



香港資優教育學苑
The Hong Kong Academy for Gifted Education

International Junior Science Olympiad 2019 - Hong Kong Screening

Question Book

Contestant No. : _____

Rules and Regulations:

1. The contest is a 1 hour written test.
2. The paper consists of 45 multiple-choice questions.
3. Questions are in bilingual version.
4. Only calculators approved by The Hong Kong Examinations and Assessment Authority with “HKEAA APPROVED” logo may be used for the contest. Measuring instruments like rulers, compasses, etc. can also be used. No stationeries will be provided.

2019 國際初中科學奧林匹克 – 香港選拔賽

問題簿

參賽編號 : _____

學生守則：

1. 比賽以筆試形式進行，限時一小時。
2. 本試卷共有 45 題多項選擇題。
3. 題目中英對照。
4. 比賽時，學生可使用香港考試及評核局認可型號，印有“HKEAA APPROVED”的計算器。直尺、圓規及其它量度工具亦可輔助之用。大會不提供任何文具。

PERIODIC TABLE 周期表

GROUP 族

		atomic number 原子序										relative atomic mass 相對原子質量	

List of formulae and relationships which may be useful

可能有用的公式和關係式

The difference in energy due to temperature change

溫度改變所做成的能量差別

$$\Delta E = mC(\Delta T)$$

The difference in energy due to state change

物態改變所做成的能量差別

$$\Delta E = \ell(\Delta m)$$

Linear motion with constant acceleration

直線均加速運動

$$v = u + at, s = ut + \frac{1}{2}at^2, v^2 = u^2 + 2as.$$

$$\text{Kinetic energy 動能} = \frac{1}{2}mv^2$$

$$\text{Potential energy 潛能} = mgh$$

$$\text{Force 力} : F = ma$$

Electrical resistance 電阻

$$R = V/I$$

$$R = R_1 + R_2 \quad \text{in series 串聯}$$

$$1/R = 1/R_1 + 1/R_2 \quad \text{in parallel 並聯}$$

$$\text{Electrical power 電功率} : P = IV = V^2/R = I^2R$$

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Multiple Choice Questions (45 marks)

Please put your answers on the MC Answer Sheet. Each question carries 1 mark. Choose the BEST answers. No marks will be deducted for incorrect answers.

1. John has a red hat and two yellow hats. He also has a green shirt, a blue shirt and a yellow shirt. How many different combinations of colour can John wear a hat and a shirt together?
 - A. 3
 - B. 4
 - C. 5
 - D. 6

2. Four coins are tossed simultaneously. Which of the following outcomes has the highest probability?
 - A. getting no head
 - B. getting exactly one tail
 - C. getting 2 heads and 2 tails
 - D. All the above 3 outcomes have the same probability

3. What type of lens is used to correct short-sightedness?
 - A. Concave lens
 - B. Convex lens
 - C. Plane lens
 - D. All of the above

4. If you are standing 1 metre in front of a plane mirror and looking into it, the image you see will be ____ metre(s) away from the mirror on the other side.
 - A. 4
 - B. 2
 - C. 1
 - D. 0.5

多項選擇題 (45 分)

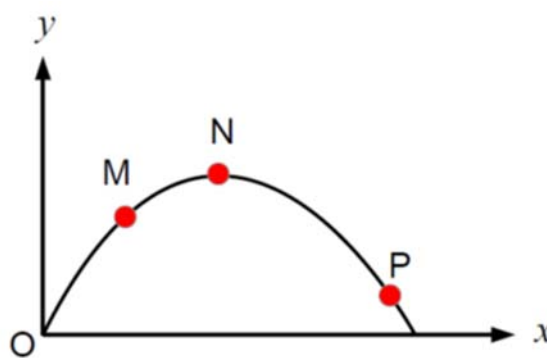
請把答案填劃在多項選擇題答題紙上適當的位置。每條題目佔 1 分。請選擇最適當的答案。錯誤答案不會被扣分。

1. 約翰有一頂紅帽子和兩頂黃帽子，他同時有一件綠襯衫、一件藍襯衫和一件黃襯衫。那麼約翰的帽子、襯衫共有多少不同顏色的配搭？
 - A. 3
 - B. 4
 - C. 5
 - D. 6
2. 同時擲出四枚硬幣，以下哪個結果出現的機率最高？
 - A. 沒有出現正面
 - B. 只出現一個反面
 - C. 出現兩個正面和兩個反面
 - D. 以上 3 種結果出現的機率均等
3. 以下哪種透鏡可用以矯正近視？
 - A. 凹透鏡
 - B. 凸透鏡
 - C. 平面鏡
 - D. 以上均可
4. 若你站在一平面鏡前 1 米，你將看到鏡中的影像位於鏡後 ____ 米。
 - A. 4
 - B. 2
 - C. 1
 - D. 0.5

5. A puppy walks due North for 10 metres, then due East for 20 metres and then due South for 15 metres. What is the distance between the puppy's end position and the starting point?

A. 19.4 m
B. 20.6 m
C. 22.4 m
D. 45 m

6. A ball is kicked from ground level at the coordinate origin O . The figure shows the path of the ball. Rank the points M , N , and P on the path according to the magnitude of acceleration of the ball at these points. You can ignore the effect of air resistance.



A. $M = N = P$
B. $M > P > N$
C. $P > M > N$
D. $N > M > P$

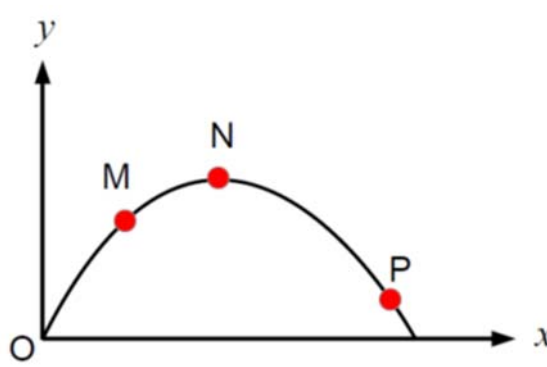
7. A box moves along a rough horizontal surface with a certain initial speed. How do the speed and the magnitude of acceleration of the box change during the motion? You can ignore the effect of air resistance.

A. Both the speed and the magnitude of acceleration of the box are decreasing.
B. Both the speed and the magnitude of acceleration of the box remain unchanged.
C. The speed is decreasing, while the magnitude of acceleration is increasing.
D. The speed is decreasing, while the magnitude of acceleration is unchanged.

5. 一小狗向北走了 10 米，然後向東走了 20 米，再向南走了 15 米。問小狗的最終位置跟起點距離多遠？

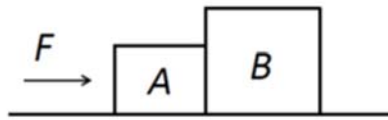
A. 19.4 米
B. 20.6 米
C. 22.4 米
D. 45 米

6. 一個皮球從地面的座標原點 O 被踢出。下圖顯示皮球的軌跡。請將皮球軌跡上的 M 、 N 和 P 點依據皮球在這些點上的加速度的量值排列。你可以忽略空氣阻力的影響。

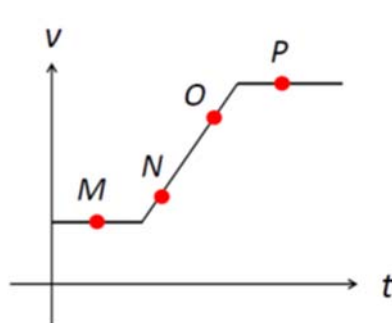


- A. $M = N = P$
B. $M > P > N$
C. $P > M > N$
D. $N > M > P$
7. 一個盒子以某一初始速率在一塊粗糙的水平面上運行。在運動過程中，盒子的速率和加速度的量值有何改變？你可以忽略空氣阻力的影響。
- A. 速率和加速度的量值一起減少。
B. 速率和加速度的量值保持不變。
C. 速率減少，但加速度的量值增加。
D. 速率減少，但加速度的量值不變。

8. A coin is thrown vertically upward from the ground. When the coin reaches the highest point,
- A. the net force acting on the coin is zero.
 - B. the net force acting on the coin is maximum.
 - C. the net force acting on the coin is minimum.
 - D. the net force acting on the coin is equal to its weight.
9. Two boxes *A* and *B* are put side by side on a horizontal surface. If a horizontal force *F* is applied to *A*,



- A. box *A* exerts more force on box *B* than *B* exerts on *A*.
 - B. box *A* exerts less force on box *B* than *B* exerts on *A*.
 - C. box *A* exerts as much force on box *B* as *B* exerts on *A*.
 - D. Answer depends on the magnitude of the force *F*.
10. The figure shows the speed *v* of a particle as a function of time *t*. Which of the following statements concerning points *M*, *N*, *O*, and *P* is correct?

