Guide Questions for Topic: The Cell Cycle

1. The four phases of the cell cycle are _____.
2. What event(s) take place during M phase of the cell cycle?
3. What event(s) take place during S phase of the cell cycle?
4. During G_1 and G_2 phases of the cell cycle, cells _____.
5. What does the term "restriction point" refer to in the context of the cell cycle?
6. What effect do extracellular growth factors have on cells with regard to the restriction point?
7. In the absence of extracellular growth factors, animal cells will enter _____.
8. What role do DNA damage checkpoints play during cell proliferation?
9. What role does the spindle assembly checkpoint play during cell proliferation?
10. What class of enzymes do proteins in the cyclin-dependent kinase (Cdk) family belong to?
11. How do cyclins affect Cdk activity?
12. One of the Video Lectures discussed experiments in which researchers took cytoplasm from a frog egg in meiosis and injected it into another frog egg that was in G_2 phase of the cell cycle. When they did so, the frog that was injected immediately progressed from G_2 to meiosis. What key insight this did observation provide?
13. TRUE or FALSE: MPF (aka, Cdk1/cyclin B) activity is required for progression of frog eggs from G_2 to meiosis, but has not role in the progression of other eukaryotic cells from G_2 to mitosis.
14. How does cyclin B synthesis trigger Cdk1 activity in cells specifically at the end of G_2 phase?
15. How does phosphorylation of Thr-14 and Tyr-15 on Cdk proteins affect their activity?
16. What class of enzymes do proteins with the Cdc25 family belong to?
17. What role do Cdc25 family proteins play during the cell cycle?
18. How do each of the following contribute to entry and progression of cells through the cell cycle?
    a. Growth factors?
    b. The ERK MAP kinase pathway?
    c. Elk-1/SRF?
    d. AP1?
19. How does activation Cdk4,6/cyclin D drive cells past the restriction point toward S phase of the cell cycle?

20. How does activation of Cdk2/cyclin E drive cells from G_1 to S phase?

21. What role do the proteins ATR and ATM play in the DNA damage checkpoints?

22. How does activation of the checkpoint kinases Chk1 and Chk2 induce cell cycle arrest?

23. How is the CKI p21 regulated in cells when they accumulate DNA damage?

24. How does induction of p21 in cells cause cell cycle arrest?

Overview of M phase

25. The stages of mitosis are _____.

26. What are the hallmark events that take place during prophase of mitosis?

27. What distinguishes a cell in prometaphase from a cell in metaphase?

28. What are spindle fibers?

29. What does the term "kinetochore" refer to?

30. What is the defining feature of a cell in anaphase of mitosis?

31. Which of the following statements defines a cell that is in telophase of mitosis?

32. What do mitosis and cytokinesis have in common? How are they different?

The G_2 to M phase transition

33. Cdk1/Cyclin B, Aurora kinase, and Polo-like kinase are collectively referred to as the "Mitotic protein kinases". Why is this the case?

34. How does Cdk1/Cyclin B, Aurora kinase, and Polo-like kinase activities induce transition of a cell from G_2 to M phase?

35. How do Cdk1/Cyclin B, Aurora kinase, and Polo-like kinase induce chromatin condensation to form mitotic chromosomes?

36. What role do cohesins play in cells?

37. What role do condensins play in cells?

38. How does phosphorylation of nuclear lamins contribute to a cell's entry into mitosis?

The metaphase to anaphase transition via the spindle assembly checkpoint

39. The ubiquitination of _____ and _____ by the E3 ubiquitin ligase _____ initiates the cell's transition from metaphase to anaphase.

40. Which of the following events take place in a cell as a consequence of Cyclin B ubiquitination by APC at metaphase?

41. Cyclin B ubiquitination by APC at metaphase initiates decondensation of mitotic chromosomes. Why is this the case?

42. Cyclin B ubiquitination by APC at metaphase initiates reformation of the nuclear envelope. Why is this the case?

43. Ubiquitination of the protein securin by APC at metaphase causes sister chromatids to separate. Why is this the case?

44. How does the spindle assembly checkpoint mechanism ensure that APC is not activated until the cell has reached metaphase?