

※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

Please choose the most appropriate terms/phrases/statements that complete or answer the questions. Attention: More than one of the choices provided may be correct. (2.5 points for each question)

每題 5 個選項，每個選項 0.5 分，答對得 0.5 分，答錯倒扣 0.5 分。倒扣至該題零分為止。

1. Plasmid DNAs are useful tools in molecular biology because
 - (A) They are easy to manipulate
 - (B) They are relatively small in size
 - (C) There are several selection markers for mammalian but not for bacterial systems
 - (D) They are able to overexpress proteins but not RNA in cells
 - (E) They are easy to propagate into large amount
2. Which abbreviations of amino acid are **NOT CORRECT**?
 - (A) Y= tyrosine
 - (B) P=Phenylalaine
 - (C) G=glutamic acid
 - (D) E=aspartic acid
 - (E) K=tryptophan
3. Regarding to nucleosome which statements are **NOT CORRECT**?
 - (A) The function of nucleosome is to pack large eukaryotic genomes into the nucleus
 - (B) It consists of DNA which wraps 4 different histones namely H2A, H2B, H3 and H4
 - (C) Linker histones such as H1 is involved in chromatin compaction
 - (D) Post-translational modification such as acetylation/deacetylation on histone tails correlates with gene silencing or activation
 - (E) Nucleosomes carry epigenetically inherited information in the form of covalent modifications of their core histones
4. The human genome project (HGP) has been completed in 2003, which statements regarding to HGP are **NOT CORRECT**?
 - (A) Number of human genes are in the range of 50000-100000
 - (B) On 2007, the person whose genome got sequenced was Crick, the Nobel prize winner for his finding in DNA double helix
 - (C) The information will help to design personalized drugs
 - (D) The information will lead to earlier detection of genetic predispositions to disease
 - (E) The scientists from Taiwan did not get involved in the HGP
5. Regarding to DNA and RNA which statements are **NOT CORRECT**?
 - (A) DNA is composed of purine (for example A and T) and pyrimidine (for example C and G)
 - (B) DNA structure is stabilized with hydrogen bonds. AT base pairing forms 3 hydrogen bonds and CG forms 2 hydrogen bonds
 - (C) The sequence of a DNA and the cDNA-derived from its mRNA is the same
 - (D) DNA contains oxyribose, RNA contains deoxyribose
 - (E) In cells, DNA is always double-stranded and RNA is always single-stranded
6. The immune system is
 - (A) composed of innate and adaptive immunity in mammals
 - (B) vital to development because the individuals with immunodeficiency usually die before birth

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- (C) a double-edged sword because it can help or harm the individual depends on the conditions the system is activated
(D) only present in higher grad animals like vertebrates but not in invertebrates such as drosophila
(E) usually activated in the host in response to pathogens such as bacteria or viruses
7. Which is involved in regulating apoptosis?
(A) Bcl2
(B) Fas
(C) Caspase 3
(D) cFLIP
(E) cytochrome c
8. Which techniques can be used to detect cytokines in the serum?
(A) ELISA
(B) Western blotting
(C) Northern blotting
(D) Flow cytometry
(E) ELISPOT
9. Polymerase chain reaction (PCR) is regularly used because:
(A) it can amplify mRNA signal easily
(B) it uses an enzyme that works at high temperature
(C) it needs a large amount of sample to start with
(D) it usually involves in a cyclic reaction
(E) the PCR product can be detected by agarose gels
10. We can use the following methods to measure cell proliferation
(A) BrdU incorporation
(B) ^3H -Thymidine incorporation
(C) PI staining
(D) CFSE staining
(E) Annexin V staining
11. Methods measure DNA-protein interaction
(A) Chromatin Immuno-precipitation (ChIP) assay
(B) DNA microarray
(C) Electrophoretic mobility shift assay (EMSA)
(D) RNA interference (RNAi)
(E) TUNEL assay.
12. Which properties of transgenic mouse are true?
(A) Gene is injected into the male pronucleus of the fertilized egg
(B) Gene is introduced into genome by homologous recombination
(C) Gene is introduced into genome by random insertion
(D) Gene is studied for gain of function
(E) Gene is studied for loss of function.
13. In controlling its function, protein could be post-translational modified by
(A) Acetylation