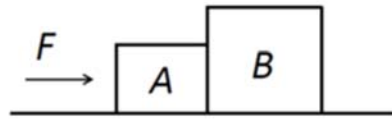


- A. The acceleration of the particle at *M* is the largest.
- B. The acceleration of the particle at *P* is the largest.
- C. The acceleration of the particle at *O* is larger than that at *N*.
- D. The accelerations of the particle at *M* and *P* are equal.

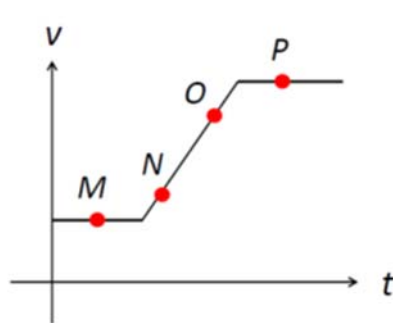
8. 一枚硬幣從地面垂直地被拋起。當硬幣到達最高點時，

- A. 作用在硬幣上的淨力是零。
- B. 作用在硬幣上的淨力是最大。
- C. 作用在硬幣上的淨力是最小。
- D. 作用在硬幣上的淨力相等於它的重量。

9. 兩個盒子 **A** 和 **B** 緊貼地放在一水平面上。如果一水平方向力 **F** 作用在 **A** 上，

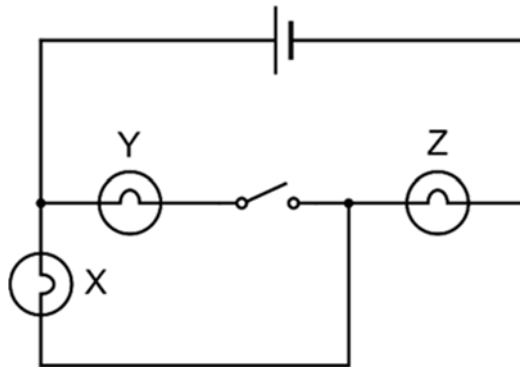


- A. 盒子 **A** 作用在盒子 **B** 的力大於 **B** 作用在 **A** 的力。
 - B. 盒子 **A** 作用在盒子 **B** 的力小於 **B** 作用在 **A** 的力。
 - C. 盒子 **A** 作用在盒子 **B** 的力跟 **B** 作用在 **A** 的力同樣大小。
 - D. 答案取決於作用力 **F** 的大小。
10. 下圖顯示一顆粒子在不同時間的速率。以下哪項關於 **M**，**N**，**O** 和 **P** 點的描述是正確的？



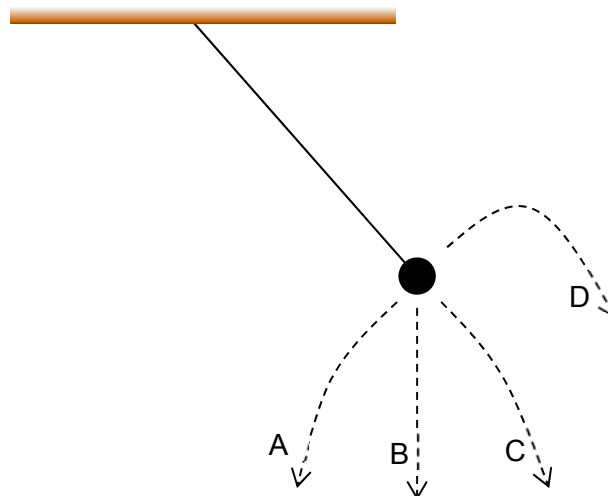
- A. 粒子在 **M** 點的加速度是最大。
- B. 粒子在 **P** 點的加速度是最大。
- C. 粒子在 **O** 點的加速度大於 **N** 點的加速度。
- D. 粒子在 **M** 點和 **P** 點的加速度是相等。

11. There are one battery, three identical light bulbs, and a switch in the following circuit.

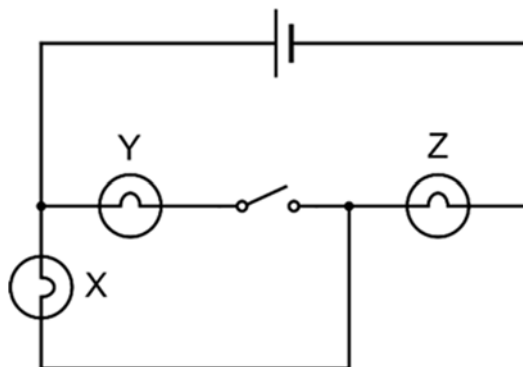


Which of the following statements is/are correct?

- (I) When the switch is closed, X and Y have the same brightness.
 - (II) When the switch is closed, Y is dimmer than Z.
 - (III) When the switch is open, X is dimmer than Z.
- A. (I) only
B. (III) only
C. (I) and (II) only
D. (II) and (III) only
12. A small metal ball is hanged from the ceiling by a string. The ball is set to swing back and forth. At the moment when the ball reaches the highest point on the right, the string breaks. Which line best represents the subsequent trajectory of the ball?



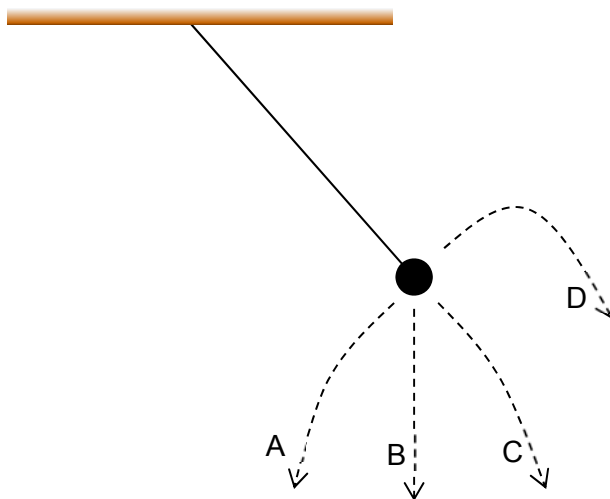
11. 以下的電路包括一電池、三個相同的燈泡，和一個開關。



以下哪些句子是正確的？

- (I) 當開關是關著的，X 和 Y 的亮度相同。
- (II) 當開關是關著的，Y 比 Z 暗。
- (III) 當開關是開著的，X 比 Z 暗。

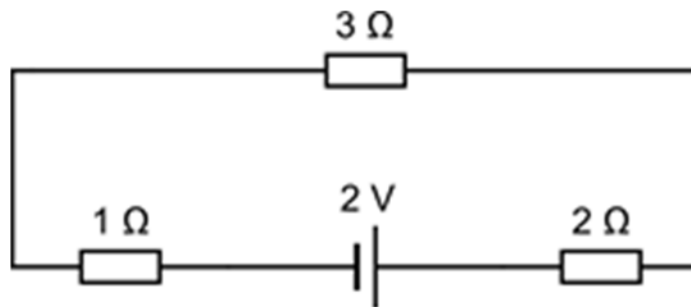
- A. 只有 (I) 是正確的
 - B. 只有 (III) 是正確的
 - C. 只有 (I) 和 (II) 是正確的
 - D. 只有 (II) 和 (III) 是正確的
12. 一個小金屬球以一條細繩從天花懸掛下來。小球來回擺動。在小球到達圖右面最高點那一刻，細繩斷了。哪一條線最能表達小球隨後的活動軌跡？



13. An apple falls from a tree and falls freely under the gravity. During the fall,

- A. its kinetic energy increases and total mechanical energy increases.
- B. its kinetic energy increases and potential energy decreases.
- C. its kinetic energy decreases and total mechanical energy decreases.
- D. its kinetic energy decreases and potential energy increases.

