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10 Toughest Subject Content Questions (2017 – 2019) with Full Solutions





SUBJECT CONTENT – 10 TOUGHEST PYQ

Hand-picked from 3 OAVS PET papers (2017, 2018 and 2019) – exercise physiology, sports training, nutrition, sports medicine and athletics – with the same step-by-step solutions you get in the full pack.

Q-1 Identify the non-essential nutrient from the following:

[OAVS PET 2017]

- (A) Amino acids
- (B) Both, Creatine and Glycerol
- (C) Creatine
- (D) Glycerol

ANS- (B) Both, Creatine and Glycerol

Explanation: Creatine and glycerol are treated as **non-essential nutrients or compounds** because the human body can produce them internally. Creatine is synthesized mainly in the **liver, kidneys and pancreas** from **3 amino acids—arginine, glycine and methionine**. Glycerol is produced during the breakdown of stored triglycerides and can be used in energy metabolism.

Key Points:

- ♦ *Meaning of non-essential:* **Produced by the body**
- ♦ *Creatine storage:* **About 95% in skeletal muscles**
- ♦ *Energy compound:* **Phosphocreatine**
- ♦ *Glycerol structure:* **Three-carbon alcohol**
- ♦ *Fat composition:* **One glycerol and three fatty acids**
- ♦ *Essential amino acids:* **9 in healthy adults**

Other Options:

- (A) **Amino acids** — They are the basic units of proteins, and the human body commonly uses **20 amino acids** for protein formation. They include **9 essential amino acids** that adults must obtain through food and other amino acids that the body can synthesize.
- (C) **Creatine** — It supports the rapid regeneration of **ATP** through the phosphocreatine energy system, particularly during short and intense activities. The human body generally synthesizes approximately **1 gram per day**, although the amount varies among individuals.
- (D) **Glycerol** — It forms the three-carbon backbone of triglycerides. During fat breakdown, glycerol enters the bloodstream, travels mainly to the liver and can contribute to glucose production through **gluconeogenesis**.

Q-2 In which of the following is ethyl chloride used as a medium of treatment for athletes?

[OAVS PET 2017]

- (A) Electrotherapy
- (B) Cellular therapy



- (C) Thermotherapy
(D) Cryotherapy

ANS- (D) Cryotherapy

Explanation: Ethyl chloride is used in **cryotherapy** as a vapocoolant spray for the temporary treatment of minor sports injuries. When sprayed on the skin, it evaporates rapidly and removes heat from the affected area, producing quick surface cooling and temporary numbness. Its boiling point is approximately **12.3°C**, which allows it to evaporate rapidly at room temperature. It may provide short-term relief from pain caused by minor sprains, muscle strains and bruises, but it must be used carefully by trained persons.

Key Points:

- ✦ *Chemical formula:* **C_2H_5Cl**
- ✦ *Alternative name:* **Chloroethane**
- ✦ *Physical form:* **Colourless volatile liquid**
- ✦ *Application method:* **Vapocoolant spray**
- ✦ *Immediate effect:* **Temporary local anaesthesia**
- ✦ *Safety requirement:* **External use with ventilation**

Other Options:

(A) **Electrotherapy** — It uses controlled electrical energy to support pain management, muscle stimulation and rehabilitation. Methods such as **TENS** apply low-voltage electrical impulses through electrodes placed on the skin, and treatment sessions commonly last around **20–30 minutes**.

(B) **Cellular therapy** — It uses living cells to repair, replace or regenerate damaged tissues. Modern examples include **stem-cell therapy**, bone-marrow transplantation and certain immune-cell treatments, with the first successful human bone-marrow transplant performed in **1957**.

(C) **Thermotherapy** — It uses heat to reduce muscle stiffness, improve blood circulation and relax soft tissues. Hot packs are commonly maintained at approximately **70–75°C** in a heating unit and wrapped in several layers of towels before being applied for about **15–20 minutes**.

Q-3 Circuit training is effective for the development of which of the following?

[OAVS PET 2017]

- (A) Dynamic resistance
(B) Combined resistance
(C) Strength endurance
(D) Aerobic resistance

ANS- (C) Strength endurance

Explanation: (C) **Strength endurance** is effectively developed through **circuit training**. It is the ability of muscles to perform repeated contractions against



resistance for a long period without becoming tired quickly. A circuit normally includes about **8–12 exercise stations**, such as push-ups, squats, sit-ups and step-ups. Participants complete each activity for a fixed time or number of repetitions with short rest intervals. Circuit training was developed by **R. E. Morgan and G. T. Adamson in 1953** at the **University of Leeds, England**.

