MARCO LEARNING®

Welcome to AP® Hacks!

AP Biology

AP Biology students are penguins because they are dressed for success!

You are now an AP Bio Penguin!

Favorite Resources

AP Bio Penguins

- @apbiopenguins (Instagram, Twitter, YouTube & TikTok)
- Website: apbiopenguins.weebly.com
- AP Biology Review Guide
- TONS of Review PowerPoints

Additional Resources

- Podcast: @theapsoluterecap
- YouTube: Bozeman Biology
- Review Book: Barron's (7th Edition)

Exam Options

Paper Administration

- May 14th @ 8am Local
- Traditional Exam: 60 MC/2 Long + 4 Short FRQ

Digital Administration

- May 27th @ 12pm Eastern

  OR
- June 11th @ 12pm Eastern
- Traditional Exam: 60 MC/2 Long + 4 Short FRQ
- Students will not be asked to draw or graph as part of their response (#2 or #5)

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Tips from Marco

Pace Yourself
Present Practice
Persevere
Penguin

Unit 3: Cellular Energetics

Big Topics

- Enzymes
- Cellular Respiration
- Photosynthesis

12 – 18% of the AP Biology Exam

Based on 2020 Practice Exams – that's 9.3 questions

Cellular Respiration

Big Ideas:

- What are the steps?
- What goes into step?
- What comes out of step?
- Where does step occur?
- Why is step important?

Cellular Respiration

Glycolysis

INPUT	OUTPUT	WHERE OCCURS	WHY IMPORTANT
Glucose	2 NADH 2 ATP 2 Pyruvate	Cytosol	Substrate Level Phosphorylation NADH (carries electrons to ETC) Breaks down glucose to pyruvate

Cellular Respiration

Pyruvate Oxidation (Intermediate)

INPUT	OUTPUT	WHERE OCCURS	WHY IMPORTANT
Pyruvate	1 CO_2 1 NADH 1 Acetyl CoA	Mitochondrial Matrix	NADH (carries electrons to ETC) Prepares pyruvate for Krebs Cycle

Cellular Respiration

Krebs Cycle/Citric Acid Cycle/TCA

INPUT	OUTPUT	WHERE OCCURS	WHY IMPORTANT
Acetyl CoA	3 NADH 1 $FADH_2$ 1 ATP 2 CO_2	Mitochondrial Matrix	Substrate Level Phosphorylation NADH & $FADH_2$ (carries electrons to ETC) Completes breakdown of glucose