14. In the following figure, what is the potential difference across the $3\ \Omega$ resistor?



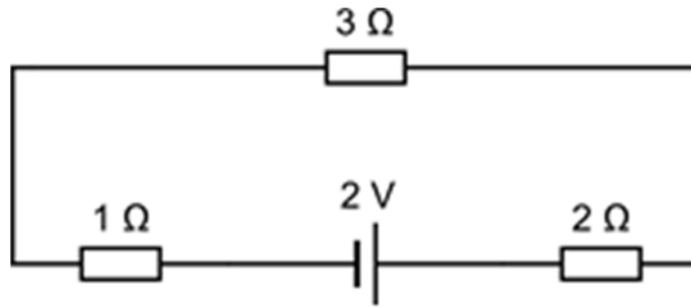
- A. 2 V
- B. 1 V
- C. $1/2$ V
- D. $1/3$ V

15. A stone is thrown upward with an initial speed v , and it reaches a height h above the initial point. The same stone is thrown upward with a different initial speed, and it reaches a height $2h$. What is the new initial speed? Assume that the air resistance is negligible.

- A. $\sqrt{2} v$
- B. $2 v$
- C. $2\sqrt{2} v$
- D. $4 v$

13. 一個從樹上跌下的蘋果，受引力影響自由下落。蘋果下落時，
- A. 它的動能增加，總機械能也增加。
 - B. 它的動能增加，而位能減少。
 - C. 它的動能減少，總機械能也減少。
 - D. 它的動能減少，而位能增加。

14. 在下圖，在 $3\ \Omega$ 電阻兩端間的電位差是多少？



- A. 2 V
 - B. 1 V
 - C. $1/2\text{ V}$
 - D. $1/3\text{ V}$
15. 一塊石頭以初速率 v 垂直上拋，到達起點上的高度 h 。同一塊石頭以一個不同的初速率垂直上拋，到達起點上的高度 $2h$ 。新的初速率是多少？假設空氣阻力可忽略不計。
- A. $\sqrt{2}v$
 - B. $2v$
 - C. $2\sqrt{2}v$
 - D. $4v$

16. Which one of the following chemical species does **NOT** contain 8 outermost shell electrons?

- A. Te^{2-}
- B. Ba^{2+}
- C. He
- D. Na^+

17. Which one of the following pairs of symbols correctly represent the isotopes of an element?

- A. ${}_{11}^{23}\text{Na}$ and ${}_{12}^{23}\text{Na}$
- B. ${}_3^7\text{Li}$ and ${}_3^6\text{Li}$
- C. ${}_{29}^{63}\text{Cu}$ and ${}_{64}^{29}\text{Cu}$
- D. ${}_{24}^{12}\text{Mg}$ and ${}_{26}^{12}\text{Mg}$

18. Which of the following gases can relight a glowing splint?

- A. Oxygen
- B. Hydrogen
- C. Fluorine
- D. Chlorine

19. Under the same unit volume, which one of the following liquids is the heaviest?

- A. Mercury
- B. Bromine
- C. Liquid nitrogen
- D. Liquid iodine

16. 在以下哪化學物種的最外層並不具有 8 粒電子？

- A. Te^{2-}
- B. Ba^{2+}
- C. He
- D. Na^+

17. 以下哪一對正確地代表了其中一種元素的同位素？

- A. $^{23}_{11}\text{Na}$ 和 $^{23}_{12}\text{Na}$
- B. ^7_3Li 和 ^6_3Li
- C. $^{63}_{29}\text{Cu}$ 和 $^{29}_{64}\text{Cu}$
- D. $^{12}_{24}\text{Mg}$ 和 $^{12}_{26}\text{Mg}$

18. 以下哪氣體可令餘燼復燃？

- A. 氧
- B. 氫
- C. 氟
- D. 氯

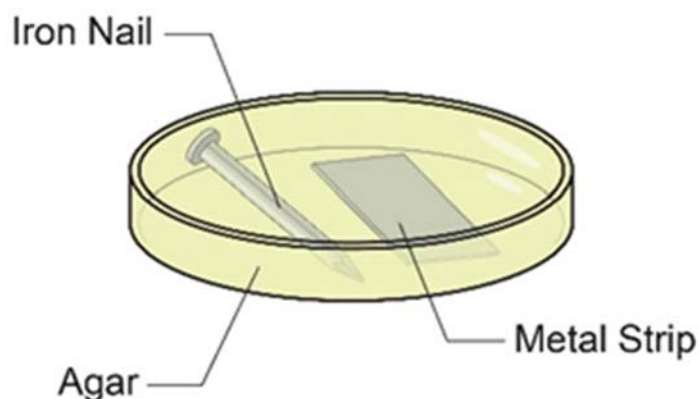
19. 在同一單位體積的情況下，以下哪一液體最重？

- A. 汞
- B. 溴
- C. 液態氮
- D. 液態碘

20. In an experiment, 32 g of element X reacts with 48 g of element Y to produce 80 g of compound Z. If 16 g of element X and 100 g of element Y are placed into a closed container and allowed to react under the same reaction condition, what is the amount of element Y leftover after the reaction?
- A. 0 g
 - B. 24 g
 - C. 52 g
 - D. 76 g
21. What is the percentage by mass of oxygen in aluminum oxide?
(Relative atomic masses: O=16.0, Al=27.0)
- A. 32%
 - B. 47%
 - C. 64%
 - D. 73%
22. Which of the following is the appropriate method to separate petrol from crude oil?
- A. Simple distillation
 - B. Fractional distillation
 - C. Partial distillation
 - D. Complex distillation
23. What is the pH value of normal rain water?
- A. pH 3
 - B. pH 4.2
 - C. pH 5.5
 - D. pH 7.0

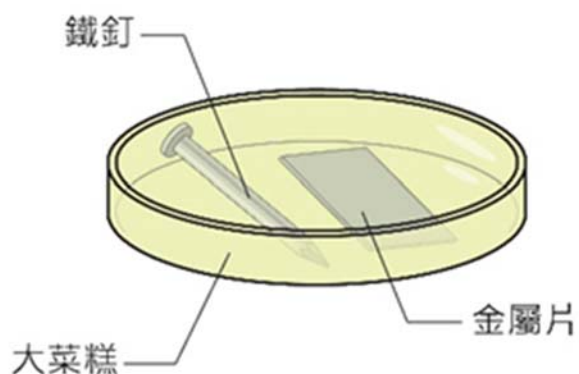
20. 在一實驗中，32 g 元素 X 與 48 g 元素 Y 反應生成 80 g 化合物 Z。若把 16 g 元素 X 與 100 g 元素 Y 置於一個密閉容器內，讓它們在相同實驗條件下發生反應。反應完畢後，元素 Y 餘下的量是多少？
- A. 0 g
 - B. 24 g
 - C. 52 g
 - D. 76 g
21. 在氧化鋁中，氧所佔的質量百分率是多少？
(相對原子質量: O=16.0, Al=27.0)
- A. 32%
 - B. 47%
 - C. 64%
 - D. 73%
22. 以下何者是把汽油從原油分離出來的合適方法？
- A. 簡單蒸餾
 - B. 分餾
 - C. 部分蒸餾
 - D. 複合蒸餾
23. 正常雨水的 pH 值是多少？
- A. pH 3
 - B. pH 4.2
 - C. pH 5.5
 - D. pH 7.0

24. The following experiment aims at studying the effect of metal on the rate of rusting. An iron nail and a metal plate are embedded into the agar in the petri dish (See figure). Which one of the following metal plates can speed up the rusting of the iron nail fastest?



- A. Magnesium
 - B. Zinc
 - C. Iron
 - D. Copper
25. Referring to question 24, what is the role of agar?
- A. Electrolyte
 - B. Non-electrolyte
 - C. Heat insulator
 - D. Separator
26. Which of the following reactions does **NOT** involve oxidation-reduction?
- A. Burning sodium in chlorine
 - B. Combustion of wood
 - C. Thermal decomposition of solid KClO_3
 - D. Neutralisation of NaOH(aq) with $\text{H}_2\text{SO}_4\text{(aq)}$

24. 以下實驗的目的是研習金屬對生銹速率的影響。把一枚鐵釘和一塊金屬片嵌在培養皿的大菜糕內(見圖)。以下哪金屬片能令鐵釘的生銹加速得最快?



