

## 2016 年第 33 屆全國華文獨中數理學識比賽 - 生物

1. 放射性同位素(radioactive isotopes)可以用在新陳代謝路徑研究之原因是  
Radioactive isotopes can be used in studies of metabolic pathways because
  - (a) 它們的半衰期允許研究者可計算實驗時間  
their half-life allows a researcher to time an experiment
  - (b) 它們更具反應性 (more reactive)  
they are more reactive
  - (c) 細胞不能辨別核心的額外質子 (protons)，因此同位素很容易在新陳代謝中使用  
The cell does not recognize the extra protons in the nucleus, so isotopes are readily used in metabolism
  - (d) 因放射性原因，它們的位置和數量能夠在實驗中被確定  
their location and quantity can be experimentally determined because of their radioactivity
  - (e) 它們的額外中子 (neutrons)產生不同顏色可以在全身體中被追蹤  
their extra neutrons produce different colors that can be traced through the body
2. 你將如何籌備 0.1M 的葡萄糖溶液( $C_6H_{12}O_6$ )？這些元素的質量是 C = 12，O = 16 及 H = 1  
How would you make a 0.1 M solution of glucose ( $C_6H_{12}O_6$ )? The mass numbers for these elements are C=12, O = 16 and H = 1.
  - (a) 混合 6 公克 C，12 公克 H 和 6 公克 O 在 1 公升水中  
Mix 6 g C, 12 g H, and 6 g O in 1 liter of water
  - (b) 混合 72 公克 C，12 公克 H 和 96 公克 O 在 1 公升水中  
Mix 72 g C, 12 g H, and 96 g O in 1 liter of water
  - (c) 用足夠的水混合 18 公克葡萄糖而成為 1 公升的溶液  
Mix 18 g of glucose with enough water to yield 1 liter of solution
  - (d) 用足夠的水混合 29 公克葡萄糖而成為 1 公升的溶液  
Mix 29 g of glucose with enough water to yield 1 liter of solution
  - (e) 用足夠的水混合 180 公克葡萄糖而成為 1 公升的溶液  
Mix 180 g of glucose with enough water to yield 1 liter of solution

3. 三種馬來西亞重要的出口作物是

The three important crops for export in Malaysia are:

- (a) 橡膠、可可和胡椒 Rubber, cocoa and pepper
- (b) 稻米、鳳梨和可可 Rice, pineapple and cocoa
- (c) 棕油、橡膠和可可 Palm oil, rubber and cocoa
- (d) 橡膠、椰子和胡椒 Rubber, coconut and pepper
- (e) 大豆、橡膠和玉米 Soybean, rubber and maize

4. 蛋白質酵素 (enzyme) 專一性的最直接原因為何？

What is the most directly responsible reason for the specificity of a protein enzyme?

- (a) 它的初級結構(primary structure)  
its primary structure
- (b) 它的二級(secondary structure) 及三級結構(tertiary structure)  
its secondary and tertiary structure
- (c) 變構部份(allosteric site) 的構象(conformation)  
the conformation of its allosteric site
- (d) 它的輔助因子(cofactors)  
its cofactors
- (e) 在活性位置(active site) 中氨基酸的 R- 根基  
the R groups of the amino acids in its active site

5. 在細胞質(cytosol) 內所使用的蛋白質通常在何處合成？  
Proteins to be used within the cytosol are generally synthesized
- (a) 與粗糙內質網 (rough ER) 連接的核糖體 (ribosomes)  
by ribosomes bound to rough ER
  - (b) 游離性核糖體 (free ribosomes)  
by free ribosomes
  - (c) 核仁 (nucleolus)  
by the nucleolus
  - (d) 高爾基體 (Golgi apparatus)  
within the Golgi apparatus
  - (e) 線粒體(mitochondria) 和葉綠體 (chloroplasts)  
by mitochondria and chloroplasts
6. 一隻淡水草履蟲(*Paramecium*) 被放入鹽水中，下列何種事件會發生？A freshwater *Paramecium* is placed into salt water. Which of the following event would occur?
- (a) 增加收縮液泡 (contractile vacuole) 的作用  
an increase in the action of its contractile vacuole
  - (b) 細胞開始膨脹直到它變成腫脹 (turgid)  
swelling of the cell until it becomes turgid
  - (c) 細胞開始膨脹直到它裂解 (lyses)  
swelling of the cell until it lyses
  - (d) 細胞萎縮 (shriveling)  
shriveling of the cell
  - (e) 鹽離子擴散 (diffusion) 出細胞外  
diffusion of salt ions out of the cell