Cellular Respiration

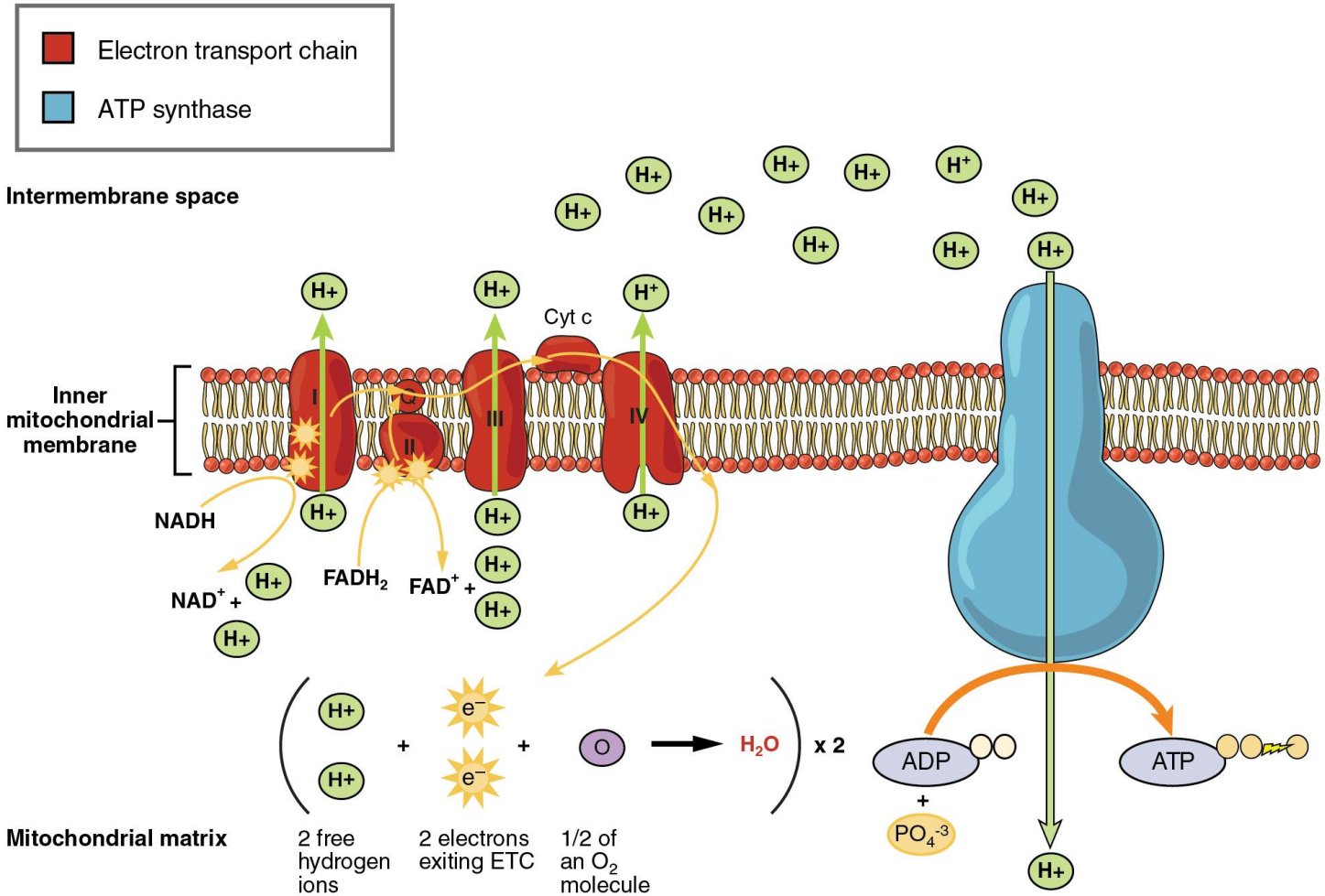
Oxidative Phosphorylation

INPUT	OUTPUT	WHERE OCCURS	WHY IMPORTANT
Electrons (NADH & $FADH_2$) O_2	ATP H_2O	Mitochondrial Cristae	Electrons provide energy for proton gradient production Highest ATP yield

Cellular Respiration

Important Concept

- Electron transport chain DOES NOT make ATP
- ETC role is to produce the proton gradient
- Protons pumped into the intermembrane space



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Teacher ShoutOuts

Mrs. Fowler
Mr. Heinrichs
Mr. Hansen
Mr. Davis
Mr. Huff
Mrs. Erdman
Ms. Mena
Ms. Jewett
Dr. Long
Ms. Ribera
Mrs. Kimbrell
Mrs. Sherman
Mrs. Sharp
Mrs. Jones

Multiple Choice Question

Practice Question

According to the data, the mice at 10°C demonstrated greater oxygen consumption per gram of tissue than did the mice at 25°C. This is most likely explained by which of the following statements?

a. The mice at 10°C had a higher rate of ATP production than the mice at 25°C.

b. The mice at 10°C had a lower metabolic rate than the mice at 25°C.

c. The mice at 25°C weighed less than the mice at 10°C.

d. The mice at 25°C were more active than the mice at 10°C

Free Response Question

Practice Question

Using the information, describe ONE contribution of each of the following in ATP synthesis.