- A. 鎂
B. 鋅
C. 鐵
D. 銅
25. 參照第 24 題，大菜糕的作用是什麼?
- A. 電解質
B. 非電解質
C. 熱絕緣體
D. 隔離物
26. 以下哪反應並不涉及氧化還原?
- A. 鈉在氯中燃燒
B. 燃燒木頭
C. KClO_3 固體的熱分解
D. 用 $\text{H}_2\text{SO}_4(\text{aq})$ 中和 $\text{NaOH}(\text{aq})$

27. The following table shows the results of the reactions of four different metals with cold water, steam and hydrochloric acid.

Metal	Reaction with		
	Cold water	Hydrochloric acid	Steam
W	✓	✓	✓
X	×	×	×
Y	×	✓	✓
Z	×	✓	×

✓ : Reaction occurs

× : Reaction does not occur

The arrangement of the reactivity of the metals in ascending order is

- A. W, Z, Y, X
- B. X, Z, Y, W
- C. Z, X, Y, W
- D. W, Y, Z, X

28. Which of the following is **NOT** a correct match between metal ions in water and color?

- | | <u>Metal Ions</u> | <u>Color</u> |
|----|-------------------|--------------|
| A. | Na ⁺ | Colorless |
| B. | Cu ²⁺ | Blue |
| C. | Cr ³⁺ | Purple |
| D. | Fe ²⁺ | Green |

27. 下表顯示四種不同金屬與冷水、水蒸汽及氫氯酸的反應結果。

金屬	與冷水反應	與氫氯酸反應	與水蒸汽反應
W	✓	✓	✓
X	×	×	×
Y	×	✓	✓
Z	×	✓	×

✓：發生反應

×：不會發生反應

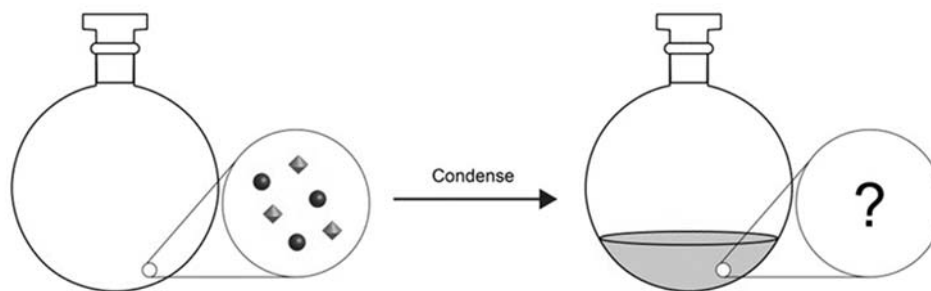
把這些金屬按反應性由小至大的排序是。

- A. W, Z, Y, X
- B. X, Z, Y, W
- C. Z, X, Y, W
- D. W, Y, Z, X



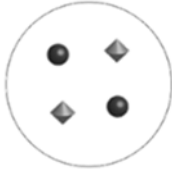

28. 就在水中金屬離子及其顏色，以下何者並不是正確配對？

- | | <u>金屬離子</u> | <u>顏色</u> |
|----|------------------|-----------|
| A. | Na ⁺ | 無色 |
| B. | Cu ²⁺ | 藍色 |
| C. | Cr ³⁺ | 紫色 |
| D. | Fe ²⁺ | 綠色 |

29. The following closed container contains two gases. When the container is cooled down to 5°C , one of the gases condenses.



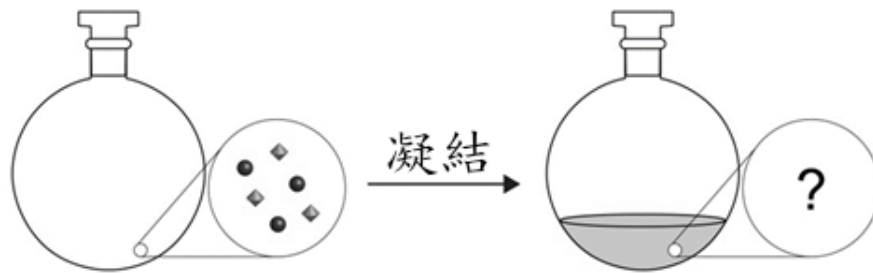
Which of the following diagrams best represents the same area of the magnified view of the liquid in the right figure with a circle?

- A. 
- B. 
- C. 
- D. 

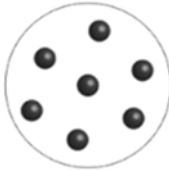

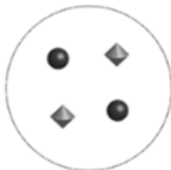

30. Which one of the following interactions explains the property of high melting point of plastic?

- A. Ionic bond
B. Covalent bond
C. Van der Waals' forces
D. Hydrogen bonding

29. 下面的密閉容器盛了兩種氣體。當把該容器冷卻至 5°C 時，其中一種氣體凝結。



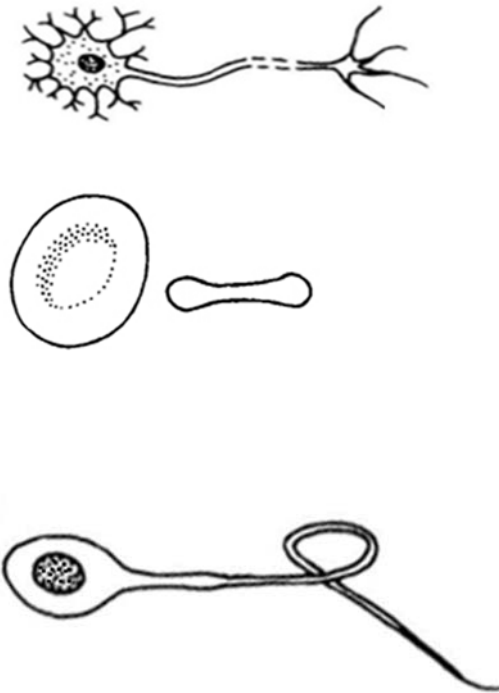
以下哪一幅圖是最代表在右圖的圓圈，該液體於相同範圍的放大圖？

- A. 
- B. 
- C. 
- D. 

30. 以下哪種作用力可以用來解釋塑膠具有高熔點的本性？

- A. 離子鍵
B. 共價鍵
C. 范德華力
D. 氫鍵

31.



Three types of human cells are shown above. Which of the following descriptions are correct about them?

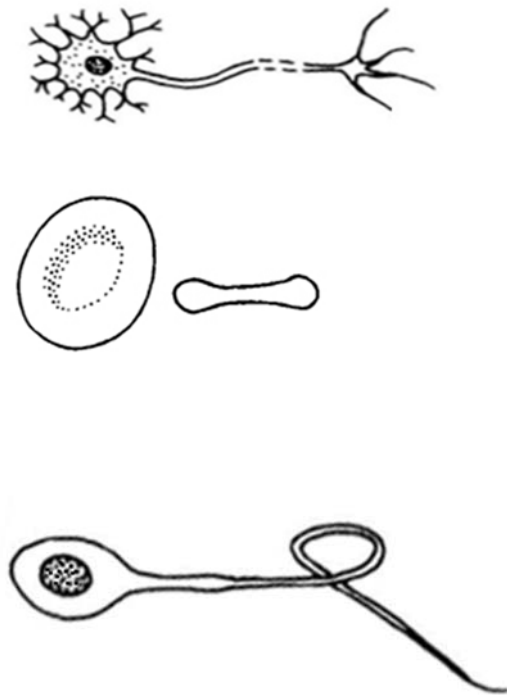
- (I) All of them are involved in delivery of materials.
- (II) None of them can undergo cell division.
- (III) All of them have cell membrane.
- (IV) All of them have nucleus.

- A. (I) and (III) only.
- B. (III) and (IV) only.
- C. (II) and (III) only.
- D. (II), (III) and (IV) only.

