Online Resource 1
Learning goals per educational video (translated from Dutch)

Chapter	Video clip	Learning Goals
2	2.1	1. Students can give the mass and atom number of a given element from the number of protons, electrons and neutrons and vice versa. 2. Students can explain the difference between two isotopes of one element. 3. Students can distribute electrons over the different types of orbitals within the first and second electron shell.
	2.2	4. Students can determine the bonding types that can occur from the electronic distribution of an element. 5. Students can determine whether a covalent bonding is polar or apolar from electronegativity values. 6. Students can order bonding types from weak to strong.
3	3.1	7. Students can describe four important properties of water. 8. Students can provide a definition for pH, acids, bases and buffers. 9. Students can name the most important buffer in blood. 10. Students know what pKa values indicate. 11. Students can use pKa values to determine the charge of a structure at certain pH values
4	4.1	12. Students can classify isomers into structural isomers, cis-trans isomers and stereo isomers 13. Students can provide the name and properties of the most important biochemical groups 14. Students can determine whether a carbon atom is asymmetric and can explain which isomer requires asymmetric atoms 15. Students can draw the phosphate groups in ATP 16. Student can provide the name of the sugar in ATP.
5	5.1	17. Students can explain whether chemical reactions are hydrolysis or dehydration reactions and can also draw examples of both reaction types. 18. Students can provide the general molecular formula of sugars. 19. Students can classify sugars into aldehydes and ketones. 20. Students can provide the names of the sugars that store glucose for energy in both animals and plants 21. Students can explain that glucose is mainly present as a ring structure when in solution. 22. Students can explain the difference between α and β glucose. 23. Students can explain the difference in structure and function of cellulose, glycogen and starch.
	5.2	24. Students can explain the differences between saturated and unsaturated fatty acids. 25. Students can explain whether a structure is a lipid and whether a lipid is a fatty acid, phospholipid or steroid.
	5.3	26. Students can describe the general chemical structure of amino acids. 27. Students can classify amino acids into hydrophilic, hydrophobic and charged amino acids from their structural formulas. 28. Students can provide the names of the three amino acids that can be phosphorylated by a kinase. 29. Students can provide a definition for primary, secondary, tertiary and quaternary protein structures. 30. Students can describe the function of chaperone proteins.
	5.4	31. Students can name the structural components of a nucleotide. 32. Students can explain that nucleic acids are polar. 33. Students can draw the chemical structure of a nucleic acid.

6	6.1	34. Students can classify chemical reactions into catabolic and anabolic reactions and provide examples of both reactions. 35. Students can explain the difference between kinetic and potential energy. 36. Students van describe the first two laws in thermodynamics. 37. Students can explain what free energy (ΔG) encompasses and can provide the formula to calculate the free energy from enthalpy and entropy. 38. Students can differentiate between exogenic and endogenic reactions and explain whether these reactions have positive or negative ΔG values. 39. Students can explain how non-spontaneous reactions can occur.
	6.2	40. Students can describe the function of enzymes and explain that they contain active sites and are substrate specific. 41. Students can name factors that influence the function of enzymes. 42. Students can explain that enzymes lower the E_a value, but do not lower ΔG. 43. Students can provide a definition for allosteric regulation. 44. Students can classify inhibitors into competitive and non-competitive inhibitors. 45. Students can explain the meaning of positive and negative feedback mechanisms.
7	7.1	46. Students can describe the differences between eukaryotic and prokaryotic cells.
	7.2	47. Students can define and describe the function of the following cell organelles: nucleus, ribosomes, smooth ER, rough ER, Golgi apparatus, endosomes, lysosomes, vacuoles, mitochondria, chloroplasts and peroxisomes.
	7.3	48. Students can determine whether a protein is synthesized by free or bound ribosomes from their final destination. 49. Students can describe the route of plasma membrane proteins from the site of production to the plasma membrane. 50. Students can name three functions of the SRP protein. 51. Students can explain where proteins are glycolyzed. 52. Students can name the organelles of the endomembrane system. 53. Students can describe phagocytosis and autophagy. 54. Students can describe how lysosomal enzymes are transported to the lysozymes. 55. Students can describe how proteins are sorted in the trans-Golgi.
	7.4	56. Students can name three types of cytoskeleton structures. 57. Students can provide the main functions and structure of microtubules, microfilaments and intermediary filaments. 58. Students can provide the function of cell walls and extracellular matrices and know in which cell types these structures can be found. 59. Students can provide the different functions of plasmodesmata, tight junctions, desmosomes and gap junctions.
8	8.1	60. Students can predict in which net direction a solute will be transported across a selective permeable membrane. 61. Students can describe the structure and components of cellular membranes. 62. Students can explain how temperature, fatty acid structure and cholesterol affect the fluidity of cell membranes. 63. Students can explain that the monolayers of the cellular membrane differ in lipid composition. 64. Students can describe in which monolayer carbohydrates can be found and how they function in cellular recognition. 65. Students can explain that the membrane structure affects the selective permeability of the membrane.
	8.2	66. Students can explain the difference between passive transport, active transport and co-transport. 67. Students can explain the difference between phagocytosis, pinocytosis and receptor mediated endocytosis.

