



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

International Junior Science Olympiad 2017 - 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.

Co-organised by The Hong Kong Academy for Gifted Education,
the Gifted Education Section of the Education Bureau,
Faculty of Science, The Chinese University of Hong Kong, and
the Hong Kong Association for Science and Mathematics Education

**THIS
IS A
BLANK
PAGE.**

**THIS
IS A
BLANK
PAGE.**

Multiple Choice Questions (45 marks)

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

1. Two dices are tossed simultaneously. Which of the following outcomes has the highest probability?
 - A. The total score is 2
 - B. The total score is 7
 - C. The total score is 12
 - D. The total score is 3

2. Which of the following number sequences has the largest mean?
 - A. 1, 2, 8, 9
 - B. 1, 2, 7, 9
 - C. 0, 2, 7, 9
 - D. 1, 1, 8, 8

3. A boy has a height of 1 m. What is the minimum height possible for a plane mirror so that the boy can see his entire image in it?
 - A. 2m
 - B. 1.5m
 - C. 1m
 - D. 0.5m

多項選擇題 (45 分)

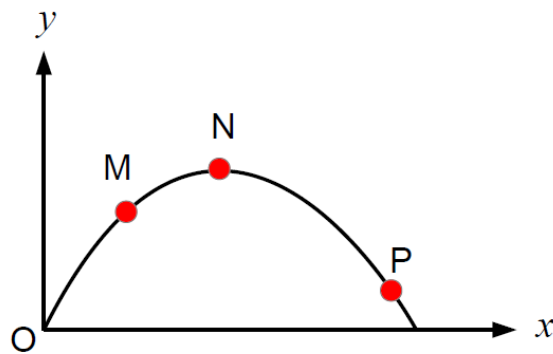
請把答案填劃在多項選擇題答題紙上適當的位置。每條題目佔 1 分。請選擇每題最適當的答案。錯誤答案不會被扣分。

1. 同時擲出兩顆骰子，以下哪個結果出現的機率最高？
 - A. 總點數為 2
 - B. 總點數為 7
 - C. 總點數為 12
 - D. 總點數為 3

2. 以下哪個數序列的平均值最大？
 - A. 1, 2, 8, 9
 - B. 1, 2, 7, 9
 - C. 0, 2, 7, 9
 - D. 1, 1, 8, 8

3. 一男孩身高 1 米。他從一平面鏡中看到自己的全身影像，那麼平面鏡的最小高度是多少？
 - A. 2 米
 - B. 1.5 米
 - C. 1 米
 - D. 0.5 米

4. Which one of the following waves has the lowest speed?
- A. Sound waves in air
 - B. Seismic waves
 - C. Light wave in vacuum
 - D. All have the same speed
5. If a heavy truck and a small car have a head-on collision, then
- A. The truck will experience the greater force of impact.
 - B. The car will experience the smaller acceleration.
 - C. The two vehicles must stick together after collision.
 - D. None of the above
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 speed of the ball at these points (starting from the greatest). You can ignore the effect of air resistance.



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

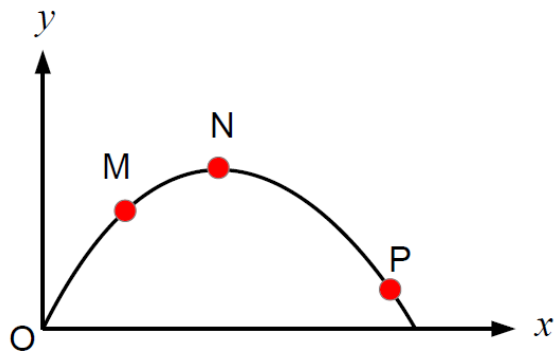
4. 以下哪種波動的速度最低？

- A. 空氣中的聲波
- B. 地震波
- C. 真空中的光波
- D. 以上波動的速度皆相同

5. 若一輛重型貨車與一輛小型汽車迎頭相撞，那麼

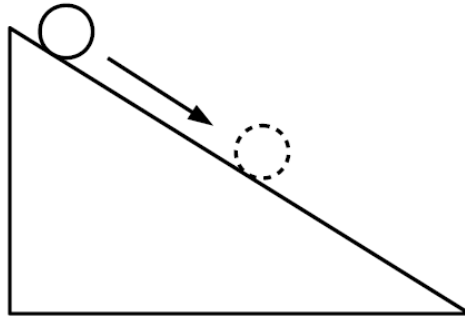
- A. 貨車將感受到較大的碰撞力。
- B. 汽車將感受到較小的加速度。
- C. 兩輛車在碰撞後必黏在一起。
- D. 以上皆不正確。

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速度排列(從大至小)。你可以忽略空氣阻力的影響。

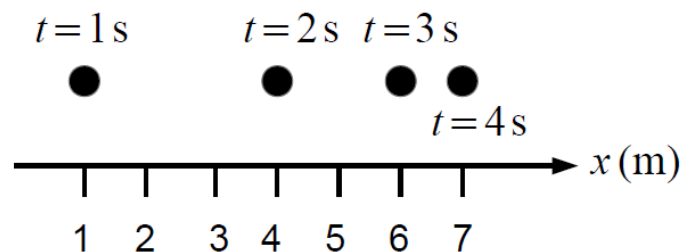


- A. $M > N > P$
- B. $M > P > N$
- C. $P > M > N$
- D. $N > M > P$

7. A ball rolls down a smooth inclined plane at a certain initial speed. How will the velocity and acceleration of the ball change during the motion?