32. A researcher examines the epidermis of a root tip under the light microscope. To observe less cells within the field of view, he should

- A. use an objective lens with a lower magnification.
- B. use an objective lens with a higher magnification.
- C. reduce the distance between the slide and the objective lens.
- D. increase the distance between the slide and the objective lens.

31.



上圖顯示三類人類細胞。以下哪些關於這些細胞的描述是正確的？

- (I) 它們全都涉及運送物料。
- (II) 它們全都不能進行細胞分裂。
- (III) 它們全都具有細胞膜。
- (IV) 它們全都具有細胞核。

- A. 只有 (I) 和 (III)
- B. 只有 (III) 和 (IV)
- C. 只有 (II) 和 (III)
- D. 只有 (II), (III) 和 (IV)

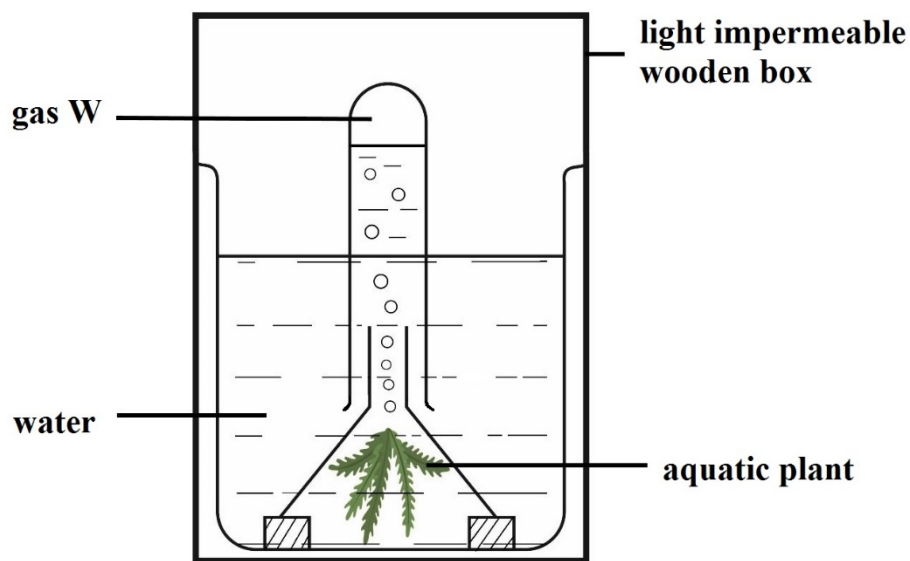
32. 一名研究員以顯微鏡檢視根尖的表皮，若要在視野中觀察到較少數目的細胞，他應該

- A. 使用較低放大率的接物鏡。
- B. 使用較高放大率的接物鏡。
- C. 縮小載玻片和接物鏡的距離。
- D. 增加載玻片和接物鏡的距離。

33. 100 grams of potato strips had been immersed in solution with high concentration of sucrose for one hour. Which of the following answers is the possible weight of potato strips after the immersion?

- A. 105 grams
- B. 100 grams
- C. 95 grams
- D. 10 grams

34. What is gas **W**?



- A. Water vapour
- B. Nitrogen
- C. Carbon dioxide
- D. Oxygen

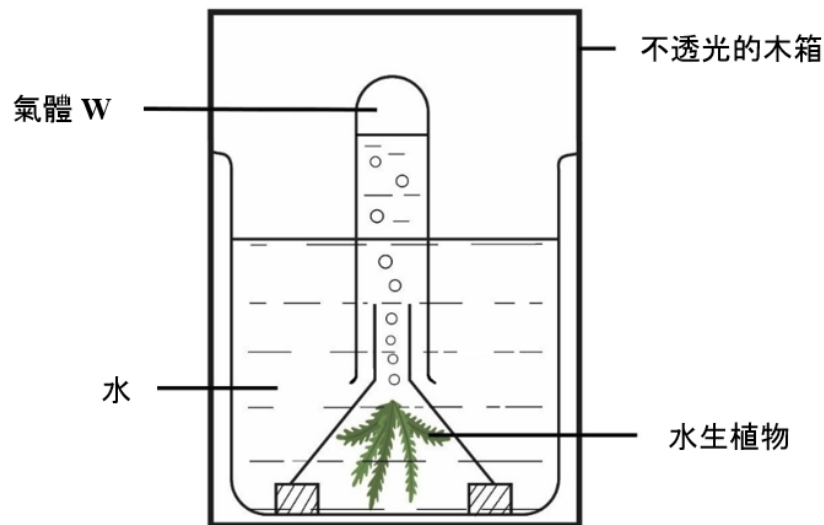
35. Potato plants can be reproduced sexually or asexually. Which of the following statements is correct for sexual reproduction of potato plants?

- A. The chance of dispersal of offspring is higher compared with those produced asexually.
- B. The offspring always preserve the good traits from their parents.
- C. Two parents are always involved.
- D. Chromosome number of the cells of offspring is half of that of parents.

33. 將 100 克馬鈴薯條浸於含高濃度蔗糖的溶液中，一小時之後，以下哪項是馬鈴薯條可能的重量？

- A. 105 克
- B. 100 克
- C. 95 克
- D. 10 克

34. 氣體 W 是什麼？



- A. 水蒸氣
 - B. 氮氣
 - C. 二氧化碳
 - D. 氧氣
35. 馬鈴薯植物可進行有性繁殖或無性繁殖。就馬鈴薯植物的有性繁殖而言，以下哪項是正確的？

- A. 與無性繁殖所得的子裔比較，有性繁殖的子裔有較高的散佈機會。
- B. 子裔經常保留得自親代的良好性狀。
- C. 總是涉及兩棵親代植株。
- D. 子裔的細胞所含染色體數目是親代的一半。

36. The dichotomous key below lists some features of vertebrates **L, M, N, O**:
- | | | |
|----|----------------------|---|
| 1a | with dry skin..... | 2 |
| 1b | with moist skin..... | 3 |
| 2a | with feather..... | L |
| 2b | without feather..... | M |
| 3a | with scales..... | N |
| 3b | without scales..... | O |

These four animals are most likely belonging to

- | | L | M | N | O |
|----|----------|------------|------------|------------|
| A. | birds | fish | reptiles | amphibians |
| B. | birds | reptiles | fish | amphibians |
| C. | fish | amphibians | birds | reptiles |
| D. | reptiles | birds | amphibians | fish |

37. A variant form of a gene is called allele. Peter has blue eyes as he has inherited two alleles for blue eyes from his parents. Given that both of his parents have brown eyes, which of the following statements is/are correct?

- (I) Each of his parents has passed one allele for blue eyes to Peter.
- (II) For his parents, the expression of the allele for blue eyes is masked by that for brown eyes.
- (III) All siblings of Peter have blue eyes.
- (IV) All children of Peter will have blue eyes.

- A. (I) only.
- B. (I) & (II) only.
- C. (III) & (IV) only.
- D. (I), (II) & (IV) only.

36. 以下的二分索引列出脊椎動物 L, M, N 和 O 的一些特徵:

1a	皮膚乾燥.....	2
1b	皮膚濕潤.....	3
2a	有羽毛.....	L
2b	沒有羽毛.....	M
3a	有鱗片.....	N
3b	沒有鱗片.....	O

這四類動物最可能是

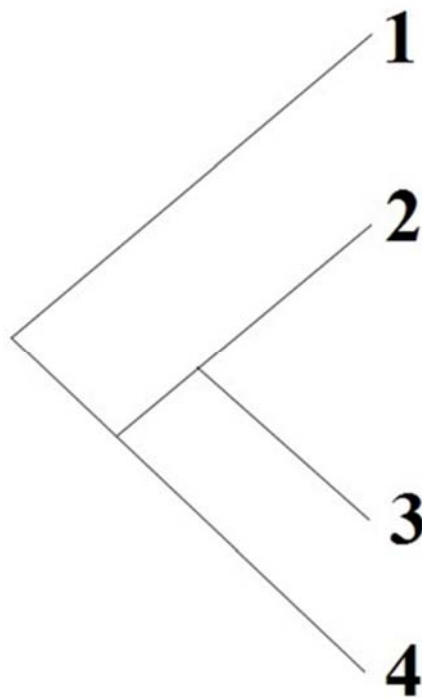
L	M	N	O
A. 鳥類	魚類	爬蟲類	兩棲類
B. 鳥類	爬蟲類	魚類	兩棲類
C. 魚類	兩棲類	鳥類	爬蟲類
D. 爬蟲類	鳥類	兩棲類	魚類