- Catabolism of glucose in glycolysis and pyruvate oxidation
- Oxidation of intermediates in the Krebs cycle
- Formation of a proton gradient by the electron transport chain

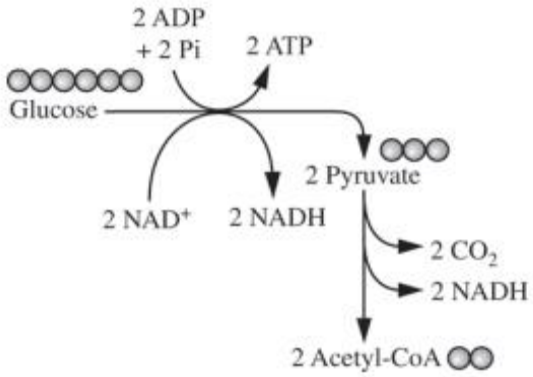


Figure 1. Glycolysis and pyruvate oxidation

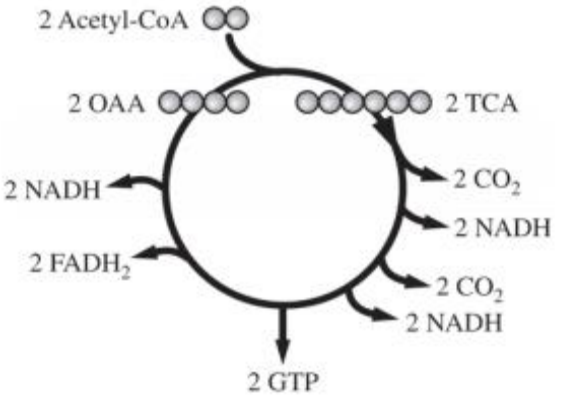


Figure 2. Krebs cycle

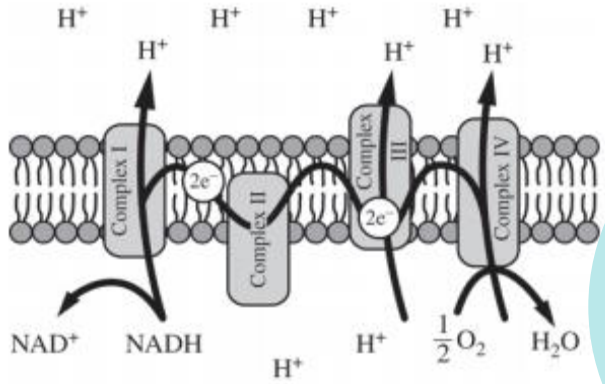
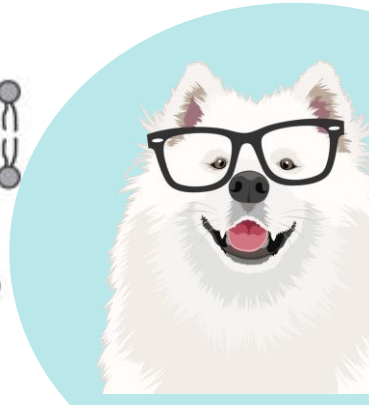


Figure 3. Electron transport chain



Free Response Question

Practice Question

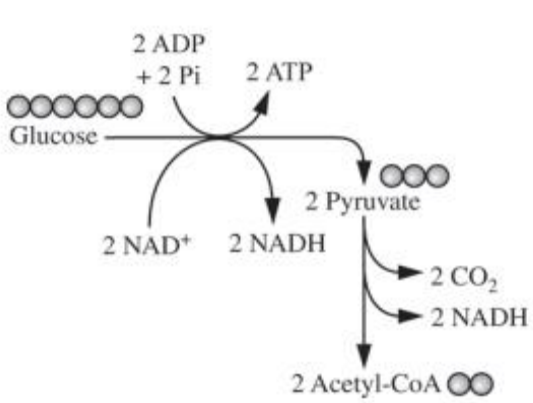
Process	**Description (1 point each box; 3 points maximum)**
Catabolism of glucose in glycolysis and pyruvate oxidation	• Produces NADH for use in ETC • Produces acetyl-CoA for entry into Krebs cycle • Provides energy for (substrate level) phosphorylation of ADP
Oxidation of intermediates in the Krebs cycle	• Produces NADH or FADH2 for use in ETC • Releases high energy electrons for use in ETC • Provides energy to pump protons against their concentration gradient • Produces GTP for (substrate level) phosphorylation of ADP
Formation of a proton gradient by the electron transport chain	• The flow of protons through membrane-bound ATP synthase generates ATP • Provides energy for (oxidative) phosphorylation of ADP

Free Response Question

Practice Question

Use each of the following observations to justify the claim that glycolysis first occurred in a common ancestor of all living organisms.