Key Points:

- ✦ *Training structure:* **Exercise stations**
- ✦ *Common stations:* **8–12**
- ✦ *Rest period:* **Short intervals**
- ✦ *Main benefit:* **Delayed muscular fatigue**
- ✦ *Equipment:* **Body weight or resistance**
- ✦ *Suitable groups:* **Athletes and students**

Other Options:

(A) **Dynamic resistance** — It involves muscular movement against an external load through a range of motion; exercises such as squats and bench presses may be performed in **2–4 sets** to develop muscular strength and movement control.

(B) **Combined resistance** — It uses more than one form of resistance, such as body weight, free weights and elastic bands; a planned combination helps train several muscle groups within a single **30–60-minute** session.

(D) **Aerobic resistance** — It represents the body's ability to continue oxygen-based activity for a prolonged period; running, cycling and swimming performed for at least **20–30 minutes** help improve the efficiency of the heart and lungs.

Q-4 During the digestion process, the stomach releases chemical substances to break food down into small pieces so that our body can use it for energy. What are the chemical substances released by the stomach called?

[OAVS PET 2018]

- (A) Enzymes pepsin, rennin and hydrochloric acid
- (B) Citric acid
- (C) Sulphuric acid
- (D) Nitric acid

ANS- (A) Enzymes pepsin, rennin and hydrochloric acid

Explanation: During digestion, the **gastric glands** in the stomach wall secrete **gastric juice**, which contains the enzymes **pepsin** and **rennin** along with **hydrochloric acid (HCl)**. HCl makes the stomach strongly acidic, kills germs and converts inactive pepsinogen into active pepsin. **Pepsin** breaks proteins into smaller peptides, while **rennin** curdles milk protein (casein), mainly in infants. The partly digested food, called **chyme**, then passes into the small intestine for further digestion and absorption.

Key Points:

- ✦ *Secreting glands:* **Gastric glands**



- ✦ *Secretion name:* **Gastric juice**
- ✦ *Acid in the stomach:* **Hydrochloric acid (HCl)**
- ✦ *Stomach pH:* **About 1.5–3.5**
- ✦ *Protein-digesting enzyme:* **Pepsin**
- ✦ *Milk-curdling enzyme:* **Rennin**

Other Options:

(B) **Citric acid** — It is a weak **organic acid** found naturally in citrus fruits such as lemon and orange. In the body it is part of the **Krebs (citric acid) cycle** inside mitochondria, but it is not secreted by the stomach.

(C) **Sulphuric acid** — It is a strong **mineral acid (H_2SO_4)** used in car batteries, fertilisers and industry. It is highly corrosive and is **not produced** anywhere in the human digestive system.

(D) **Nitric acid** — It is a strong **mineral acid (HNO_3)** used to make fertilisers and explosives. It is not a digestive secretion; the only mineral acid secreted by the stomach is **hydrochloric acid**.

Q-5 Water acts as a main component of a person's body. Which of the following factors affects the amount of water?

[OAVS PET 2018]

- (A) Amount of fat contained in the body
- (B) Diet
- (C) Play and sport
- (D) Body temperature

ANS- (A) Amount of fat contained in the body

Explanation: The percentage of water in a person's body is strongly affected by the amount of **body fat**. Fatty tissue contains much less water than lean tissue such as muscles and organs. Therefore, people with a higher proportion of body fat usually have a lower percentage of total body water. In an average adult, water accounts for approximately **55–60% of body weight**, while fat-free mass contains nearly **70–75% water**.

Key Points:

- ✦ *Water inside cells:* **Intracellular fluid**
- ✦ *Water outside cells:* **Extracellular fluid**
- ✦ *Major body-fluid mineral:* **Sodium**
- ✦ *Main intracellular mineral:* **Potassium**
- ✦ *Water-regulating organ:* **Kidneys**
- ✦ *Water-loss routes:* **Urine, sweat, breathing and faeces**

Other Options:

(B) **Diet** — Food and drinks supply water to the body every day. Fruits and vegetables such as watermelon, cucumber and oranges have high water content, while sodium intake influences the retention and distribution of water.