37. 一枚基因的變異體稱為等位基因。志德具有藍色眼睛，是因為其父母遺傳了兩枚控制藍色眼睛的等位基因給他。已知他的父母都具有棕色眼睛，以下哪項/些是正確的？

- (I) 志德的父母各自把一枚控制藍色眼睛的等位基因遺傳給他。
- (II) 對志德的父母而言，控制藍色眼睛的等位基因的效應被控制棕色眼睛的等位基因所遮蔽。
- (III) 志德的所有兄弟姊妹都具有藍色眼睛。
- (IV) 志德的所有子女都具有藍色眼睛。

- A. 只有 (I)
- B. 只有 (I) 和 (II)
- C. 只有 (III) 和 (IV)
- D. 只有 (I), (II) 和 (IV)

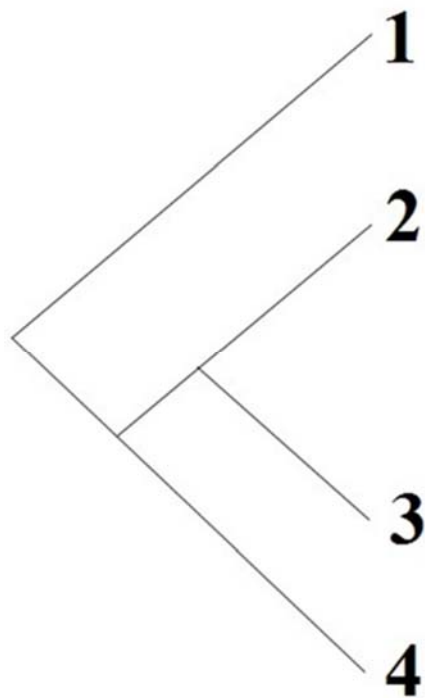
38. Species **1** to **4** are the living species of phylogenetic tree **T**. Which of the following statements is/are correct about **T**?



Phylogenetic tree T

- (I) Species **2**, not species **4**, shares a common ancestor with species **3**.
 - (II) Species **4** is the most advanced species among all living species in the phylogenetic tree **T**.
 - (III) There are three speciation events shown in the phylogenetic tree **T**.
- A. (I) only.
 - B. (III) only.
 - C. (I) & (II) only.
 - D. (I), (II) & (III) only.

38. 物種 **1** 至 **4** 是系統發生樹 **T** 的四種存活物種。就 **T** 而言，以下哪項/些是正確的？

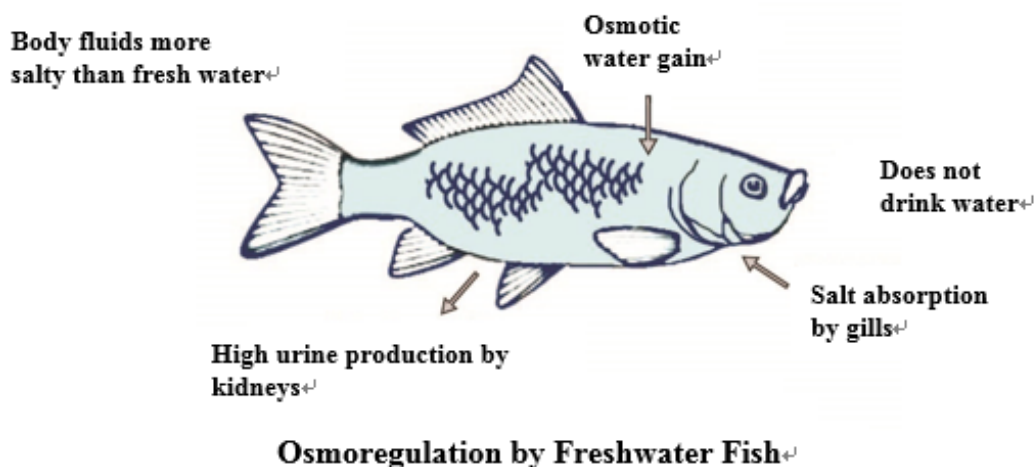
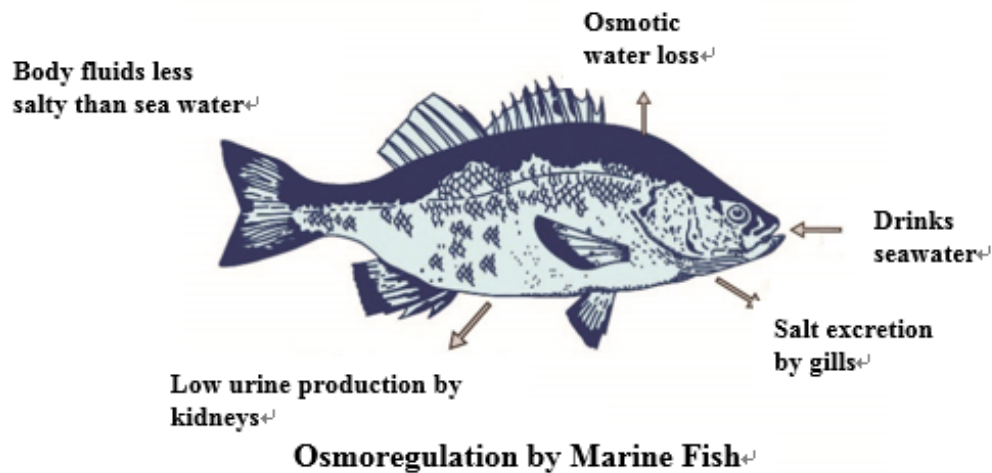


系統發生樹 **T**

- (I) 物種 **2** 與物種 **3** 有一個共同的祖先，物種 **2** 與物種 **4** 則否。
- (II) 在系統發生樹 **T** 的所有存活物種中，物種 **4** 是最高等的物種。
- (III) 系統發生樹 **T** 顯示了三次物種形成的事件。

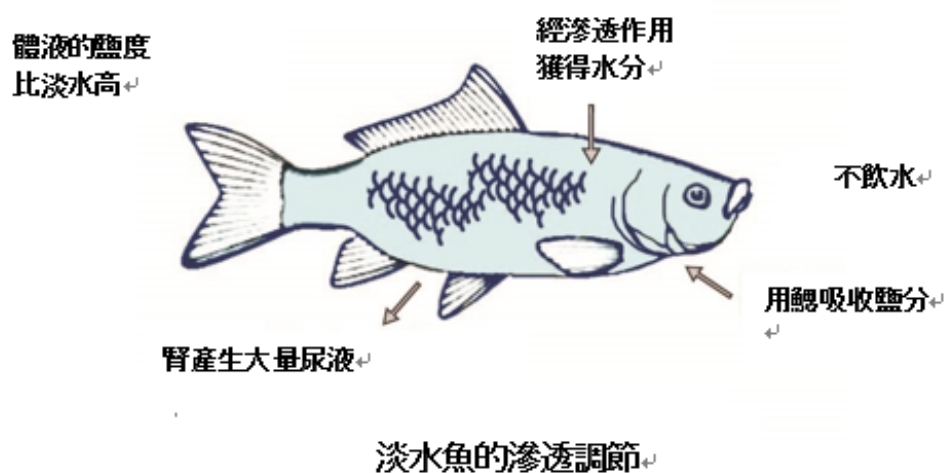
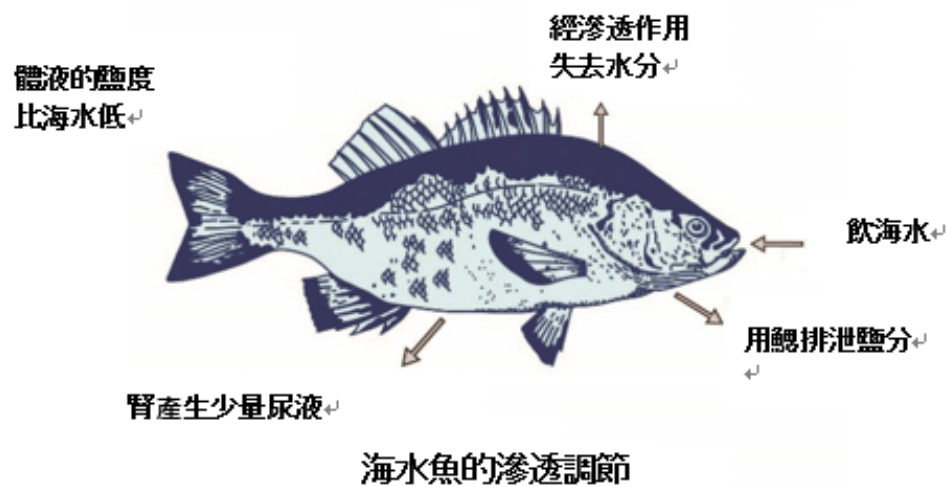
- A. 只有 (I)
- B. 只有 (III)
- C. 只有 (I) 和 (II)
- D. 只有 (I), (II) 和 (III)