- Nearly all existing organisms perform glycolysis.
- Glycolysis occurs under anaerobic conditions.
- Glycolysis occurs only in the cytosol.



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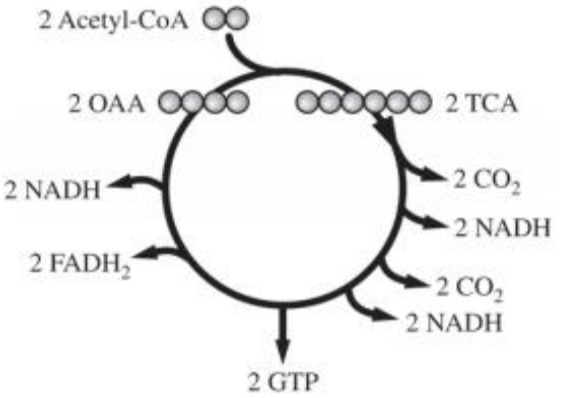


Figure 2. Krebs cycle

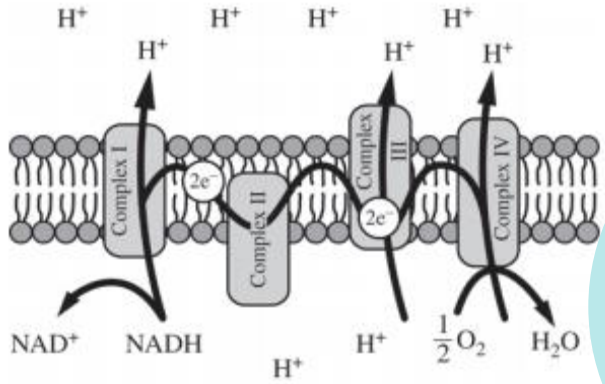
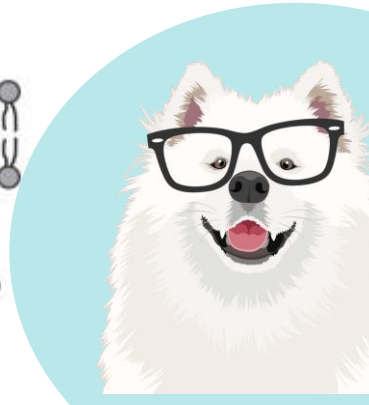


Figure 3. Electron transport chain



Free Response Question

Practice Question

Observation	**Justification (1 point each box; 3 points maximum)**
Nearly all existing organisms perform glycolysis	• Trait/gene/process originated early and was inherited/passed down/highly conserved • Glycolysis provided a selective advantage that was passed on to descendants
Glycolysis occurs under anaerobic conditions	Origin of glycolysis pre-dates free atmospheric oxygen/photosynthesis
Glycolysis occurs only in the cytosol	Origin of glycolysis pre-dates cell types with membrane-bound organelles/eukaryotes/endosymbiosis

Free Response Question

Practice Question

A researcher estimates that, in a certain organism, the complete metabolism of glucose produces 30 molecules of ATP for each molecule of glucose. The energy released from the total oxidation of glucose under standard conditions is 686 kcal/mol. The energy released from the hydrolysis of ATP to ADP and inorganic phosphate under standard conditions is 7.3 kcal/mol. **Calculate** the amount of energy available from the hydrolysis of 30 moles of ATP. **Calculate** the efficiency of total ATP production from 1 mole of glucose in the organism. **Describe** what happens to the excess energy that is released from the metabolism of glucose.