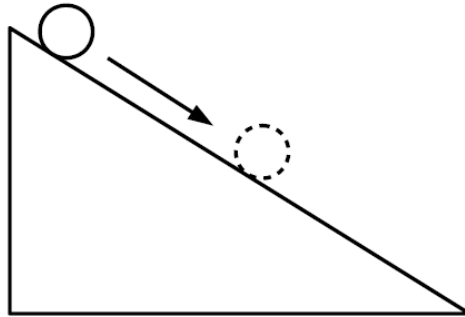


- A. Both the velocity and acceleration of the ball are increasing.
B. The velocity is increasing, while the acceleration is unchanged.
C. The velocity is increasing, while the acceleration is decreasing.
D. The velocity is decreasing, while the acceleration is unchanged.
8. The figure shows the position of a particle (moving along a straight line) as a function of time. Which of the following descriptions is correct?

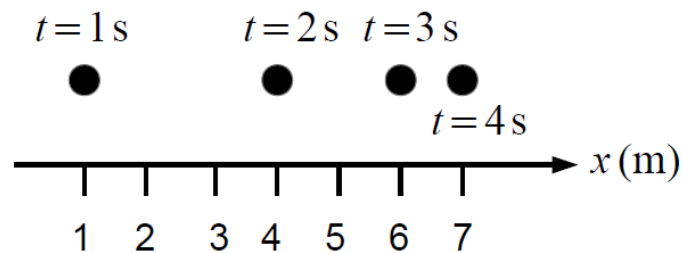


- A. The net force acting on the particle is zero.
B. The net force acting on the particle is to the left.
C. The net force acting on the particle is to the right.
D. The speed of the particle is constant.

7. 一個皮球以某一初始速度滾落一塊光滑斜面。在運動過程中，皮球的速度和加速度有何改變？



- A. 皮球的速度和加速度一起增加。
B. 速度增加，但加速度不變。
C. 速度增加，但加速度減少。
D. 速度減少，但加速度不變。
8. 下圖顯示一顆粒子在(直線運動中)不同時間的位置。以下哪項是正確的描述？



- A. 作用在粒子上的淨力是零。
B. 作用在粒子上的淨力是向左。
C. 作用在粒子上的淨力是向右。
D. 粒子的速度不變。

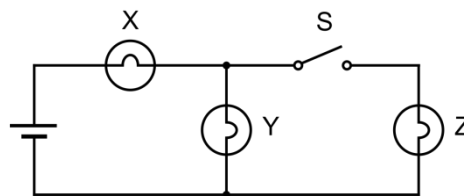
9. A dog sits at rest on the ground. The weight of the dog is equal to the magnitude of the upward force that the ground exerts on the dog. Which of the following explanations is correct?

A. This is a consequence of Newton's first law.
B. This is a consequence of Newton's third law.
C. Because the two forces form an action-reaction pair.
D. Because we assume that the ground is perfectly rigid.

10. Which of the following celestial objects is most similar to Earth in terms of its mass and radius?

A. Mercury
B. Venus
C. Mars
D. Moon

11. The following circuit includes a battery, a switch (S), and 3 identical light bulbs (X, Y, Z).



Which of the following statements is **correct**?

A. If S is open, X is brighter than Y.
B. If S is open, X and Z have the same brightness.
C. When S is changed from open to closed, the brightness of X remains unchanged.
D. If S is closed, Y and Z have the same brightness.

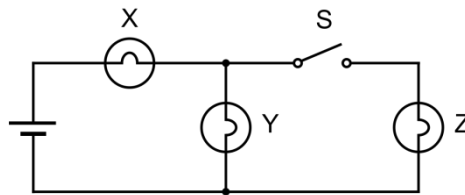
9. 一隻小狗靜坐在地上。小狗的重量跟地面給予它的承托力大小相同。以下哪項是正確的解釋？

- A. 這是牛頓第一定律的結果。
- B. 這是牛頓第三定律的結果。
- C. 這是因為這兩種力組成作用—反作用力對。
- D. 這是因為我們假設地面是堅硬的。

10. 依據質量和半徑作比較，以下哪個天體最類似地球？

- A. 水星
- B. 金星
- C. 火星
- D. 月球

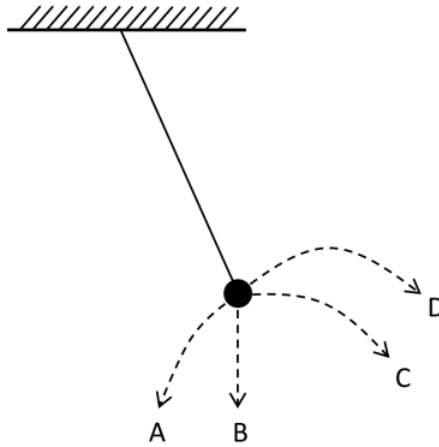
11. 以下電路由一個電池、一個開關（S）、和三個相同的燈泡（X，Y，Z）組成。



