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**QUESTION 1**

Energy for ATP synthesis is produced primarily by: A. NADH

B. proton gradient

C. ATP synthase

D. Na⁺

Correct Answer: B

Proton pumps located along the inner mitochondrial membrane enable the passage of H⁺ across a concentration gradient. These protons pass through ATP synthase in which an axel rotates to combine phosphate with ADP to form ATP.

Without the proton gradient, ATP synthase could not create ATP.

QUESTION 2

$i^3 - i^{3/2} =$

A. $i^{3/2}$

B. $-i$

C. \sqrt{i}

D. $\sqrt{-i}$

A. Option

B. Option

C. Option

D. Option

Correct Answer: D

Simplify the expression:

$$i^{\frac{6}{2}} - i^{\frac{3}{2}} = i^{\frac{3}{2}} = \sqrt{i^3}$$

$$i = \sqrt{-1}$$

$$i^3 = -\sqrt{-1} = -i$$

$$\sqrt{i^3} = \sqrt{-i}$$

**QUESTION 3**

If $-10 \leq 3x + 4$

A. $(-14/3,)$

B. $(, 16/3)$

C. $[-14/3, 16/3]$

D. $[-14/3, 16/3)$

Correct Answer: D

Subtract 4 from all parts of the inequality, and then divide everything by 3 to find out the value of x:

$$-10 \leq 3x + 4$$

Therefore, the answer in interval form should be $[-14/3, 16/3)$.

QUESTION 4

Which of the following lipids in a cell membrane acts as a selective barrier for controlling the exit and entry of substances into and out of the cell?

A. Cholesterol

B. Glycolipids

C. Phospholipids

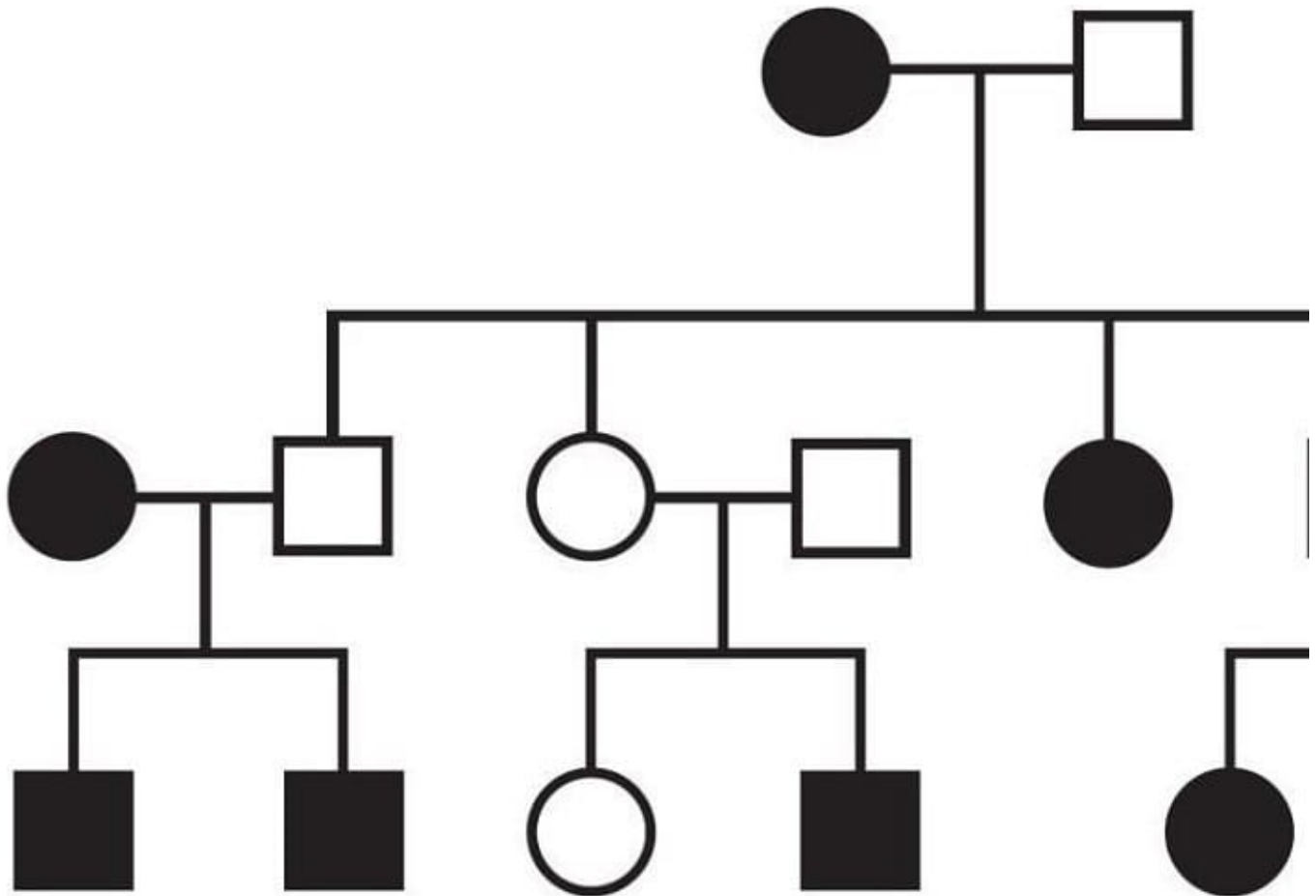
D. Lipoproteins

Correct Answer: C

The primary type of lipids found in the cell membrane are phospholipids, cholesterol and glycolipids. Out of these, phospholipids play an important role in controlling the movement of substances into and out of the cell. In general, lipid soluble substances are allowed to move into the cell whereas water soluble molecules are restricted or not allowed to pass through the cell membrane.

QUESTION 5

What is the inheritance pattern of the observed trait indicated by the pedigree below?



- A. Autosomal recessive
- B. Autosomal dominant
- C. X-linked recessive
- D. X-linked
- E. Cannot be determined

Correct Answer: A

Pedigrees show the distribution of a single observable trait, or phenotype, across a family tree. In classical genetics, each phenotype is determined by a combination of two alleles contributed by two copies of the same (but not necessarily identical) chromosome. One allele is generally dominant, meaning it is expressed if it is present at all. In contrast, the other allele is recessive, meaning it is only expressed in the absence of a dominant allele, which generally means two copies need to be inherited to display the recessive phenotype. The exceptions are those alleles found on the X chromosome in males; males' sex chromosomes include only one X (and one Y), so each trait coded for on the X chromosome is determined by only one allele instead of a combination of two alleles. This means it's statistically more likely for males to inherit recessive X-linked traits since only one copy of the recessive alleles needs to be inherited to display the recessive phenotypes, as opposed to the usual two.

The fastest way to determine which inheritance pattern is shown by a pedigree, then, is to use the Kaplan shortcut: Identify whether two matching parents have an opposite offspring. If two affected parents have an unaffected offspring, both parents must have been heterozygous (having one of each allele), and the trait must be dominant: $Rr \times Rr \rightarrow Rr, rr$. If two unaffected parents have an affected offspring, both parents must have one again been heterozygous, but in that situation, the trait being tracked must have been the recessive one: $Rr \times Rr \rightarrow Rr, rr$. In the pedigree provided in this



question, generational skipping occurs in the middle portion: Generation 2 has two unaffected parents, but generation 3 has an affected offspring. This indicates a recessive trait. Since a roughly equal number of males and females are affected (5 : 4 ratio), this is an autosomal trait.

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