Full Explanation Document for 20 MCQs

Q1. Why is NADPH production through the oxidative phase of the PPP important?

A. It provides reducing power for biosynthetic reactions

Slide Quote:

Cells require NADPH for reductive biosynthetic reactions.

Simple:

NADPH is the 'electrons-on-demand' molecule your cells use to build fats or fight damage.

Audio Transcript:

Breaking down glucose-6-phosphate into NADPH and pentose.

Q2. Why is glucose-6-phosphate dehydrogenase (G6PD) considered the control point of the PPP?

A. It is the first step that generates NADPH

Slide Quote:

Step 1 - Glucose-6-phosphate dehydrogenase NADP is reduced to NADPH.

Simple:

This enzyme starts the PPP and makes the molecule (NADPH) that the pathway exists to produce.

Audio Transcript:

G6PD starts the pathway and generates NADPH.

Q3. Why is thiamine pyrophosphate (TPP) required by transketolase in the PPP?

A. It uses 2-carbon transfers to generate glyceraldehyde-3-phosphate and a seven carbon sugar

Slide Quote:

This reaction requires thiamine pyrophosphate as a coenzyme.

Simple:

TPP acts like a molecular 'helper' that holds reactive pieces during sugar reshuffling.

Audio Transcript:

Transketolase requires thiamine pyrophosphate as a coenzyme.

Q4. Why does the PPP include a reversible non-oxidative phase?

A. To interconvert sugars based on cellular needs for DNA synthesis or energy production

Slide Quote:

These steps produce ribose-5-phosphate Some carbon is directed to glycolysis or gluconeogenesis.

Simple:

This part of the PPP is flexible if the cell needs DNA, it gives ribose; if it needs energy, it gives glycolytic sugars.

Audio Transcript:

PPP products can go into glycolysis or back to make ribose.

Q5. Why is the PPP especially active in tissues like liver and adipose cells?

A. These tissues use PPP for fatty acid synthesis

Slide Quote:

It operates mostly in the cytosol of liver and adipose cells NADPH is used in cytosol for fatty acid synthesis.

Simple:

Liver and fat cells use PPP to build stuff (like fats); RBCs use it to stay protected from damage.

Audio Transcript:

Occurs mostly in liver and adipose tissue due to fatty acid synthesis.

Q6. Why is ribose-5-phosphate important in the non-oxidative phase of PPP?

A. It is a precursor for nucleotide and nucleic acid synthesis

Slide Quote:

This pathway also produces ribose five phosphate precursor for synthesis of nucleotides.

Simple:

Ribose-5-phosphate is the backbone sugar for building RNA, DNA, and coenzymes.

Audio Transcript:

Ribose-5-phosphate used for nucleotide synthesis.

Q7. Why can intermediates from the PPP re-enter glycolysis?

A. To meet cellular energy demands by converting sugars back to energy pathways

Slide Quote:

Fructose six phosphate and glyceraldehyde three phosphate can go back to glycolysis.

Simple:

If the cell doesn't need ribose, it can recycle those sugars back to make ATP.

Audio Transcript:

Fructose-6-phosphate and glyceraldehyde-3-P feed back into glycolysis.

Q8. Why does G6PDH activity reflect a cells redox status?

A. NADP activates the enzyme, while NADPH inhibits it

Slide Quote:

Glucose 6-phosphate dehydrogenase is allosterically stimulated by NADP inhibited by NADPH.

Simple:

If there's lots of NADPH, the cell says 'we're good'; if not, G6PDH gets busy.

Audio Transcript:

G6PDH is inhibited by NADPH, activated by NADP.

Q9. Why is PPP flexibility critical for balancing biosynthesis and energy needs?

A. It enables flux toward nucleotide production or glycolysis depending on cellular state

Slide Quote:

Depending on the bodys state ribulose-5-phosphate will go toward DNA or glycolysis.

Simple:

The pathway adapts: it builds DNA if needed, or feeds glycolysis for energy.

Audio Transcript:

Cell chooses pathway based on need for DNA vs energy.

Q10. Why does a high NADPH/NADP ratio inhibit the PPP?

A. It signals that biosynthetic reducing power needs are already met

Slide Quote:

NADPH inhibits glucose 6-phosphate dehydrogenase.

Simple:

When NADPH is high, the pathway shuts off because the cell doesnt need more.