7. 脂肪和蛋白質在細胞中可以作為燃料是因為它們

Fats and proteins can be used as fuel in the cell because they

- (a) 可以被酶 (enzymes) 轉換成葡萄糖  
can be converted to glucose by enzymes
- (b) 可以轉換成糖解反應 (glycolysis) 及克雷伯氏循環 (Kreb's cycle) 之中間代謝物  
can be converted to intermediates of glycolysis or the Kreb's cycle
- (c) 可以穿透線粒體膜進入克雷伯氏循環  
can pass through the mitochondrial membrane to enter the Kreb's cycle
- (d) 含有不穩定的磷酸鍵(phosphate bonds)  
contain unstable phosphate bonds
- (e) 含有比葡萄糖更多的能量  
contain more energy than glucose

8. 葉綠體能在黑暗中製造碳水化合物，如果提供

Chloroplasts can make carbohydrate in the dark if provided with

- (a) ATP, NADPH 和  $\text{CO}_2$   
ATP, NADPH and  $\text{CO}_2$
- (b) 一個由人工所誘導的質子梯度 (proton gradient)  
an artificially induced proton gradient
- (c) 有機酸或四碳化合物 (four-carbon compounds)  
organic acids or four-carbon compounds
- (d) 氫氣源 (source of hydrogen)  
a source of hydrogen
- (e) 光子(photons) 和二氧化碳  
photons and  $\text{CO}_2$

9. 認識細胞週期(cell cycle) 控制系統之智識對那種領域有最大益處  
Knowledge of the cell cycle control system will be most beneficial to the area of
- (a) 人類生殖系統 human reproduction
  - (b) 植物遺傳學 plant genetics
  - (c) 原核細胞 (prokaryotic) 之生長和發育 prokaryotic growth and development
  - (d) 癌症的預防和治療 cancer prevention and treatment
  - (e) 心血管疾病的預防和治療 prevention and treatment of cardiovascular disease
10. 減數分裂 II (meiosis II) 與有絲分裂 (mitosis) 有相似乃是因為  
Meiosis II is similar to mitosis because
- (a) 姊妹染色體 (sister chromosomes) 的分開  
sister chromatids separate
  - (b) 同源染色體 (homologous chromosomes) 的分開  
homologous chromosomes separate
  - (c) DNA 的複製在細胞分裂之前  
DNA replication precedes the division
  - (d) 它們都在相同的時間內作用  
they both take the same amount of time
  - (e) 都產生單倍體細胞 (haploid cells)  
haploid cells are produced
11. 一位色盲 (color-blind) 的兒子從何處繼承他的特徵  
A color-blind son inherited this trait from his
- (a) 母親 mother
  - (b) 父親 father
  - (c) 母親，如果她是色盲 mother only if she is color-blind
  - (d) 父親，如果他是色盲 father only if he is color-blind
  - (e) 母親，如果她不是色盲 mother only if she is not color-blind