39. Osmoregulation is the process of maintaining an internal balance of salt and water in the body. With reference to the processes of osmoregulation in marine and freshwater fish as shown below, which of the following statements (A to C) is incorrect?



- A. Kidneys and gills play active roles in osmoregulation in both marine and freshwater fish.
- B. Brackish water fish should be able to switch between different ways of osmoregulation according to the exact salinity they experience.
- C. Fish living in an isotonic environment (which is as salty as body fluids) does not need to osmoregulate.
- D. All statements above are correct.

39. 滲透調節是保持體內鹽分和水分平衡的過程。參照下圖所示鹹水魚和淡水魚的滲透調節過程，以下(A 至 C)哪項陳述是不正確的？



- A. 腎和鰓均在海水魚和淡水魚的滲透調節過程中扮演主動的角色。
- B. 在鹹淡水交界生活的魚類應該能根據身處水域的確切鹽度來轉換不同的滲透調節方法。
- C. 在等滲環境（水域的鹽度和魚的體液的鹽度相同）生活的魚類，不需要進行滲透調節。
- D. 以上陳述全部正確。

40. Oceanic islands are isolated ecosystems where population size is small and species composition are affected by immigration and evolution. It was reported that 80% of animal extinction after year 1500 A.D. occur in islands, the following statements account for the high extinction rate in oceanic islands except:

- A. Animals in islands are usually adapted to live in very specific ecological niches.
- B. Animals in islands usually do not have strong defenses against predators.
- C. Genetic variability in island populations is usually low.
- D. Evolution usually occurs slowly in oceanic islands.

41. What is the ultimate source of all genetic variation?

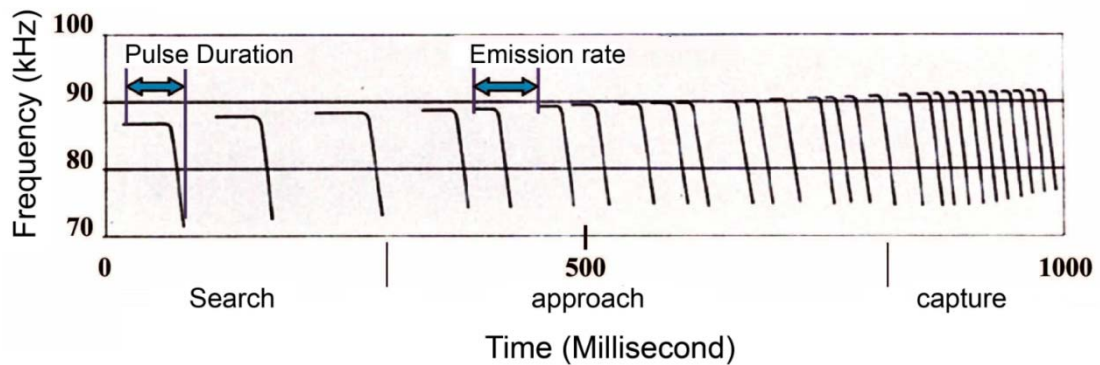
- A. Selection.
- B. Mutation.
- C. Sexual reproduction.
- D. Mass extinction.

42. Which of the following statements correctly describes the common feature shared by proteins, carbohydrates and nucleic acids?

- A. They all contain sulfur.
- B. They all contain carbon.
- C. They all contain branched molecules.
- D. They are all double-stranded.

40. 海洋島嶼是隔離的生態系統，其種群數目小，物種的組成受移入和演化影響。據報在公元 1500 年以後的動物滅絕個案當中，有 80% 是居住在島嶼的動物。以下陳述解釋了海洋島嶼物種滅絕率高的原因，除了
- A. 島嶼的動物通常適應生活於非常獨特的生態位。
 - B. 島嶼的動物通常不能有效抵禦捕食者。
 - C. 島嶼種群的遺傳變異程度通常是低的。
 - D. 海洋島嶼上的演化通常緩慢發生。
41. 所有遺傳變異的最終源頭是什麼？
- A. 選擇
 - B. 突變
 - C. 有性生殖
 - D. 集體滅絕
42. 以下陳述，哪項正確描述蛋白質、碳水化合物和核酸的共同特徵？
- A. 它們都含有硫。
 - B. 它們都含有碳。
 - C. 它們都含有支鏈分子。
 - D. 它們都是雙鏈結構。

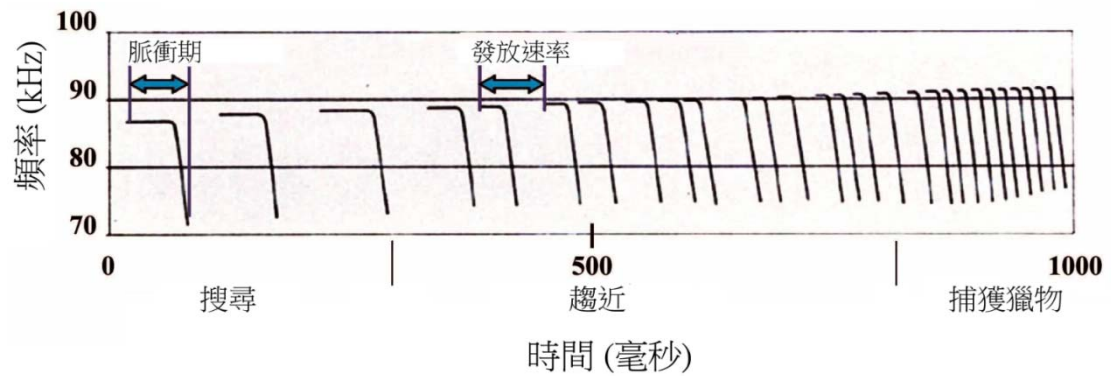
43. Bats give off ultrasound and detect obstacles and prey by picking up the ultrasound waves bounced back from objects. The figure below shows the changes in frequency, pulse duration and emission rate during the prey capturing process. The following statements correctly describe the characters of the ultrasonic waves except



Ultrasonic profile during prey capture of a bat

- A. There is a trend of increasing in ultrasonic frequency from the search to the capture phase.
- B. In the search phase, the pulse duration is the longest and the emission rate is the lowest.
- C. The bat is sensitive to its own outgoing ultrasonic pulses.
- D. Overlapping of ultrasonic signals occur only in the capture phase.

