-1) Afterload is proportional to mean systolic blood pressure and is measured in [millimeters of mercury (mm Hg)](https://en.wikipedia.org/wiki/Millimetre_of_mercury).

**Calculating afterload:-**

Quantitatively, afterload can be calculated by determining the wall stress of the left ventricle, using the [Young–Laplace equation](https://en.wikipedia.org/wiki/Young%E2%80%93Laplace_equation):

{\textstyle \left({\frac {EDP\cdot EDR}{2h}}\right)} Where

EDP is [end diastolic pressure](https://en.wikipedia.org/wiki/Left_ventricular_end_diastolic_pressure) in the left ventricle, which is typically approximated by taking [pulmonary artery wedge pressure](https://en.wikipedia.org/wiki/Pulmonary_artery_wedge_pressure),

EDR is end diastolic [radius](https://en.wikipedia.org/wiki/Radius) at the midpoint of the left ventricle, and

*H* is mean thickness of the left ventricle wall. Both radius and mean thickness of the left ventricle may be measured by [echocardiography](https://en.wikipedia.org/wiki/Echocardiography).

**QNO.4 WHAT ARE THE FACTORS INCREASING STROKE VOLUME?**

**ANS:-STROKE VOLUME:-**

Stroke volume index is the volume of blood pumped by the heart with each beat (in milliliters) divided by the body surface area (square meters). This allows direct comparison of the stroke volume index of large and small patients.

Stroke volume index is determined by three factors:

1. [**Preload**](http://pie.med.utoronto.ca/CA/CA_content/CA_cardiacPhys_preload.html): The filling pressure of the heart at the end of diastole.
2. [**Contractility**](http://pie.med.utoronto.ca/CA/CA_content/CA_cardiacPhys_contractility.html): The inherent vigor of contraction of the heart muscles during systole.
3. [**Afterload**](http://pie.med.utoronto.ca/CA/CA_content/CA_cardiacPhys_afterload.html): The pressure against which the heart must work to eject blood during systole.

**Starling's Law** is the relationship between preload and stroke volume.

SV is the difference among end diastolic volume (EDV) and end systolic volume (ESV). Many factors can affect SV, eg. Factors that changes either EDV or ESV will changes SV. The three primary factors that regulate SV are preload, afterload and contractility.

Heart rate (HR) also affects SV. Changes in HR alone inversely affects SV. However, SV can increase when there is an increase in HR (during exercise for example) when other mechanism are activated, but when these mechanism fail, SV cannot be maintained during an elevated HR. these mechanism include increased venous return, venous constriction, increase atrial and ventricular inotropy and enhanced rate of ventricular relaxation.

**QNO 5. DIFERENTIATE BETWEEN ISOMETRIC, ISOTONIC AND ISOKINATIC EXERCISE?**

**ANS:-ISOMETRIC EXERCISE:-**

* Isometric exercises are strength exercises where your muscles contract while you hold a still position.
* Isometric comes from the Greek “iso-,””equal+”metron,”measure” maintaining the same measure, dimension or length.

1. Isometric exercise involves static muscle contraction against a stationary resistance.
2. It is used only in a few games like gtymnastics, weightlifting , wresting etc.
3. It develops maximum strength.
4. Iso-same, matric- length: this is a type of muscle contraction in which muscle remains at same length.
5. It can rehabilitate immobilized joint.
6. Amount of strength develops does not last long
7. Poor development of coordination and skill.
8. Does not contribute to development of endurance and speed.

**EXAMPLES ARE:**

* Pushing against a well
* Flexed arm hang, etc.

**ISOTONIC EXERCISES:-**

Isotonic comes from the Greek ‘iso-“equal+ “tonos” tone= maintaining equal (muscle) tone.

1. Isotonic exercise involves dynamic movement but doesn’t require a constant movement speed.
2. Isotonic exercise is most popular and effective type of strength training used in almost games/sports.
3. It develops explosive strength.
4. Iso- same, tonic- tension. A type of muscle contraction in which the muscle changes the length either shortening or lengthening.
5. Does not contribute to rehabilitation.
6. Strength developed through this method remains for longer period.
7. It develops excellent coordination.
8. It contributes to development of strength, endurance and speed.

**EXAMPLES ARE:**

* Push-ups, pull- ups
* Rope climbing, bench press.
* Overhead press, etc.



**ISOKINATIC EXERCISE:-**

1. This involves movement but maintains a constant speed.
2. Isokinetic generally involves muscle contraction against an electronic resistance and is specific to a particular sport.
3. It develops explosive strength as well as strength endurance.
4. Iso-same, kinetic-speed. Isokinetic exercises are done with machine that regulates movement, velocity and resistance.
5. It cannot rehabilitate immobilized joint.
6. Amount of strength develops is excellent.
7. It develops good coordination.
8. Better development of speed as compared to isotonic.

**EXAMPLES ARE:**

* Treadmill
* Cybex
* Butterfly stroke in swimming, etc.



**THE END**