(C) **Play and sport** — Physical activity increases water loss through sweating and breathing. Athletes must replace both water and electrolytes during prolonged



exercise, especially when activity continues for more than **60 minutes** in hot conditions.

(D) **Body temperature** — An increase in body temperature activates sweating, which helps cool the body through evaporation. Normal body temperature is approximately **37°C**, and fluid requirements rise during fever, hot weather and intense exercise.

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Q-6 What is the resting heart rate for a well-trained athlete?

[OAVS PET 2018]

- (A) 10 to 25 beats per minute
- (B) 40 to 60 beats per minute
- (C) 30 to 50 beats per minute
- (D) 35 to 55 beats per minute

ANS- (B) 40 to 60 beats per minute

Explanation: The resting heart rate of a well-trained athlete is commonly around **40–60 beats per minute**. Regular endurance training strengthens the heart and increases the amount of blood pumped in each beat, known as **stroke volume**. Therefore, an athlete's heart can supply sufficient blood and oxygen with fewer beats than the usual adult resting range of **60–100 beats per minute**.

Key Points:

- ◆ *Unit of heart rate:* **Beats per minute**
- ◆ *Best measurement time:* **After waking**
- ◆ *Common pulse site:* **Wrist**
- ◆ *Heart's natural pacemaker:* **SA node**
- ◆ *Rate below 60 BPM:* **Bradycardia**
- ◆ *Recommended aerobic activity:* **150 minutes per week**

Other Options:

(A) **10 to 25 beats per minute** — This represents an extremely slow pulse and requires urgent medical assessment, particularly when accompanied by **fainting, chest pain, confusion, breathing difficulty, or low blood pressure**.

(C) **30 to 50 beats per minute** — This range may occur in highly trained endurance athletes, especially during sleep, because long-term training can increase stroke volume; rates near **30 BPM** should be medically assessed when symptoms appear.

(D) **35 to 55 beats per minute** — This range can be recorded in some trained athletes and overlaps with athletic bradycardia; heart rate should be counted for a complete **60 seconds** when the rhythm feels irregular.



Q-7 Except which of the following conditions, the O_2 demand increases for better unloading of haemoglobin?

[OAVS PET 2019]

- (A) PO_2 decreases
- (B) Temperature decreases
- (C) pH decreases
- (D) Temperature increases

ANS- (B) Temperature decreases

Explanation: Oxygen is **unloaded** from haemoglobin more readily in active muscles when **PO_2 decreases**, **temperature increases**, **pH decreases** (more acidity) and **CO_2 rises**. This shifts the **oxygen-dissociation curve to the right**, known as the **Bohr effect**. A **decrease in temperature** does the opposite and holds oxygen more tightly.

Key Points:

- ✦ *Bohr effect described by: Christian Bohr (1904)*
- ✦ *Right-shift factor: Increase in 2,3-BPG*
- ✦ *Left-shift factor: Low temperature, high pH*
- ✦ *Shape of O_2 -dissociation curve: Sigmoid (S-shaped)*

Other Options:

- (A) **PO_2 decreases** — This happens in working muscles as oxygen is used up; low partial pressure of oxygen (about **40 mmHg** in tissues) helps haemoglobin **release oxygen**.
- (C) **pH decreases** — This happens when **lactic acid** and **CO_2** accumulate during exercise; the acidic environment weakens the bond between oxygen and haemoglobin.
- (D) **Temperature increases** — This happens in exercising muscles as **heat** is produced by metabolism, shifting the curve to the **right** and improving oxygen delivery.

Q-8 Which of the following changes does NOT occur in blood during exercise?

[OAVS PET 2019]

- (A) Relative number of RBCs per unit volume increases
- (B) Venous oxygen concentration increases
- (C) Venous oxygen concentration decreases
- (D) Plasma volume decreases

ANS- (B) Venous oxygen concentration increases

Explanation: During exercise, working muscles extract more oxygen from blood, so **venous oxygen concentration decreases**, not increases. At the same time, **plasma volume decreases** due to sweating and fluid shift, which increases the



relative number of RBCs per unit volume (haemoconcentration). The arteriovenous oxygen difference widens.