12. 細菌轉型 (bacterial transformation) 是參與

Bacterial transformation involves

- (a) 外部遺傳物質的吸收，通常是一種菌株 (strain) 轉到另一個細菌  
the uptake of external genetic material, often from one bacteria strain to another
- (b) 從一條 DNA 分子製造一條 RNA 鏈  
the creation of a strand of RNA from a DNA molecule
- (c) 由噬菌體 (phage) 所感染的細菌  
the infection of bacterial cells by phage
- (d) 經過 DNA 表現之半保留複製 (semiconservative replication) 類型  
the type of semiconservative replication shown by DNA
- (e) 沿滯留鏈 (lagging strand) 所複製之 DNA  
the replication of DNA along the lagging strand

13. 含有 600 個核苷酸 (nucleotides) 長之原核基因可以編碼 (code for) 約多少個氨基酸的多肽鏈

How many polypeptide chains of amino acids can be coded with a prokaryotic gene 600 nucleotides long?

- (a) 100
- (b) 200
- (c) 300
- (d) 600
- (e) 1800

14. 請指出下述一句話，對椰子油的描述是不正確的。

Please identify the statement which does not correctly describe coconut oil:

- (a) 椰子油是一種飽和油 Coconut oil is saturated
- (b) 他的食用是對身體無害的 It is healthy to consume
- (c) 它比棕油還好 It is better than palm oil
- (d) 這是一種新的工業植物油  
The crop is considered as the sunrise industry of vegetable oil
- (e) 這是一種對慢性疾病有益處的植物油 It is good for chronic diseases

15. 特有物種 (endemic species) 的最適當描述就是該物種  
The best description of endemic species are species that are
- (a) 只有在島嶼(islands) 上發現 found only on islands
  - (b) 可在同一地理區域內發現 found in the same geographic area
  - (c) 只有在大陸 (mainland) 地區發現 found only on mainland
  - (d) 僅在某位置上發現，在地球其它地方沒有發現  
found only in that location and nowhere else on earth
  - (e) 可引起疾病和農藥的抗藥性 disease causing and pesticide resistant
16. 達爾文適應度 (Darwinian fitness) 是作為測量物種的  
Darwinian fitness is a measure of
- (a) 生存力 survival
  - (b) 交配的次數 number of matings
  - (c) 對環境的適應力(adaptation) adaptation to the environment
  - (d) 對資源的競爭成功力 successful competition for resources
  - (e) 可見後代 (viable offspring) 的數量 number of viable offspring
17. 真菌 (fungus) 既是一種寄生蟲 (parasite) 也是腐生菌 (saprobe) 是指  
A fungus that is both a parasite and a saprobe is one that
- (a) 僅消化它的宿主 (host) 體內的非生命部分 (nonliving portions)  
digests only the nonliving portions of its host's body
  - (b) 依靠其宿主體內汁液而存活 lives off the sap within its host's body
  - (c) 開始時以寄生蟲方式生存，但當宿主死亡後會消耗宿主 (consuming the host)  
first lives as a parasite but then consumes the host after it dies
  - (d) 以互惠共生方式 (mutualistic symbiont) 在宿主內生存  
lives as a mutualistic symbiont on its host
  - (e) 引起腳癬 (athlete's foot)和陰道感染  
Causes athlete's foot and vaginal infections

18. 下列那一項在消化系統中是沒有消化循環腔 (gastrovascular cavity)

Which of the following does not have a gastrovascular cavity for digestion?

- (a) 扁蟲 flatworm
- (b) 水螅 hydra
- (c) 多毛類蠕蟲 polychaete worm
- (d) 海葵 sea anemone
- (e) 吸蟲 fluke

19. 植物基本分生組織 (ground meristem) 是 Ground meristem

- (a) 生產根系統 (root system) produces the root system
- (b) 產生基本組織系統 (ground tissue system) produces the ground tissue system
- (c) 產生二次生長 (secondary growth) produces secondary growth
- (d) 是在單子葉節點 (nodes of monocot) 所發現的分生組織  
is meristematic tissue found at the nodes in monocot
- (e) 從表皮層 (protoderm) 發展 develops from protoderm

20. 下列那一種不會刺激葉片氣孔(stomata) 的打開

Which of these does *not* stimulate the opening of stomata of leaf?