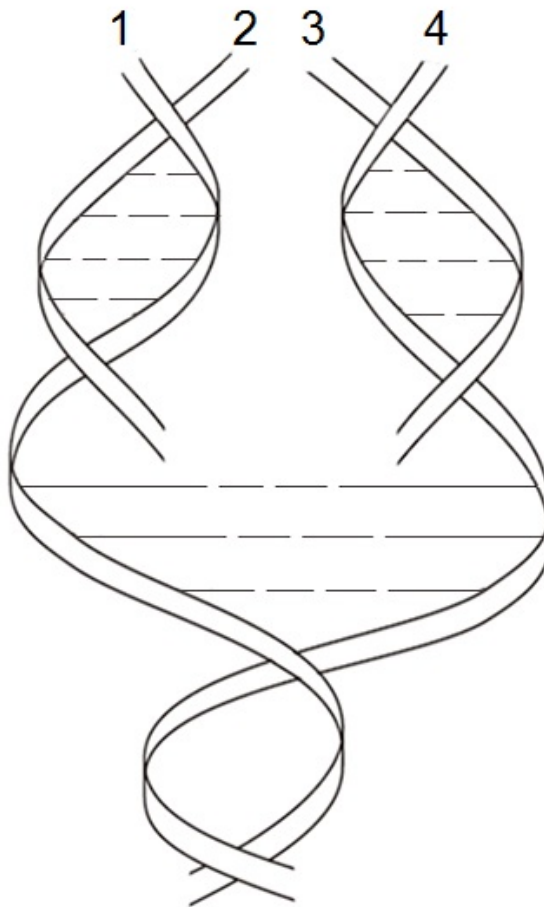
43. 蝙蝠發出超聲波，再收集由物體反映回來的超聲波，來探測障礙物和獵物。下圖顯示在捕食過程中，超聲波的頻率、脈衝期和發放速率的變化。以下陳述正確描述超聲波的特性，除了



蝙蝠捕食期間的超聲波變化概要

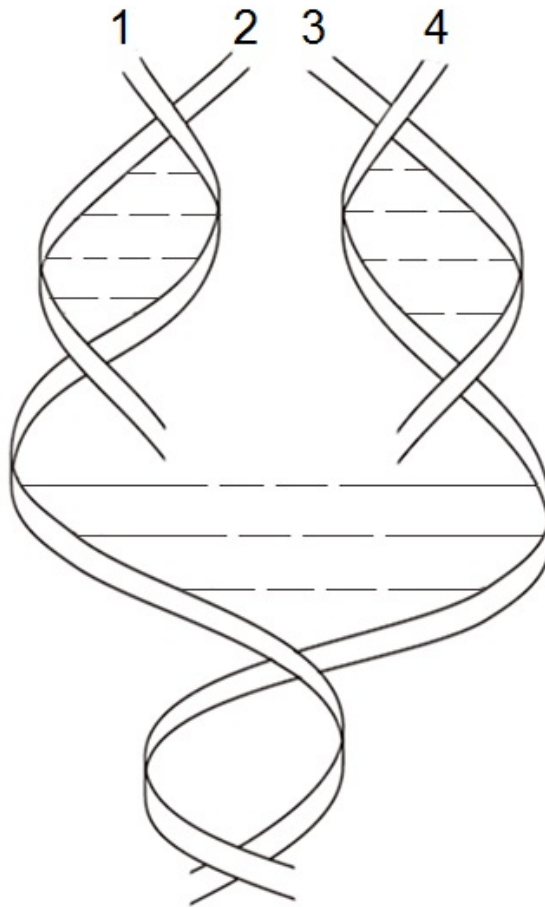
- A. 由搜尋至捕獲獵物的階段，超聲波的頻率呈上升的趨勢。
- B. 在搜尋階段，超聲波的脈衝期最長，發放速率最慢。
- C. 蝙蝠對本身發出的超聲波脈衝是敏感的。
- D. 只有在捕獲獵物階段，超聲波訊號才會發生重疊。

44. The figure below shows a section of DNA molecule undergoing replication. Which of the following pairs of DNA strands should have the same base sequence?



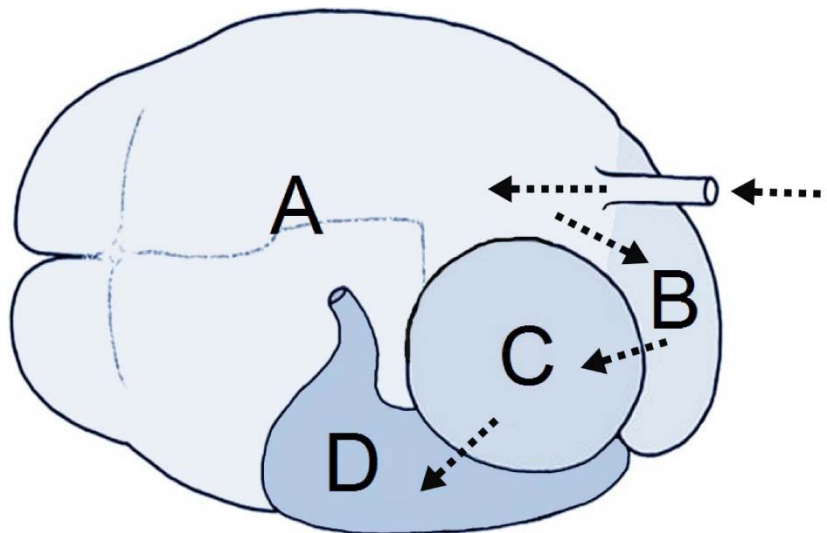
- A. Strands 1 and 4.
- B. Strands 2 and 4.
- C. Strands 2 and 3.
- D. Strands 1 and 2.

44. 下圖顯示 DNA 分子正在進行複製的部分。以下哪對 DNA 鏈應該具有相同的鹼基序列？



- A. 鏈 1 和 4.
- B. 鏈 2 和 4.
- C. 鏈 2 和 3.
- D. 鏈 1 和 2.

45. Ruminants are mammals which are specialized in eating plant materials. Since animals do not have enzyme which can break down cellulose molecules, ruminants rely on symbiotic micro-organisms to digest the cell walls of plant materials and they have a complex stomach, as shown in figure below. Which part of the ruminant stomach most likely corresponds to the stomach in other mammals, which is highly acidic in nature in order to facilitate the digestion of food materials?"

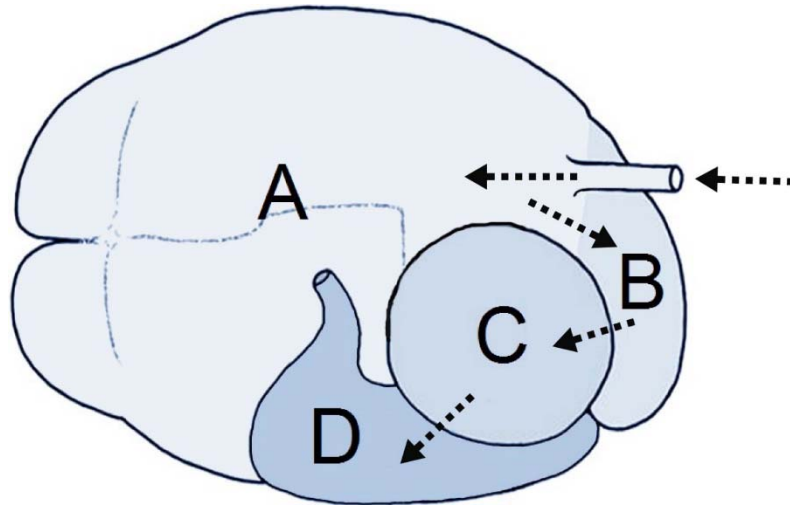


Path of materials during the digestion process in ruminants.

- A. Chamber A.
- B. Chamber B.
- C. Chamber C.
- D. Chamber D.

End of Paper

45. 反芻動物是特化為專吃植物物料的哺乳類。由於動物缺乏能消化纖維素分子的酶，反芻動物倚賴共生微生物來消化植物物料的細胞壁，牠們具有複雜的胃，參照下圖所示。其他動物的胃是強酸性的，藉此促進消化食物；反芻動物的胃的哪部分最可能相當於其他動物的胃？



食物在反芻動物的消化過程所經的路徑。

- A. A 室
- B. B 室
- C. C 室
- D. D 室

全卷完

**Student Training Course for
16th International Junior Science Olympiad Training Programme**

**Screening Test
29 September 2018**

Answer Sheet

1. D	16. C	31. C
2. C	17. B	32. B
3. A	18. A	33. C
4. C	19. A	34. C
5. B	20. D	35. A
6. A	21. B	36. B
7. D	22. B	37. B
8. D	23. C	38. B
9. C	24. D	39. C
10. D	25. A	40. D
11. C	26. D	41. B
12. B	27. B	42. B
13. B	28. C	43. C
14. B	29. A	44. B
15. A	30. C	45. D