		68. Students can describe the process of receptor mediated endocytosis. 69. Students can explain how receptors that need to be recycled are separated from receptors that need to be degraded.
9	9.1	70. Students can explain how cells can communicate and provide responses to certain external/internal signals. 71. Students can provide examples and definitions for different types of short-distance and long-distance cell-cell communication 72. Students can name three stages of cell signaling (reception, transduction and response) 73. Students can explain how a ligand can stimulate signaling pathway through binding of a receptor. 74. Students can explain the difference in signaling pathway for hydrophilic and hydrophobic signals 75. Students can explain how different signaling molecules can bind to similar receptors resulting in different signaling pathways. 76. Students can describe the general cell signaling pathway of G-protein coupled receptors. 77. Students can explain how G-proteins are activated and inactivated. 78. Students can describe the functions of guanosine exchange factor and GTPase. 79. Students can explain the general function of kinases. 80. Students can describe how tyrosine kinases are activated and deactivated. 81. Students can explain the function of ligand gated ion channels.
	9.2	82. Students can describe the cell signaling pathway resulting in amplification of cAMP. 83. Students can describe the cell signaling pathway resulting in amplification of Ca^{2+}. 84. Students can describe the mechanism and function of phosphorylation and dephosphorylation in signal transduction and explain that these mechanisms are regulated by kinases and phosphatases. 85. Students can describe what second messengers are and provide the function of cAMP, Ca^{2+}, DAG and IP3 in general signaling pathways. 86. Students can describe the general functions of cAMP, AMP, phosphodiesterase and adenylyl cyclase. 87. Students can explain that transcription and cytoplasmic activities can be affected by cell signaling. 88. Students can describe the function of scaffolding proteins.
	9.3	89. Students can describe the function of apoptosis in embryonic development and explain that this process is regulated by signaling pathways.
10	10.1	90. Students can explain the difference between catabolic and anabolic pathways. 91. Students can describe the processes of fermentation and aerobic respiration and describe whether each of these requires oxygen. 92. Students can explain the difference between oxidation and reduction. 93. Students can select the electron donor, reducing agent, electron acceptor and oxidizing agent of a redox reaction. 94. Students can explain whether oxidation occurred in specific reactions during cellular respiration. 95. Students can describe the three steps of aerobic respiration.
	10.2	96. Students can describe the main steps of glycolysis, the location of glycolysis and the amount of ATP and NADH that are produced during this process.
	10.3	97. Students can explain how glycolysis is connected to the citric acid cycle. 98. Students can give the amount of ATP, NADH and $FADH_2$ formed during the citric acid cycle.
	10.4	99. Students can describe how electrons move to a lower energetic stage within the electron transport chain and explain the role of NAD^+ and NADH during this process.

		100. Students can describe how chemiosmosis is coupled to ATP synthesis during oxidative phosphorylation and where each of these processes occurs. 101. Students can explain the difference between oxidative phosphorylation and substrate level phosphorylation. 102. Students can provide a definition for ATP synthase, chemiosmosis, cytochrome, ubiquinone, electron carriers and proton motive force. 103. Students can explain the function of fermentation and describe the differences between alcohol fermentation and lactic acid fermentation. 104. Students can give the amount of ATP, NADH and $FADH_2$ formed during glycolysis when no oxygen is present. 105. Students can explain the function of beta oxidation. 106. Students can describe the feedback mechanism of cellular respiration. 107. Students can name the three most important components to be catabolized.
11	11.1	108. Students can explain the difference between autotrophic and heterotrophic organisms. 109. Students can describe the location and net reaction of photosynthesis and explain why this reaction is a redox reaction. 110. Students can explain how light energy is converted to chemical energy to ATP and NADPH. 111. Students can provide a definition for photophosphorylation, carbon fixation, NADP+ and NADPH. 112. Students can explain which spectrum is most effective for photosynthesis from the results of Engelmann's experiment. 113. Students can explain that pigments in the thylakoid differ in their absorption spectrum.
	11.2	114. Students can provide a definition for photosystem, primary electron acceptor, reaction centre and light harvesting complex. 115. Students can describe how photosystem II is connected to photosystem I. 116. Students can describe how linear electron flow yield ATP and NADPH.
	11.3	117. Students can explain the difference between linear and cyclic electron flow. 118. Students can describe the components that enter and leaf the Calvin cycle. 119. Students can describe the function of Rubisco.
12	12.1	120. Students can provide a definition for somatic cells, gametes, sister chromatids, centromeres, kinetochores and cytokinesis. 121. Students can calculate the number of chromosomes, chromatids and centromeres in each cell cycle stage from a given chromosome number in somatic cells. 122. Students can explain which processes occur during M phase, G1 phase, S phase and G2 phase. 123. Students can describe, name and recognize the phases of mitosis. 124. Students can explain how sister chromatids are held together and pulled apart during anaphase. 125. Students can explain the differences between kinetochore and non-kinetochore microtubules. 126. Students can provide a definition for centrosome and centrioles. 127. Students can describe the components of the mitotic spindle and explain where assembly of the spindle starts. 128. Students can explain the mechanism of binary fission of bacteria.
	12.2	129. Students can explain how the eukaryotic cell cycle is regulated by a molecular control system. 130. Students can explain how the cell cycle is regulated by cyclines, cyclin dependent kinases. 131. Students can describe the activity and concentration of specific cyclins and cyclin depend kinases during a specific cell cycle stage. 132. Students can name three important checkpoints of the cell cycle. 133. Students can explain how loss of checkpoints can result in cancer.