Free Response Question

Practice Question

30 moles produced x 7.3 kcal/mole = 219 kcal

Glucose has 686 kcal/mol

Efficiency = 219 kcal/686 kcal = 0.319

31% or 32%

The excess energy is released as heat.

All this talk of cellular respiration is making me hungry.

Is it time for my treat now?

Photosynthesis

Big Ideas:

- What are the steps?
- What goes into step?
- What comes out of step?
- Where does step occur?
- Why is step important?

Photosynthesis

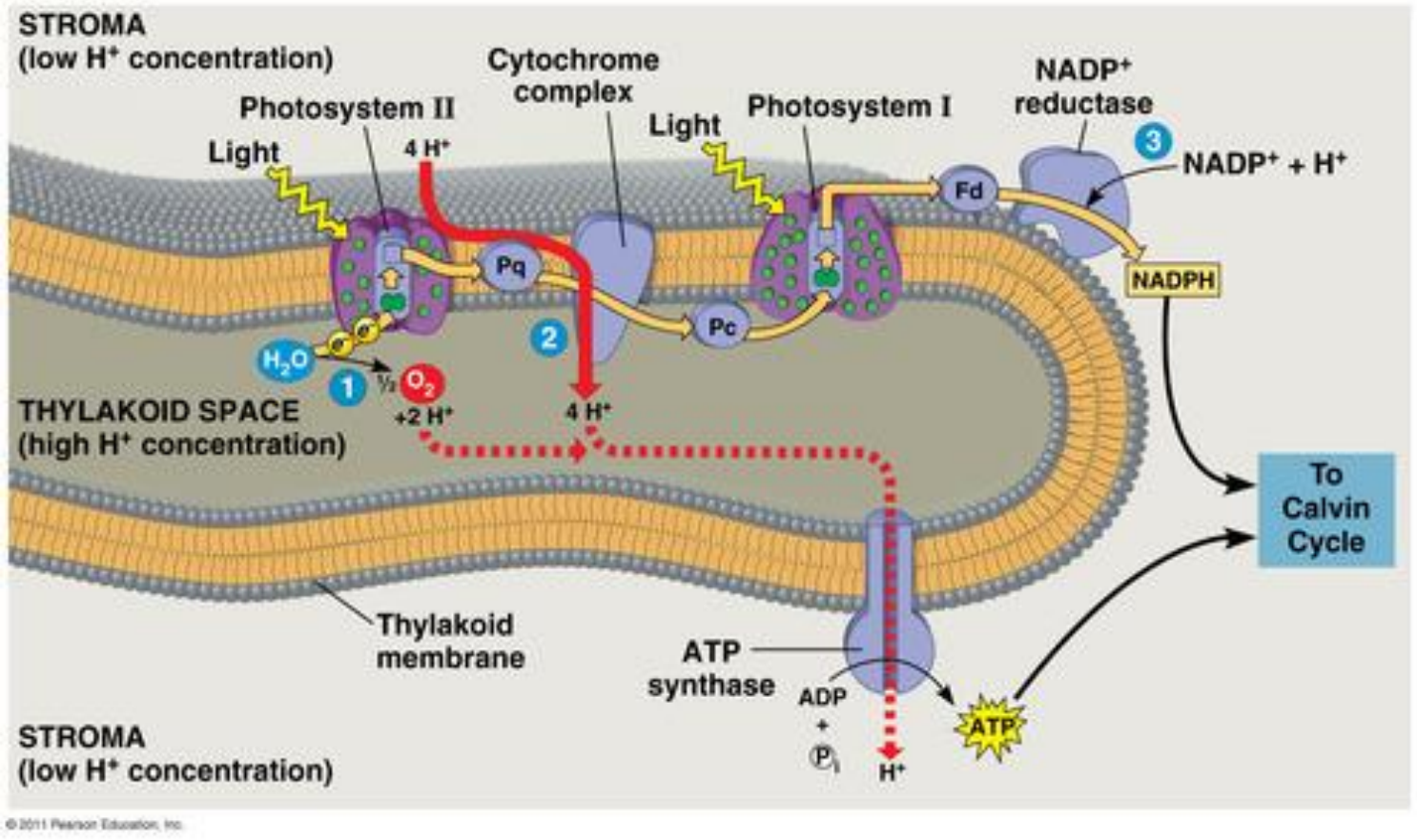
Light Reactions

INPUT	OUTPUT	WHERE OCCURS	WHY IMPORTANT
Photons H_2O	ATP NADPH O_2	Thylakoid Membrane	ATP produced to fuel Calvin cycle NADPH shuttles electrons for reduction of carbon

Photosynthesis

Important Concept

- Protons pumped into the thylakoid space
- Water resupplies the lost electron in PS II
- Cyclic vs. Linear Electron Flow



Photosynthesis

Calvin Cycle/Dark Reactions

INPUT	OUTPUT	WHERE OCCURS	WHY IMPORTANT
6 NADPH 9 ATP	G3P (glyceraldehyde-3-phosphate)	Stroma	Stores energy in the form of G3P Inorganic Carbon -> Organic Carbon

Multiple Choice Question

The chemical reaction for photosynthesis is

