

Science of Fitness – C (04)

by Karen L. Lancour

This event encompasses the **physiology of the cardiovascular, respiratory and urinary systems in health and disease.**

Facts and Concepts

Cardiovascular System

- Basic anatomy of the heart and circulatory system, including heart chambers, valves, and major vessels.
- Blood flow through the body and heart.
- Recognizing physical signs associated with atherosclerosis and their causes and effects.
- Relationship of the cardiac cycle to the EKG (electrocardiogram) EKG at rest vs. during exercise.
- Description and importance of the waves and intervals associated with the EKG.
- Calculation of blood pressure (systolic, diastolic, and Mean Arterial Pressure), breathing, and heart rates.
- **Formulas:** stroke volume, heart rate, cardiac output, pulse pressure, mean arterial pressure.

Respiratory System

- Basic anatomy of the respiratory system—nose to lungs.
- Oxygen-transportation from lungs to muscle tissues, at rest and during exercise (breathing, gas exchange, red blood cell uptake and release).
- Effects of smoking (primary and secondary) carbon monoxide, nicotine, and air quality on emphysema, asthma, and lung cancer.
- Problems: graph interpretation and epidemiological risk eg. odds ratio.
- **Formulas:** partial pressure of gases, oxygen saturation curve analysis, respiratory volumes.

Urinary System

- Basic anatomy of the urinary system including kidneys, ureters, bladder, and urethra.
- Formation of urine, GFR calculation, concepts of tubular secretion and absorption, and the effects of ADH.

Relevant Formulas – Science of Fitness (C)

Circulation:

Stroke volume

Heart rate

Cardiac output

Pulse pressure

Mean Arterial Pressure (2 equations):

Respiration:

Partial pressure of gases

Lung capacity

Vital capacity

Tidal volume

Expiration reserve volume

Inspiration reserve volume

Residual volume

Urinary System:

Glomerular Filtration Rate (GFR– amount of filtrate formed per minute in all nephrons of both kidneys).

Odds ratio:

Sample Problems – Science of Fitness (C)

How does the body adapt to exercise acutely (in the short-run) compared to chronically (in the long-run) [e.g., effects on cardiac output, systolic vs. diastolic blood pressure, minute ventilation, and blood flow to various tissues]?

If systolic pressure is 122 and diastolic pressure is 84, what are the pulse pressure and the Mean Arterial Pressure?

Mrs. Jones has a heart rate of 85, a systolic pressure of 140 and diastolic pressure of 60, and an end diastolic volume of 110 and end systolic volume of 40. What is her cardiac output?

Name three major cellular and biochemical effects nicotine has on the efficiency of breathing and gas delivery to the muscles of the body.

Given the composition of gas, calculate the partial pressure of each component.

Given the blood plasma and urine concentrations of a substance and the urinary output per hour, calculate the glomerular filtration rate (GFR).

Resources of Science of Fitness

CDC Resources

The CDC Science of Fitness website at

http://www.cdc.gov/nccdphp/dnpa/science_olympiad/index.htm <http://web.uccs.edu/scioly/>

The CDC Division of Nutrition and Physical Activity website

(<http://www.cdc.gov/nccdphp/dnpa/index.htm>) will have updates, sample questions and problems.

Also refer to the Surgeon General's Report on Physical Activity and Health at

<http://www.cdc.gov/nccdphp/sgr/sgr.htm>.

EXcellence in Curriculum Integration through Teaching Epidemiology (EXCITE) at

<http://www.cdc.gov/excite>

EXcellence in Curriculum Integration through Teaching Epidemiology (EXCITE)—Science Olympiad at

<http://www.cdc.gov/excite/olympiad.htm>

Division of Nutrition and Physical Activity at <http://www.cdc.gov/nccdphp/dnpa>

Adult and Community Health at <http://www.cdc.gov/nccdphp/dach>

Tobacco Information and Prevention Source (TIPS) at <http://www.cdc.gov/tobacco/>

Government Resources

Health finder at <http://www.healthfinder.gov>

[President's Council on Fitness and Health](http://www.fitness.gov)

<http://www.fitness.gov>

Non-Governmental Resources

American College of Sports Medicine at <http://www.acsm.org>

American Heart Association at <http://www.americanheart.org>

Norman J. Arnold School of Public Health at <http://www.sph.sc.edu/>

Science Olympiad Inc. at <http://www.SOinc.org>

University of Colorado at Colorado Springs at <http://web.uccs.edu/scioly/>