- (B) Methylation
(C) Phosphorylation
(D) Sumoylation
(E) Ubiquitination.
14. Mature Immune cells mature in gene-knockout mice with RAG recombinase deficiency
(A) B cells
(B) Dendritic cells
(C) Macrophages
(D) Mast cells
(E) T cells.
15. Which of the following mechanisms by which transcription factors are activated?
(A) Protein phosphorylated/dephosphorylated
(B) Ligand binding
(C) Release by inhibitor
(D) Change of partner
(E) Cleavage releases active factor.
16. Which of the following proteins are relevant to cancer in human cells?
(A) Myc
(B) p53
(C) Ras
(D) Rb
(E) Rho factor
17. Methods used for identifying cytokine-secreting cells
(A) Mapping with restriction enzymes
(B) ELISA
(C) Proliferation analysis
(D) Intracellular cytokine staining (ICS)
(E) Yeast two-hybrid.
18. Which of following statements about **retroviruses** are correct??
(A) A typical retrovirus has three genes: *gag*, *pol* and *env*.
(B) Retroviral genes are processed to give many proteins.
(C) Viral DNA is generated by reverse transcription.
(D) Viral DNA integrates into the host chromosome mediated by the host integrase
(E) Retroviruses may transduce cellular sequence.
19. Which of the following statements about **repair systems** are correct?
(A) Repair systems can be triggered by single-base changes in the DNA.
(B) Repair systems can be triggered by structural distortions in the DNA.
(C) Excision systems remove one strand of DNA at the site of damage and then replace it.
(D) Recombination-repair systems use recombination to replace the double-stranded region been damaged.
(E) Repair systems are prone to introducing errors during the repair process.

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20. Which of the followings are involved in protein trafficking?
(A) Cargo
(B) Cdc13
(C) COP-I/II
(D) Endosomes and lysosomes
(E) ER and Golgi.
21. The biological functions of cytokine family are multiple that including
(A) Immunomodulation
(B) Hematopoiesis
(C) Cell proliferation/differentiation
(D) Maintain electrolyte balance
(E) Elicit inflammation
22. Nitric oxide is an important molecule to mediate
(A) Angiogenesis
(B) Enhance leukocyte phagocytosis
(C) Vasodilation
(D) Facilitation of wound healing
(E) Immunoregulation
23. Choose the correct biological phenomenon—relevant molecule pair from the following answers!
(A) Cell apoptosis—phospholipase
(B) Inflammation—tumor necrosis factor- α
(C) Chemotaxis—prostaglandin E2
(D) Cancer metastasis—metalloproteinase
(E) Adhesion between two heterogenous cells—cadherins
24. The enzyme activity can be modified by the process of
(A) Glycosylation
(B) Lipooxygenation
(C) Nitrotyrosination
(D) Phosphorylation
(E) Ubiquitination
25. Acute phase reactants are quickly produced from liver cells by the action of
(A) Allergic reaction
(B) Angiogenesis
(C) Tissue necrosis
(D) Inflammatory process
(E) Cell apoptosis
26. Which molecules are constitutively present in the cytosol of the cells
(A) Protein tyrosine kinase
(B) Transcription factors
(C) Adaptor molecules of the surface-expressed receptors
(D) Amyloid proteins
(E) Intron-encoded products

27. Which organelle—function pair in the cells is correct?
(A) Peroxisome—free radicals production
(B) Lysosome—lipid storage
(C) Endoplasmic reticulum—protein sorting
(D) Proteasome—protein degradation
(E) Endosome—storage for the endocytosed molecules
28. Which molecules are involved in the redox reaction in the cells?
(A) Glutathione reductase
(B) Lactic dehydrogenase
(C) Cyclooxygenase
(D) Alkaline phosphatase
(E) Superoxide dismutase
29. The major functions of the transporters on the cell surface of epithelial cells are
(A) Exchange membrane components between different cells
(B) Carry essential nutrients into cells
(C) Transduce different signals from outside into cells
(D) Maintain cell-cell interactions in the tissue
(E) Expel waste products out of cells
30. GTP-binding proteins work as
(A) Contractile protein
(B) Regulatory protein
(C) Transport protein
(D) Thermogeneration
(E) Cofactors for enzyme activity

