USE THE SCANTRON FOR QUESTIONS 1-40. Multiple choice/true-false/open answer: 2 pts each

1) Which of the following are **NOT** hallmarks of cancer?
a. Growth signal autonomy and angiogenesis
b. Invasion and metastasis.
c. Evasion of growth inhibitory signals and avoiding immune destruction
d. Induction of cell death and tumor-promoting inflammation.

2) Which one of the following statements regarding the phenotype of transformed cell phenotypes is **FALSE**?
a. They can grow in the absence of growth factors.
b. They exhibit anchorage independence.
c. They have stable genomes.
d. They grow as foci against a monolayer of normal cells.

3) The following about cancer cells growing in a laboratory dish are true **EXCEPT**:
a. They are growing in vitro
b. They can evade normal growth inhibitory signals
c. They are growing in vivo
d. They are immortalized.

4) DNA base sequence frameshift mutations can be caused by:
a. transitions
b. transversions
c. insertions
d. irradiation

5) All of the following are true about the Philadelphia chromosome **EXCEPT:**
a. It is formed by a reciprocal translocation
b. It is diagnostic for Acute Myelogenous Leukemia
c. It forms the Bcr-Abl fusion gene and protein

6) Which one of the following statements correctly describes an oncogene?
a. A gene that codes for proteins that helps inhibit tumor growth and formation.
b. A mutated gene whose protein product is produced in increased quantities or has increased activity and contributes to carcinogenesis.
c. A type of cancer therapy.
d. A mutated gene whose protein product is produced in deficient quantities and contributes to carcinogenesis.

7) Which of the following intermediates is **NOT** formed during radiolysis?
a. Hydrogen peroxide.
b. Superoxide radical.
c. Hydroxyl radical.
d. Hydrogen.

8) All of the following types of radiation can cause DNA mutations **EXCEPT**:
a. Ultraviolet (UV)
b. X-Rays
c. Gamma Rays
d. Microwaves

9) Which one of the compounds below is **NOT** a known carcinogen?

a. Nitrosamines.
b. beta-carotene
c. Alkylating agents.
d. Aromatic amines.

10) Which one of the following cancer drugs mimics an endogenous metabolite and interferes with nucleic acid synthesis?

a. Methotrexate.
b. Cyclophosphamide.
c. Doxorubicin.
d**.** Vincristine.

11) UV from the sun is carcinogenic and is the principal cause of skin cancer. What is the most common UV photoproduct?

a. pyrimidine-pyrimidone photoproducts
b. purine dimers.
c. pyrimidine dimers
d. pyrimodone dimers

12) Which of the following statements is **TRUE**:
Platinum-based chemotherapies modify DNA through the process of...

a. epoxidation
b. alkylation
c. hydroxylation
d. glycosylation

13) Which of the following does **NOT** cause G➔T transversions?

a) Ultraviolet light
b) Gamma rays
c) polycyclic hydrocarbons
d) taxanes
e) heterocyclic amines

14) All of the following are **TRUE** about nitrosamine and nitrosamides (nitrates and nitrites) **EXCEPT:**

a) they are produced by cooking meat
b) they bind to heme to form nitrosyl heme
c) they are added to cured meats as preservatives
d) they are broken down into reactive oxygen species in the gut

15) Which one of the following is **FALSE**?

a. Epigenetic alterations regulate gene expression.
b. Epigenetic alterations do not cause mutation.
c. Hypermethylation of promoter regions activates gene expression.
d**.** Histone acetyltransferases (HATs) acetylate specific histone-tail lysines and this correlates with increased gene expression.

16) Which of the following therapeutic strategies is **INCORRECTLY** matched to a drug for cancer treatment?

a. DNA methylation transferase (DNMT) inhibitor: 5-aza-2'-deoxycytidine (AZT)
b. Microtubule assembly inhibitor: Vinblastine.
c. HAT (histone acetyltransferase) inhibitors: SAHA
d. Telomerase II inhibitor: Doxorubicin

17) All of these EGFR-family dimers can transduce downstream signals **EXCEPT**:
- a. EGFR/HER2
- b. EGFR/EGFR
- c. HER2/HER2
- d. EGFR/HER4

18) Receptor Tyrosine Kinases (RTKs) are activated through all of the following mechanisms **EXCEPT**:
- a. Ligand binding
- b. Transphosphorylation
- c. Acetylation
- d. Dimerization