- (a) 從葉肉組織 (mesophyll cells) 釋放的脫落酸 (abscisic acid)  
release of abscisic acid by mesophyll cells
- (b) 在葉片空氣中的二氧化碳已消耗  
Depletion of CO<sub>2</sub> inside the leaf
- (c) 由 K<sup>+</sup>的移動進入保衛細胞 (guard cells) 所引起質子泵 (proton pump) 的刺激  
stimulation of proton pumps that results in the movement of K<sup>+</sup> into the guard cells
- (d) 開啟保衛細胞的晝夜節律 (circadian rhythm)  
the circadian rhythm in guard cell opening
- (e) 增加保衛細胞的膨脹 (turgor) an increase in the turgor of guard cells



21. 提供組成大部分植物有機物質的無機化合物(inorganic compound) 是  
The inorganic compound that contributes most of the mass to a plant's organic matter is
- (a) H<sub>2</sub>O
  - (b) CO<sub>2</sub>
  - (c) NO<sub>3</sub><sup>-</sup>
  - (d) O<sub>2</sub>
  - (e) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>
22. 在種子內的生長抑制劑 (growth inhibitor) 通常是  
The growth inhibitor in seeds is usually
- (a) 脫落酸 (abscisic acid) abscisic acid
  - (b) 乙烯 (ethylene) ethylene
  - (c) 吉貝素 (gibberellin) gibberellin
  - (d) 少量的 ABA 與較大量濃度的吉貝素混合  
a small amount of ABA combined with larger concentration of gibberellin
  - (e) 高比例的分裂素和生長素 (cytokinin-to-auxin)  
a high cytokinin-to-auxin ratio
23. 以下那一項是平滑肌 (smooth muscle) 的最佳描述  
Which of the following is the best description of smooth muscle?
- (a) 橫紋 (striated), 分支細胞 (branching cells) ; 不隨意控制 (involuntary control)  
striated, branching cells ; involuntary control
  - (b) 梭型細胞 (spindle-shaped cells) ; 不隨意控制  
spindle-shaped cells ; involuntary control
  - (c) 通過閥盤 (intercalated discs) 與梭型細胞連接  
spindle-shaped cells connected by intercalated discs
  - (d) 含有重疊細絲 (overlapping filaments) 的橫紋肌細胞 (striated cells) ; 不隨意控制  
striated cells containing overlapping filaments ; involuntary control
  - (e) 梭型橫紋肌細胞 (spindle-shaped striated cells) ; 隨意控制 (voluntary control)  
spindle-shaped striated cells ; voluntary control

24. 以下那一項是與其功能是不相配的

Which of the following is mismatched with its function?

- (a) 大部分 B 族維生素----輔酶 (coenzyme)    most B vitamins -- coenzymes
- (b) 維生素 E-----抗氧化 (antioxidant)    vitamin E -- antioxidant
- (c) 維生素 K-----凝血 (blood clotting)    vitamin K -- blood clotting
- (d) 鐵-----甲狀腺激素的成分    iron -- component of thyroid hormones
- (e) 磷-----骨頭型成, 核苷酸合成    phosphorus -- bone formation, nucleotide synthesis

25. 當護士告訴你, 你的血壓是 112 / 70, 其中的 70 是代表

The nurse tells you that your blood pressure is 112/70. What does the 70 refer to?

- (a) 你的心跳速率    your heart rate
- (b) 舒張期 (diastole) 的血液流速    the velocity of blood during diastole
- (c) 在心室收縮時的收縮壓 (systolic pressure)  
the systolic pressure from ventricular contraction
- (d) 從動脈的反沖作用 (recoil) 所產生的舒張壓 (diastolic pressure)  
the diastolic pressure from the recoil of the arteries
- (e) 由血壓箍 (blood pressure cuff) 的壓縮所引起的靜脈壓 (venous pressure)  
the venous pressure caused by the compression of the blood pressure cuff