Audio Transcript:

High NADPH inhibits the enzyme to prevent waste.

Q11. Why is glycogen phosphorylase regulated by both allosteric effectors and covalent modification?

A. To allow energy-dependent activation and inhibition depending on ATP and AMP levels

Slide Quote:

AMP is an allosteric activator ATP and glucose-6-P are inhibitors phosphorylation converts it to a persistently active form.

Simple:

The enzyme listens to both hormones and energy signals like ATP and AMP.

Audio Transcript:

AMP activates; phosphorylation locks it into active state.

Q12. Why does phosphorylation of Ser14 activate glycogen phosphorylase?

A. It induces a change that makes the enzyme persistently active

Slide Quote:

Phosphorylation of serine-14 converts phosphorylase b to phosphorylase a persistently active.

Simple:

Phosphorylation flips the enzyme into always-on mode, so it doesnt need AMP.

Audio Transcript:

Phosphorylation removes the need for AMP.

Q13. Why is cyclic AMP (cAMP) important in glycogen metabolism?

A. It acts as a second messenger to transmit hormone signals

Slide Quote:

Cyclic AMP is a second messenger: transduces the message of the hormone.

Simple:

Hormones cant enter your cells, so cAMP delivers the message inside to trigger enzyme action.

Audio Transcript:

cAMP is the internal messenger for hormone signals.

Q14. Why is UDP-glucose required in glycogen synthesis?

A. It is the activated form of glucose required by glycogen synthase

Slide Quote:

Glucose is activated for glycogen synthesis by attachment to uridine diphosphate, to form UDP-glucose.

Simple:

UDP-glucose is a 'primed' version of glucose thats easy for the enzyme to plug into glycogen.

Audio Transcript:

Glucose must be activated into UDP-glucose first.

Q15. Why does AMP activate glycogen phosphorylase in muscle cells?

A. It signals low energy, promoting glycogen breakdown

Slide Quote:

AMP is an allosteric activator of glycogen phosphorylase Glycogen catabolism is stimulated when energy reserves are low.

Simple:

When your muscles are low on energy, AMP tells enzymes to break down stored fuel (glycogen).

Audio Transcript:

AMP means low energy, phosphorylase gets turned on.

Q16. Why is glycogen synthesis regulated reciprocally with glycogen breakdown?

A. To prevent futile cycling and optimize energy storage vs. release

Slide Quote:

Phosphorylation has opposite effects on glycogen phosphorylase and glycogen synthase.

Simple:

One signal turns on storage and turns off breakdown, or vice versa no wasted effort.

Audio Transcript:

Phosphorylation inhibits synthase and activates phosphorylase.

Q17. Why does insulin promote glycogen synthesis?

A. It activates pathways that dephosphorylate and activate glycogen synthase

Slide Quote:

Insulin acts to lower blood glucose rapidly stimulating glycogen synthesis and inhibiting glycogen breakdown.

Simple:

Insulin tells cells to store sugar by activating the glycogen-making pathway.

Audio Transcript:

Insulin promotes glycogen synthesis and inhibits breakdown.

Q18. Why is the branching enzyme important in glycogen metabolism?

A. It creates new (16) linkages, improving glycogen solubility and mobilization

Slide Quote:

Formation of glycogen branches is catalyzed by the branching enzyme transferred to C-6 hydroxyl group.

Simple:

Branches make glycogen more compact and easier to build or break down quickly.

Audio Transcript:

Branching makes glycogen more soluble and accessible.

Q19. Why does glucose-6-phosphatase activity matter in liver glycogen metabolism?

A. It allows liver cells to release free glucose into the bloodstream

Slide Quote:

In liver glucose-6-P is hydrolyzed to glucose for transport to other tissues.

Simple:

Liver cells can free glucose for the rest of the body; muscle cells can't.

Audio Transcript:

Liver has glucose-6-phosphatase; muscles dont.

Q20. Why does glucagon stimulate glycogen breakdown?

A. It signals low blood glucose and triggers enzyme phosphorylation cascades

Slide Quote:

Glucagon stimulates mobilization of glycogen via cAMP-dependent cascade.

Simple:

Glucagon sounds the alarm when blood sugar is low and releases stored glucose.

Audio Transcript:

Glucagon raises cAMP and triggers breakdown.