2020 Spring Cell Biology Final Exam Answer Key

1	2	3	4	5	6	7	8	9	10
E	C	C	D	D	B	E	E	N	E
11	12	13	14	15	16	17	18	19	20
E	A	A	C	C	D	D	B	C	B
21	22	23	24	25	26	27	28	29	30
B	C	C	C	A	C	BAE	212221	TFFFT	GGTVT
31	32	33	34						
MIMI	2431	BDCA	TTTT						

35	(a) The binding of the cytokine either causes two separate receptor polypeptide chains to dimerize or re-orients the receptor chains in a preformed dimer. In either case, the associated JAKs are brought together so that they can phosphorylate each other on tyrosines to become fully activated, after which they phosphorylate the receptors to generate binding sites for the SH2 domains of STAT proteins. The JAKs also phosphorylate the STAT proteins, which dissociate from the receptor to form dimers and enter the nucleus to control gene expression. (b) ex: interferon-γ, interferon-α,erythropoietin (EPO), thrombopoietin (TPO), prolactin, growth hormone, GMCSF, …
36	(a) The eukaryotic cell cycle is divided into four sequential phases: **G1 , S, G2 , and M**. Chromosome duplication occurs during S phase (S for **DNA synthesis**). After S phase, chromosome segregation and cell division occur in M phase (M for **mitosis**). Most cell cycles have **gap phases** —a G1 phase between M phase and S phase and a G2 phase between S phase and mitosis, partly to **allow time for growth**. (b) **Cyclin binding results in partial activation of the Cdk enzyme**. Full activation of the cyclin–Cdk complex then occurs when **Cdk-activating kinase (CAK)** phosphorylates an amino acid near the entrance of the Cdk active site. This causes a small conformational change that further increases the activity of the Cdk, allowing the kinase to phosphorylate its target proteins effectively and thereby induce specific cell-cycle events. Cdk activity can be suppressed by inhibitory phosphorylation and Cdk Inhibitor Proteins (CKIs). Cdk inhibitor protein (CKI) binds to and inhibits cyclin–Cdk complexes. (c) APC/C is the key regulator of the metaphase-to-anaphase transition. It is a ubiquitin ligase that catalyzes the ubiquitylation and destruction of securin and M- and S-cyclins, initiating the separation of sister chromatids in the metaphase-to-anaphase transition during mitosis.

37	(a) In the hereditary retinoblastoma, all cells in the body lack one of the normal two functional copies of the *Rb* tumor suppressor gene, and tumors occur where the remaining copy is lost or inactivated by a somatic event. (b) The result of errant homologous recombination that uses the homolog from the other parent instead of the sister chromatid as the template, converting the sequence of the repaired DNA to that of the other homolog.
38	A protein complex forms at the centromere and attaches the duplicated chromosomes to the mitotic spindle, allowing them to be pulled apart.
39	**Totipotent cells** can have the potential to give rise to all the different cell types in an organism, including extraembryonic tissues such as those of the placenta. **Multipotent cells** can give rise to the full range of differentiated cell types in an organ.