19) Upon activation, Phospho-tyrosine motifs on the cytoplasmic domain of EGFR-family RTKs directly associate with:
- a. SH3-containing proteins
- b. Kinases
- c. Transcription factors
- d. SH2-containing proteins
- e. Ras

20) The correct order of binding of these proteins to an EGFR/EGFR dimer is:
- a. Grb2-Shc-Sos-Ras
- b. Shc-Grb2-Ras-Sos
- c. Shc-Grb2-Sos-Ras
- d. Sos-Shc-Grb2-Ras
- e. Ras-Grb2-Sos-Shc

21) Which of the following is **FALSE** about the MAPK Pathway:
- a. It is pro-apoptotic
- b. Is activated through a series of protein phosphorylations
- c. It promotes the expression of genes that encode powerful transcription factors
- d. When dysregulated, it promotes continual cellular proliferation

22) The AP-1 transcription factor is composed of the 2 protein types:
- a. Myc-Abl
- b. Elk-1/Jun
- c. Erk-MEK
- d. Jun-Fos

23) PI3K converts:
- a. PIP3 to PIP2
- b. PIP2 to PIP3
- c. GDP to GTP
- d. Inositol to glycerol

24) PI3K activity is opposed by:
- a. Akt
- b. EGFR
- c. PTEN
- d. Ras

25) Which of the following transcription factors is **NOT** activated through MEK/ERK signaling AND is **NOT** frequently mutated in human tumors:

a. AP-1
b. Sp1
c. Myc
d. Elk-1

26) If PTEN is highly expressed, Akt is:

a. Constitutively phosphorylated
b. Mutated
c. Never phosphorylated
d. Deleted

27) Which statement is **INCORRECT** about K-ras mutations:

a. They are rare in human tumors
b. Occur in codons 12, 13
c. Maintain K-Ras in a constitutively active state
d. Can amplify downstream signaling through MEK/ERK and PI3K/Akt pathways

29) Which of the following is **FALSE** about oncogenes:

a) They were initially identified as human genes that had been picked up by viruses that infected human cells.
b) They are often over-expressed or continuously activated in cancers.
c) They cause tumors when deleted or under-expressed in human cells.
d) They can transform cells.

30) Which of the following is **NOT** a mechanism of oncogene activation:

a) point mutations/deletions in gene coding regions
b) point mutations/deletions in gene regulatory regions
c) chromosomal translocations producing fusion genes/proteins
d) gene deletion/under-expression
e) gene amplification/over-expression

31) The Rous Sarcoma Virus carried which oncogene?

a) myc
b) src
c) abl
d) PTEN

32) Which of the following statements is **FALSE:**

a) Monoclonal antibodies target the ligand binding domain of EGFR
b) Small molecule inhibitors target the TK domain of EGFR
c) Cetuximab is a small molecule inhibitor of EGFR
d) Erlotinib is a small molecular inhibitor of EGFR

33) All of the following mechanisms can dysregulate the Androgen Receptor and cause it to promote tumorigenesis **EXCEPT:**

a) amplification
b) mutation to form splice variants
c) deletion
d) phosphorylation by many kinases

34) All of the following are true about onocmiRs **EXCEPT**:
a) They can block translation of tumor suppressor gene transcripts
b) They are over-expressed in tumors
c) They are often mutated in tumors
d) They promote epithelial-mesenchymal transition (EMT)

35) Which of the following statements is **FALSE:**
a) Acrylamide is converted in the liver to glycidamide
b) Acrylamide is a DNA adducting agent
c) Acrylamide cross-links guanine residues in DNA
c) Acrylamide is formed by frying starchy foods in oil

36) Which of the following statements about photolyase is **FALSE**:
a) it is an enzyme
b) is uses energy from near-UV light to break bonds
c) it can reverse covalent modifications to DNA
d) it can repair alkylated bases

37) Thymidine dimers cannot be repaired by:
a) nucleotide excision repair
b) mismatch repair
c) photolyase
d) base excision repair

38) How many ligand molecules are required to activate an EGFR/HER2 heterodimer?
a) 0
b) 1
c) 2
d) 3

39) All of the following are TRUE about proteins that bind to the phosphorylated tyrosine kinase domain of EGFR-family members **EXCEPT**:
a) they must contain SH3 domains
b) they bind to specific tyrosine-containing sequences
c) they must contain an SH2 domain
d) they are involved in activating Ras

40) Double stranded DNA breaks cannot be repaired through:
a) homologous recombination
b) non-homologous end-joining
c) nucleotide excision repair
d) recombinational repair