Cell Respiration and Photosynthesis IB/AP Biology
Reading and Objectives

I. Cellular Respiration *Ch 9

2.7.1 Define cell respiration. 1
7.1.1 State that oxidation involves the loss of electrons from an element whereas reduction involves a gain in electrons, and that oxidation frequently involves gaining oxygen or losing hydrogen, whereas reduction frequently involves loss of oxygen or gain in hydrogen. 1
2.7.2 State that in cell respiration glucose in the cytoplasm is broken down into pyruvate with a small yield of ATP. 1
2.7.4 Explain that in aerobic cell respiration pyruvate is broken down in the mitochondrion into carbon dioxide and water with a large yield of ATP. 3
2.7.3 Explain that in anaerobic cell respiration pyruvate is converted into lactate or ethanol and carbon dioxide in the cytoplasm, with no further yield of ATP. 3
7.1.3 Draw the structure of a mitochondrion as seen in electron micrographs.1
7.1.6 Explain the relationship between the structure of the mitochondrion and its function. 3
7.1.2 Outline the process of glycolysis including phosphorylation, lysis, oxidation and ATP formation. 2
7.1.4 Explain aerobic respiration including oxidative decarboxylation of pyruvate, the Krebs cycle, NADH + H+, the electron transport chain and the role of oxygen. 3

In aerobic respiration (in mitochondria in eukaryotes) each pyruvate is decarboxylated (CO 2 removed). The remaining two-carbon molecule (acetyl group) reacts with reduced coenzyme A, and at the same time one NADH + H+ is formed. This is known as the link reaction.
In the Krebs cycle each acetyl group (CH 3CO) formed in the link reaction yields two CO2. The names of the intermediate compounds in the cycle are not required. Thus it would be acceptable to note: C2 + C 4 = C6 --> C 5--> etc. Students should also note that the hydrogen atoms removed are collected by "hydrogen-carrying coenzymes".

One turn of the Krebs cycle yields:
2 ´ CO2
3 ´ NADH + H +
1 ´ FADH2
1 ´ ATP (by substrate level phosphorylation)

7.1.5 Explain oxidative phosphorylation in terms of chemiosmosis. 3
7.1.7 Describe the central role of acetyl CoA in carbohydrate and fat metabolism. 2

➔ Redox; phosphorylation: substrate-level; oxidative; chemiosmosis; fermentation
➔ How are organic molecules broken down by catabolic pathways?
➔ What is the role of O_2 in energy-yielding pathways?
➔ How do cells generate energy in the absence of O_2?

II. Photosynthesis *Ch 10

7.2.1 Draw the structure of a chloroplast as seen in electron micrographs.1
7.2.6 Explain the relationship between the structure of the chloroplast and its function.3
2.8.1 State that photosynthesis involves the conversion of light energy into chemical energy. 1
2.8.2 State that white light from the sun is composed of a range of wavelengths (colours). 1
2.8.3 State that chlorophyll is the main photosynthetic pigment.1
2.8.4 Outline the differences in absorption of red, blue and green light by chlorophyll. 2
7.2.7 Draw the action spectrum of photosynthesis. 1
7.2.8 Explain the relationship between the action spectrum and the absorption spectrum of photosynthetic pigments in green plants. 3
2.8.5 State that light energy is used to split water molecules (photolysis) to give oxygen and hydrogen, and to produce ATP. 1
2.8.6 State that ATP and hydrogen (derived from the photolysis of water) are used to fix carbon dioxide to make organic molecules. 1
7.2.2 State that photosynthesis consists of light-dependent and light-independent reactions. 1 Not "light" and "dark" reactions.
7.2.3 Explain the light-dependent reactions. 3
7.2.4 Explain photophosphorylation in terms of chemiosmosis.3
7.2.5 Explain the light-independent reactions. 3
Include the roles of ribulose bisphosphate (RuBP) carboxylase, reduction of glycerate 3-phosphate (GP) to triose phosphate (TP), NADPH + H+, ATP, regeneration of RuBP and synthesis of carbohydrate.
2.8.7 Explain that the rate of photosynthesis can be measured directly by the production of oxygen or the uptake of carbon dioxide, or indirectly by the increase in biomass. 3
2.8.8 Outline the effects of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis. 2
7.2.9 Explain the concept of limiting factors with reference to light intensity, temperature and concentration of carbon dioxide. 3

➔ How does photosynthesis convert light energy into chemical energy?
➔ How are the chemical products of the light-trapping reactions coupled to the synthesis of carbohydrates?
➔ What kinds of photosynthetic adaptations have evolved in response to different environments?

➔ What interactions exist between photosynthesis and cellular respiration?
➔ How does chemiosmosis function in bioenergetics?