SSM
Scuola Superiore Meridionale

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CONCORSO GEM 2022-2023
WRITTEN TEST

II LIVELLO: GEM

EXAMPLE

1) The conversion of pyruvate to oxaloacetate is likely to require which of the following coenzymes?
   (A) Biotin
   (B) Vitamin B12
   (C) Thiamine pyrophosphate
   (D) Pyridoxal phosphate
   (E) Flavin adenine dinucleotide

2) Which of the following is true about a circular double stranded DNA genome that is determined by chemical means to be 21% adenosine?
   (A) The genome is 10.5% guanosine
   (B) The genome is 21% guanosine
   (C) The genome is 29% guanosine
   (D) The genome is 58% guanosine
   (F) The base percent composition of guanosine in the genome cannot be determined from the information given

3) In prokaryotes, environmental sensing frequently involves regulatory proteins (two components systems) that sense and respond changes in surroundings. These two-component systems may involve which of the following?
   I. Protein phosphorylation
   II. Transcriptional regulation
   III. Membrane proteins
   (A) I only
   (B) II only
   (C) III only
   (D) II and III only
   (E) I, II and III.

4) Pyruvate kinase transfers a phosphate group from phosphoenolpyruvate to ADP, forming pyruvate and ATP. The reaction catalyzed by this enzyme is essentially irreversible. Which of the following is the best explanation for the irreversible nature of this reaction?
   (A) The binding of pyruvate to the active site is very weak relative to the binding of phosphoenolpyruvate
   (B) The reaction is coupled to the pyruvate dehydrogenase reaction
   (C) The hydrolysis of ATP is highly favorable
   (D) The change in free energy ($\Delta G'$) for the overall reaction is large and negative
   (E) There is different enzyme in the cell which synthesizes phosphoenolpyruvate

5) Substrate-level phosphorylation in the citric acid (Krebs) cycle depends directly on the energy of the
   (A) Thioester bond of succinyl CoA
   (B) Oxidative decarboxylation of isocitrate to a-ketoglutarate
   (C) Formation of citrate from oxaloacetate and acetyl CoA
   (D) FAD-dependent oxidation of succinate to fumarate
   (E) Phosphoanhydride bond of 1,3-bisphosphoglycerate

6) Some viruses have increased the coding potential of their genome by
   (A) Integrating into the host genome
   (B) Using host ribosomes for translation
   (C) Using alternative splicing sites
   (D) Using a degenerate triplet code
   (E) Covalently linking a protein to the genome

7) The completion of the S phase of the cell cycle of a mammalian cell is marked by all of the following EXCEPT:
   (A) Histone content per cell is double that of cells in G_1
   (B) In replicated DNA, newly incorporated bases are paired with parental bases
   (C) Each replicated chromosome has four telomeres
   (D) Sister chromatids disjoin from one another
   (E) The nucleus contains the equivalent amount of DNA of a tetraploid cell in G_1

8) Members of which of the following classes of macromolecules are known to exhibit enzymelike (catalytic) properties?
   I. RNA
   II. Glycoproteins
   III. Lipoproteins
   IV. Polysaccharides
   (A) I and II only
   (B) II and III only
   (C) III and IV only
   (D) I, II and III only
   (E) I,II,III and IV

9) A homozygous, Rh-positive man (RR) marries an Rh-negative (rr) woman. Their first child is normal, but their second child has hemolytic disease (Rh disease). The first child did not have hemolytic disease because
   (A) The child was heterozygous (Rr)
   (B) The child lacked Rh antigens
   (C) The mother had a previous blood transfer that protected the child against her antibodies
   (D) Anti-Rh antibodies present in the mother were destroyed by child's immune system
   (E) Anti-Rh antibodies were not induced in the mother until the delivery if the first child

10) Which of the following takes part during anaphase of mitosis in an animal cell?
   (A) Kinetochore microtubules elongate to push chromosomes toward the metaphase plate
   (B) The chromosomes align on the metaphase plate
   (C) Sister chromatids remain attached to each other at the centromere and move toward the pole as a unit
   (D) The contractile ring completes the process of cytokinesis
   (E) Polar microtubules elongate and slide to push the spindle poles apart

(A) una sequenza di stop-transfer
(B) operano solo in ambiente alcalino
(C) sono racchiuse in vescicole rivestite di clatrina
(D) sono fosforilate su residui di mannosio
(E) Sono modificati dalla glicosilazione O-linked dei residui di asparagina