You have a crude cell extract (CE) containing a mixture of six proteins (x, y, z, w, v and β -galactosidase), and you want to have purified β -galactosidase (β -Gal). Some characteristics of these proteins are shown in the following table:

Protein	Concentration of $(\text{NH}_4)_2\text{SO}_4$ Required for precipitation	Molecular Weight (kDa)	Isoelectric point
x	45%	38	3.7
y	80%	22	4.8
z	65%	4	5.3
w	20%	75	6.8
v	30%	55	9.5
β -Gal	45%	115	5.3

You begin your purification by performing ammonium sulfate (AS) precipitation. You add appropriate concentration of AS to your CE sample, incubate at 0°C , 30 min and centrifuge to generate a supernatant (AS-S) and pellet (AS-P).

31. The most optimal concentration of AS to precipitate β -Gal is
(A) 20%
(B) 30%
(C) 45%
(D) 65%
(E) 80%

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32. After addition of that concentration of AS and centrifugation, which protein will be in the supernatant?
- (A) x
 - (B) y
 - (C) z
 - (D) w
 - (E) v
33. Which proteins will be in the pellet (AS-P)?
- (A) x
 - (B) y
 - (C) z
 - (D) w
 - (E) v
34. One way to purify β -Gal away from any contaminating proteins in the AS-P sample would be to separate the proteins by
- (A) Sephadex G-100 column
 - (B) Sephadex G-10 column
 - (C) Sephadex G-50 column
 - (D) Sephadex G150 column
 - (E) Sephadex G-20 column.
35. You want to further purify β -Gal by anion exchange column chromatography away from other proteins in your AS-P sample. The column was equilibrated with a pH 5.0 buffer. After loading the AS-P sample, the column was eluted with 0.1-1.0 M NaCl linear gradient. The protein that does not bind to the column would be
- (A) x
 - (B) y
 - (C) z
 - (D) w
 - (E) v
36. You analyze CE sample (in sample buffer with β -mercaptoethanol) containing six proteins by SDS-PAGE. After staining with Coomassie blue, which protein will migrate closest to the dye front of the SDS-gel?
- (A) x
 - (B) y
 - (C) z
 - (D) v
 - (E) β -Gal
37. Which of the following statement is/are true?
- (A) Product of pancreatic lipase is glycerol
 - (B) Substrate of glycogen synthase is UDP-Galactose
 - (C) Substrate of glycogen synthase is UDP-Glucose
 - (D) Product of glycogen phosphorylase is Glucose 6-phosphate
 - (E) Product of fermentation in muscle cell is pyruvate

38. Many transcription factors shuttle into and out of the nucleus. One such factor is Smad3. In unstimulated fibroblast cells Smad3 is exclusively present in the cytosol. After TGF- β stimulation, Smad3 is phosphorylated and moves into the nucleus. Upon TGF- β withdrawal, Smad3 is de-phosphorylated and moves immediately (i.e., within 5 min) from the nucleus back into the cytosol. You treat your fibroblast cell with TGF- β for 15 min and observe about half of Smad3 is phosphorylated while half is not phosphorylated. You prepare the whole cell extracts with a non-ionic detergent and perform immunoprecipitation with exportin antibody. You then detect the exportin-bound Smad3. Which of the following form(s) of Smad3 is/are bound to exportin?
- (A) phosphorylated
 - (B) unphosphorylated
 - (C) ~50% phosphorylated and ~50% unphosphorylated
 - (D) ~90% phosphorylated and ~10% unphosphorylated
 - (E) ~90% unphosphorylated and ~10% phosphorylated.
39. The nuclear pores regulate traffic between the nucleoplasm and the cytoplasm and separate reactions that occur exclusively in one or the other. Which of the following molecules pass through the nuclear pore?
- (A) RNA polymerase II
 - (B) mRNAs
 - (C) rRNAs
 - (D) ribosomes
 - (E) proteosomes.
40. Which of the following happens only in the Golgi?
- (A) synthesis of membrane lipid
 - (B) sorting of proteins
 - (C) O-linked glycosylation
 - (D) N-linked glycosylation
 - (E) the creation of lysosomes.

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