$6\ CO_2 + 12\ H_2O + \text{light energy} \rightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$

If the input water is labeled with a radioactive isotope of oxygen, ^{18}O, then the oxygen gas released as the reaction proceeds is also labeled with ^{18}O. Which of the following is the most likely explanation?

a. During the light reactions of photosynthesis, water is split, the hydrogen atoms combine with the CO2, and oxygen gas is released.

b. During the light reactions of photosynthesis, water is split, removing electrons and protons, and oxygen gas is released.

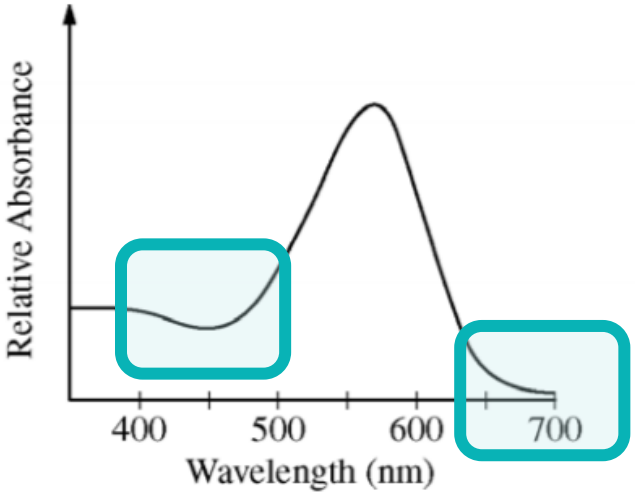
c. During the Calvin cycle, water is split, regenerating NADPH from NADP+, and oxygen gas is released.

d. During the Calvin cycle, water is split, the hydrogen atoms are added to intermediates of sugar synthesis, and oxygen gas is released.

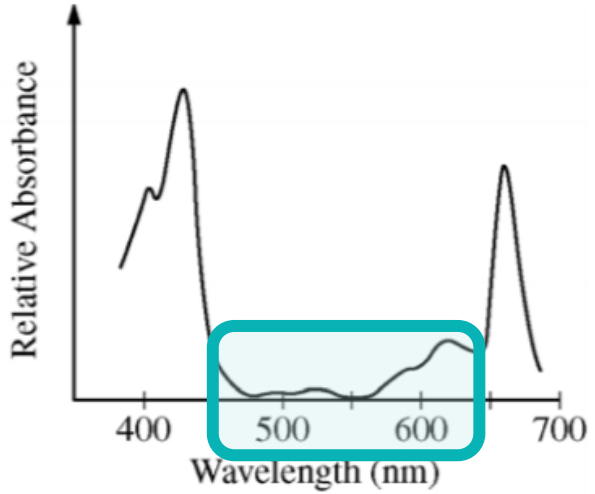
B

Free Response Question

One of the pigments is chlorophyll a, commonly found in green plants. The other pigment is bacteriorhodopsin, commonly found in purple photosynthetic bacteria.