Key Points:

- ✦ *Resting venous O_2 saturation:* **About 75%**
- ✦ *Cardiac output at rest:* **About 5 L/min**
- ✦ *Plasma share of blood:* **About 55%**
- ✦ *Blood lactate during intense exercise:* **Increases**

Other Options:

- (A) **Relative number of RBCs per unit volume increases** — This occurs as plasma is lost through **sweat**, raising the **haematocrit** temporarily during exercise.
- (C) **Venous oxygen concentration decreases** — This occurs because active muscles take up more oxygen, increasing the **a- vO_2 difference** from about **5 to 15 mL per 100 mL** of blood.
- (D) **Plasma volume decreases** — This occurs as fluid moves from blood into muscle tissue and is lost as **sweat**, reducing plasma volume by about **10–15%** during heavy exercise.

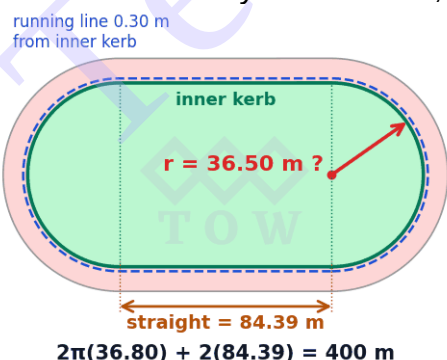
Q-9 A standard 400 m athletic track has two semi-circles. According to IAAF, their radius is:

[OAVS PET 2019]

- (A) 35.50 m
- (B) 38.50 m
- (C) 46.80 m
- (D) 36.50 m

ANS- (D) 36.50m

Explanation: A standard 400 m athletic track has **two straights** and **two semi-circular bends**. As per the **IAAF (now World Athletics)** standard, the radius of each bend, measured to the inner edge, is **36.50 m**. Each straight is **84.39 m** long, and the track usually has **8 lanes**, each **1.22 m** wide.



Key Points:

- ✦ *Length measured along:* **30 cm from the inner edge of lane 1**
- ✦ *Lane line width:* **5 cm**
- ✦ *IAAF renamed World Athletics:* **2019**



✦ *World Athletics headquarters: Monaco*

Other Options:

(A) **35.50 m** — This is **1 m** shorter than the standard radius; a curve of this radius would make each bend shorter than the 400 m layout requires.

(B) **38.50 m** — This is **2 m** longer than the standard radius; some older and non-standard tracks were built with bend radii between **35 m and 38 m**.

(C) **46.80 m** — This value is larger than the standard bend radius and would suit a longer track layout with shorter straights.

Q-10 According to IAAF standards, the angle of the shot-put sector is:

[OAVS PET 2019]

(A) 35.80°

(B) 40.00°

(C) 34.92°

(D) 28.96°

ANS- (C) 34.92°

Explanation: As per **World Athletics (IAAF) rules**, the **landing sector** for the **shot put** is marked at an angle of **34.92°** , with its apex at the **centre of the throwing circle**. The same **34.92°** sector is used for **discus** and **hammer** throws. This angle makes the sector easy to mark on the ground, since the width across the sector is **0.6 times** its distance from the centre.

Key Points:

✦ *Shot put circle diameter: 2.135 m*

✦ *Stop board height: 10 cm*

✦ *Men's shot weight: 7.26 kg*

✦ *Women's shot weight: 4 kg*

Other Options:

(A) **35.80°** — This value is about **0.88°** more than the standard sector; older rules once used a **40°** sector for throws.

(B) **40.00°** — This was the **older sector angle** used for shot put and discus before the change to **34.92°** in the early **2000s**.

(D) **28.96°** — This angle is close to the **javelin runway sector**, where the landing area is marked at about **28.96°** .





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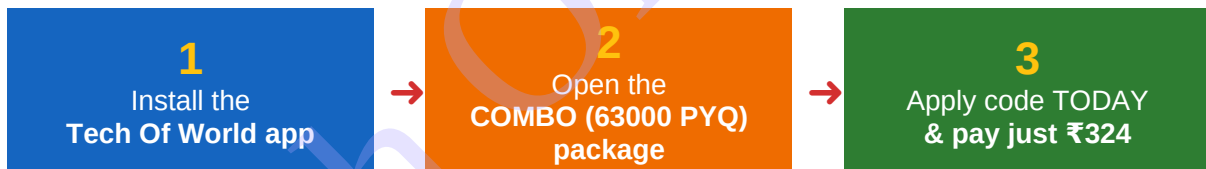
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