Lecture Exam #2 – Key

1. Define:

Carrying capacity – Carrying capacity is a feature of the environment, and refers to the number of organisms an environment can support in a fully functional state. Carrying capacity is influenced by limiting factors, e.g., nutrient availability, water supply, essential minerals, gasses, etc. that are required for organism function and available in limited supply.

Cellular respiration – Cellular respiration is a three-part metabolic process involving glycolysis, the Krebs cycle and the electron transport chain. It allows respiratory organisms to completely catabolize glucose, releasing carbon dioxide, electrons, hydrogen protons and energy, some of which is captured in the form of ATP. In addition, cellular respiration provides cells with important metabolic intermediates that can be used for the synthesis of amino acids, triglycerides, etc.

Ribulose-bisphosphate Carboxylase Oxygenase – RuBisCO is an enzyme involved in carbon fixation within many autotrophic organisms. It catalyzes reactions binding carbon dioxide with ribulose-bisphosphate molecules at the start of the Calvin-Benson cycle, and is one of the most abundant enzymes on the planet. Organisms can increase the efficiency of this enzyme by concentrating it within carboxysomes (prokaryotic cells) or the stroma of chloroplasts (eukaryotic cells).

2. Cell size, dry weight, DNA content and metabolic activity.

3. Exponential growth phase or logarithmic growth phase/ binary fission

4. Bacteria typically have only one origin of replication associated with their ccc-DNA, but can initiate multiple replication cycles that overlap in time, i.e., they can begin a second and third cycle before the first one is completed./ Elongation requires that the cells partially degrade their peptidoglycan walls (in sections along the long axis, or at the cellular equator), and then deposit new wall material in the gaps that develop as the cell expands.

5. Stationary/ Growth is limited by the lack of nutrients available and by the buildup of toxic metabolic waste products.

6. Metabolism/ exergonic

7. Phosphorylation

8. Reduction

9. Matching letter sequence is: C, A, G, E, H, B, F and D.

10. Temperature/ competitive

11. Ribozymes

12. Glycolysis/ constitutive

13. Fermentation

14. Oxygen serves as the final electron acceptor at the end of the electron transport chain, so one of its functions is the oxidation of coenzymes (allowing them to be used again). Oxygen can bind with electrons and hydrogen protons to form water, so another function of oxygen is providing cells with metabolic water essential to cellular processes. / Carbon dioxide is formed during the decarboxylation of organic acids just prior to and during the Krebs cycle. The acids are pyruvic acid, isocitric acid and α-ketoglutaric acid, and the extra electrons and hydrogen protons associated with the carboxyl groups ($COOH^-$) are passed to NAD, forming NADH + H^+.

15. Acetyl co-A/ Krebs

16. β-oxidation

17. Coenzymes/ Niacin and riboflavin

18. Cytochromes/ proton motive force/ ATP synthase

19. Photophosphorylation

20. Bacteriorhodopsin

21. Plastoquinone/ Water donates electrons to replace those missing, and molecular oxygen is formed as a waste gas.

22. Calvin-Benson cycle/ carboxysomes

23. Matching letter sequence is: C, D, E, F, B, and A.

24. Define:

Phosphodiester bonds – Phosphodiester bonds are the covalent bonds that form between the sugar of one nucleotide and the phosphate group of the next, during the replication, transcription and reverse transcription of nucleic acids. Polymerase, primase and ligase enzymes can all catalyze the formation of these bonds, a process that involves dehydration synthesis (water being formed from OH- from the sugar, and H from the phosphate)

Translation – Translation is the term applied to protein synthesis within cells, because it involves converting information stored in the nucleotide sequences of m-RNA molecules, into amino acid sequences within polypeptide molecules. Translation occurs in association with ribosomes, and the formation of the peptide bonds between amino acids is catalyzed by ribozymes.

Cytolytic bacteriophage – A cytolytic bacteriophage is a virus capable of infecting bacteria, and ultimately causing cell lysis and death. The coliphages X174 and T2 are cytolytic bacteriophages.

25. Ribose

26. Antiparallel/ hydrogen

27. Replication/ primase

28. Polymerase/ Okazaki fragments/ ligase

29. Transcription/ polycistronic

30. Post-transcriptional modification/ spliceosomes

31. Transcription will yield – AUG CUG CGA CAA UUU CUC UGC UGA
Translation will yield – Methionine, Leucine, Arginine, Glutamine, Phenylalanine, Leucine, and Cystein/ No/ The last codon (UGA = Umber) is a terminator codon or stop codon, and does not encode any amino acid. For this reason, there is one less amino acid in the resulting polypeptide than there are codons in the m-RNA strand.

32. Translation/ aminoacyl-t-RNA synthase/ peptidyl transferase

33. Codons with anti-codons

34. Allosteric

35. Tryptophan is a corepressor, and binds with an inactive repressor protein, making it active. The repressor-corepressor complex can then bind with DNA at the operator site and block (repress) transcription./ Allolactose is an inducer, and can bind with and inactivate the active repressor protein encoded by the *lacI* gene. When inactivated, the repressor releases the operator site, and the genes associated with the *lac* operon can be transcribed (transcription is induced).

36. Operon/ P = promoter site, and is a region of DNA (upstream of the structural genes) where the sigma factor of RNA polymerase can bind to begin transcription./ O = operator site, and is a region of DNA between the promoter site and the

structural genes. This is where an active repressor protein can bind to block transcription.

37. β-galactosidase

38. Catabolite repression/ cyclic-AMP

39. Phenotype/ environment

40. Genome/ mutation

41. A substitution type point mutation replacing the first purine in the DNA strand with a different purine, would change the first G to A. Prior to this mutation, the second codon in the m-RNA transcribed from the DNA shown would encode the amino acid argenine. After the mutation, the second codon in the m-RNA would be UGA, a stop codon, so the substitution would result in a **nonsense mutation**. Subjecting this DNA strand to ultra violet light would cause the two adjacent thymine bases to form a dimer, so would result in a deletion type point mutation. This would cause a shift (one base to the right) in the codon reading frame (a frame shift), and all the codons beyond the mutation point would change.

42. Transposons/ translocation

43. Recombinant/ one-way, from donor to recipient

44. Transformation

45. Matching letter sequence is: H, E, F, G, A, C, B, and D.

46. Episome/ the ability to produce sex pili and to initiate gene transfer.

47. Virion/ capsomers

48. Tail fibers/ penetration

49. The host DNA is chopped into pieces, and the viral DNA is transcribed, translated and eventually replicated. / Assembly – The viral components formed during the latent period are assembled into new virions within the host cell. DNA is packaged into capsids and tail assemblies are added.

50. Prophage/ lysogenic conversion