WWU Biology – Applying to the Major/Minor

Focal Areas of Knowledge Assessment (required for a complete application)

1. Using the Metric System
   a) Unit conversions
   b) Prefixes. Abbreviations, and English expression
2. Scientific Notation and Significant Figures
   a) Rules for working with significant figures
   b) Using scientific notation
   c) Combining measurements
3. Logarithms and Exponents
   a) Identifying and manipulating logarithmic and exponential functions
   b) Rewriting equations with logarithms and exponents
4. Reading and Interpreting Scientific Graphs
   a) Extracting the overall trend or message of a graph
   b) Understanding Axes, independent and dependent variables
   c) Types of graphs: scatterplots, lines, curves, histograms
5. Basic Probability
   a) Multiplication rule of probability ('both-and' rule)
   b) Sum rule of probability ('either-or' rule)
6. Concentrations and Dilutions
   a) Dilution factors
   b) $V_1C_1 = V_2C_2$
   c) Molarity and formula weight
7. Fractions, Proportions, Percentages
   A) Manipulating and calculating fractions, proportions, and percentages
8. Process of Science
   a) General steps of the scientific process
   b) Questions, hypotheses, and predictions
   c) Theories
   d) Designing experiments to test hypotheses, and the importance of controls
   e) Interpreting data from experiments and observations
   f) Drawing conclusions
9. Bacteria, Archaea, and Single-celled Eukaryotes
   a) Relationships among and defining features of the domains of life

b) Modes of energy and nutrient acquisition
c) Origins of mitochondria and chloroplasts
d) Life cycles

10. Plants
    a) Colonization of land and adaptations for terrestrial life
    b) Vascular vs. non-vascular plants
    c) Life cycles and reproduction
    d) Defining features of major plant groups (“Nonvascular plants” (Bryophytes: Liverworts, hornworts, and mosses) and Vascular plants (seedless and seed plants (gymnosperms and angiosperms)))
11. Animals
    a) Animal origins
    b) Body plans
    c) Development and germ layers
    d) Reproductive strategies
    e) Defining features of major animal groups (Porifera, Cnidaria, Deuterostomes and Protostomes (Lophotrochozoa and Ecdysozoa)
12. Fungi
    a) Nutrient acquisition
    b) Life cycles and reproduction
    c) Body plans
    d) Defining characteristics of major fungal groups (Basidiomycota, Ascomycota, Zygomycota, and Chitridiomycota)
13. Foundational Ecological Principles
    a) Trophic levels and food webs
    b) Nutrient cycles and energy flow
    c) Biotic vs. abiotic ecological factors
    d) Major categories of interspecific interactions
    e) Exponential and logistic population growth
    f) Population size estimation
    g) Global climate change
14. Mendelian Genetics
    a) Alleles and Mendelian particulate inheritance
    b) Independent assortment and segregation

c) Genotype vs. phenotype
d) Homozygosity, heterozygosity
e) Dominance, recessivity
f) Use of Punnett squares to predict outcomes of monohybrid and dihybrid crosses

15. Cell cycle, Mitosis, & Meiosis
    a) Chromosomes and chromatids
    b) Ploidy
    c) Major phases of cell cycle
    d) Phases of mitosis and meiosis
    e) Mitotic spindle, microtubules and chromosome capture
    f) Chromosome segregation
    g) Origins of genetic variation
    h) Crossing over and independent assortment
    i) Evolutionary benefits of sexual reproduction
16. Phylogenetics
    a) Interpreting evolutionary relationships from phylogenies
    b) Homology and homoplasy
    c) Monophyly, paraphyly, polyphyly
    d) Cladistics: terminology, principle of parsimony, importance of synapomorphies
17. Natural Selection
    a) Fitness
    b) Heritable variation
    c) Adaptation
    d) Directional, stabilizing, and diversifying selection
18. Hardy-Weinberg and Evolutionary Forces (including Drift, Mutation, Gene Flow)
    a) Consequences of genetic drift and effects of population size
    b) Founder effect and population bottlenecks
    c) Gene flow: causes and consequences
    d) Importance of mutation for evolution
    e) Non-random mating: inbreeding and assortative mating
    f) Hardy-Weinberg as a testable null model
19. Speciation
    a) Biological, phylogenetic, and morphological species concepts
    b) Forms of reproductive isolation

c) Sympatric and allopatric speciation
d) Hybridization
e) Adaptive radiation

20. Cell structure and function
    a) Eukaryote organelles and their basic function; endosymbiotic theory
    b) Bacterium cell structure
    c) Free and bound ribosomes
    d) Cellular transport mechanisms; membrane transporters/vesicle trafficking
21. Chemistry of life
    a) Covalent and noncovalent bonds
    b) Atoms and atomic structure
    c) Chemical equations and equilibrium
    d) Common functional groups
    e) Major macromolecules of the cell; nucleic acids, proteins, carbohydrates, lipids
22. DNA Replication
    a) Semi-conservative replication of the DNA double helix
    b) Mechanism of replication by DNA polymerase (priming, 5’ to 3’ synthesis)
    c) Replication origins, replication bubble, and progression of each replication fork
    d) Asymmetry of replication forks: leading and lagging strands
    e) Point mutations and chromosomal mutations; consequences for the phenotype
    f) DNA repair: correcting mistakes in DNA synthesis; repairing DNA damage
23. DNA/RNA Structure
    a) Double helical structure of DNA and base-pairing rules
    b) Antiparallel arrangement of complementary strands and polarity of ends (5’ vs. 3’ ends)
    c) RNA structure and major types (mRNA, tRNA, rRNA)
24. Enzymes and Catalysis, Bioenergetics
    a) Enzyme catalyzed reaction curves
    b) Free energy changes during reactions, equilibrium
    c) Oxidation and reduction reactions
    d) Enzyme structure: active sites, inhibitors and allosteric regulation
25. Membrane structure and function
    a) The lipid bilayer: phospholipids, cholesterol and membrane fluidity
    b) Membrane permeability

c) Surface glycolipids
d) Membrane proteins and asymmetry of the bilayer

26. Photosynthesis
    a) Chloroplast structure and function
    b) Carbon fixation: the conversion of CO2 into sugars
    c) Photosystems I and II: energy capture and electron transport chain
    d) ATP production via proton motive force
27. Protein Structure and Function
    a) Amino acid structure, major categories of side chains
    b) Protein structure: primary, secondary, tertiary, and quaternary
    c) Importance of protein folding for protein function
28. Respiration (Glycolysis, Fermentation, Krebs cycle and oxidative phosphorylation)
    a) Citric acid cycle; oxidation and reduction reactions
    b) Electron carriers
    c) ATP synthesis in glycolysis, fermentation and oxidative phosphorylation
    d) Mitochondria structure
29. Transcription and control of gene expression
    a) Flow of genetic information (‘Central dogma’)
    b) Transcription initiation, chain elongation, and termination in prokaryotes and eukaryotes
    c) RNA processing in the nucleus to generate mature mRNA (functional significance of capping, splicing, polyadenylation; mechanistic details not necessary)
    d) Transcriptional control by gene regulatory DNA (promoters) and gene regulatory proteins (transcription factors); Lac operon as an example of control of gene expression in bacteria
30. Translation
    a) The genetic code
    b) Ribosomes and the function of tRNA and rRNA
    c) Translation initiation, elongation, and termination
    d) Post-translational modification of polypeptides (covalent modifications, allosteric regulation)