Graph I



Graph II

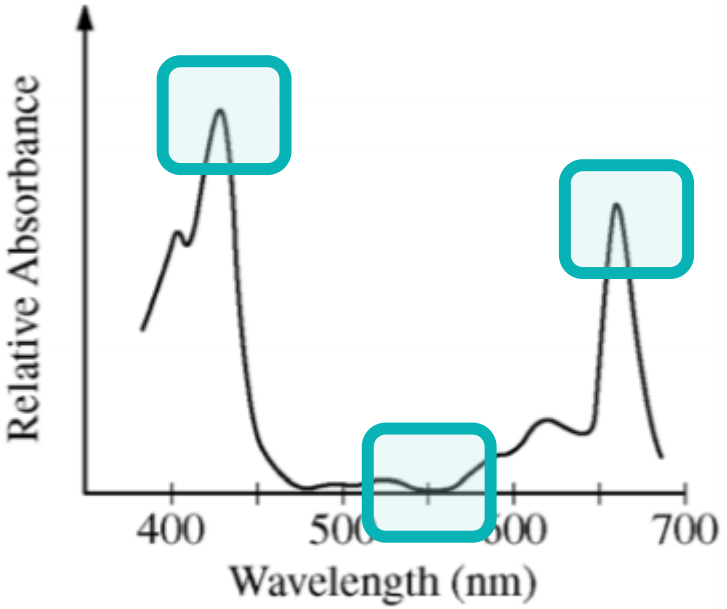
Color	Wavelength (nm)
Violet	380–450
Blue	450–475
Cyan	475–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

Identify the pigment (chlorophyll a or bacteriorhodopsin) used to generate the absorption spectrum in each of the graphs above. Explain and justify your answer.

Free Response Question

Practice Question

In an experiment, identical organisms containing the pigment from Graph II as the predominant light-capturing pigment are separated into three groups. The organisms in each group are illuminated with light of a single wavelength (650 nm for the first group, 550 nm for the second group, and 430 nm for the third group). The three light sources are of equal intensity, and all organisms are illuminated for equal lengths of time. **Predict** the relative rate of photosynthesis in each of the three groups. **Justify** your predictions.



Graph II

Free Response Question

Practice Question

Wavelength (Group)	Prediction (**1 point each box**)	Justification (**1 point each box**)
650 nm (1st Group)	Intermediate rate	An intermediate level of absorption occurs at 650 nm (compared to 430 nm and 550 nm); *therefore*, an intermediate amount of energy is available to drive photosynthesis.
550 nm (2nd Group)	Lowest rate	The lowest level of absorption occurs at 550 nm; *therefore*, the least amount of energy is available to drive photosynthesis.
430 nm (3rd Group)	Highest rate	The highest level of absorption occurs at 430 nm; *therefore*, the greatest amount of energy is available to drive photosynthesis.

Marco: Do you realize you talk a lot AP Bio Penguin?

Penguin: Just part of my nature to squawk

Strategies for Questions

- Use the diagrams
- Develop your OWN ideas
- Read the questions before reading the prompt
- Paper Testers - Underline/circle important information in prompt
- Paper Testers - Write analysis on graph
- Digital Testers - average about 1.3 minutes per question
- Digital Testers – ask teacher for a bubble sheet to cross off answer choices

Strategies for Questions

FRQ Timing

- Approximate: 25 min per long & 10 min per short
- Recommendation: 20 min per long & 8 min per short

- Checkboxes
- Time on Page
- Order of Knowledge/Ability

Strategies for Questions

FRQ Writing

- Read the question, Read the question, Read the …
- Label your responses (a), (b), (c) & (d)
- Write in knowledge order
- Beware of contradictions
- Use the diagrams
- Define your terms
- Cross out
- Pen, Pencil, Crayon, Marker – doesn't matter

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Party on Penguin

See you 3/20 at 1:00pm EST