以下哪項敘述是正確的？

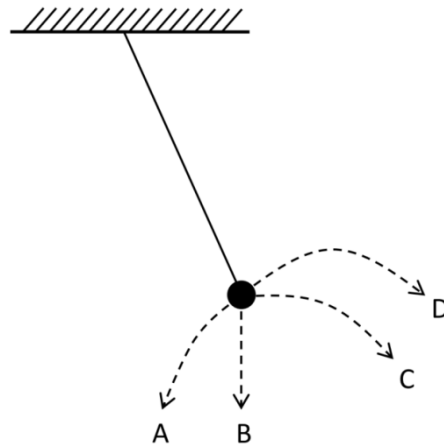
- A. 若 S 是打開的，X 較 Y 光亮。
- B. 若 S 是打開的，X 及 Z 的亮度相同。
- C. 若 S 由打開轉為閉合，X 的亮度維持不變。
- D. 若 S 是閉合，Y 及 Z 的亮度相同。

12. A small ball hanging by a string swings back and forth. The string breaks when the ball is at the highest point. Which path (A, B, C, or D) in the following diagram does the ball travel afterwards?



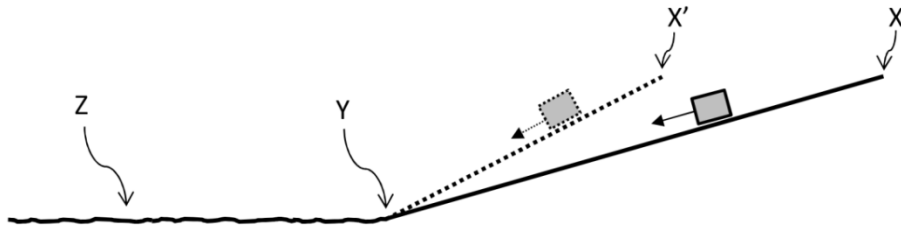
13. In a spaceship that orbits the Earth, an astronaut has a sensation of weightlessness. Which of the following statements best explains the sensation?
- A. Being far away from the Earth, the gravity on the astronaut is very weak.
 - B. An outward force on the astronaut balances the gravity, so the net force on the astronaut is zero.
 - C. The effect of gravity cannot propagate through the space.
 - D. The astronaut and the spaceship accelerate at the same rate toward the Earth.

12. 一個以細繩懸掛着的小球來回擺動。當小球在最高點，細繩斷了。小球隨後會沿着下圖中的哪一條路徑（A，B，C 或 D）移動？



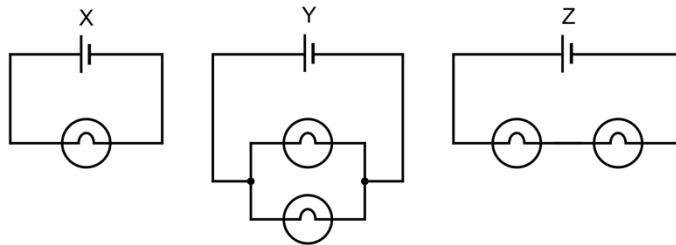
13. 在繞地球運行的一艘太空船內，一個太空人有無重的感覺。下列哪一項最能解釋該感覺？
- A. 太空人身處之地遠離地球，因此在太空人身上的重力非常微弱。
 - B. 在太空人身上有一個向外的力，平衡重力。因此作用在其上的淨力為零。
 - C. 重力的作用無法在太空傳遞。
 - D. 太空人和太空船以相同的加速度向地球加速。

14. In the following diagram, a box is released from rest at point X. It slides down a smooth slope (XY), and then moves on a rough horizontal surface and stops at Z.



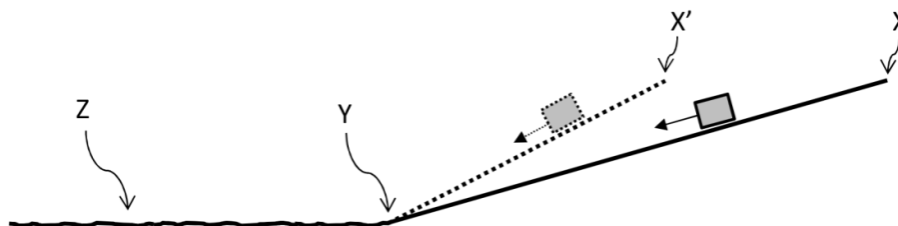
The inclination of the slope is increased, such that the box starts from rest at point X' (which is at the same height as X). Which of the following statements is **correct** regarding the **new** position at which the box stops?

- A. The box stops on the left of point Z.
 - B. The box stops at point Z.
 - C. The box stops on the right of point Z.
 - D. There is not enough information to determine the new stopping position.
15. Three circuits are constructed with identical batteries and identical light bulbs (as shown in the following figure). Which battery has the largest output power?



- A. Battery X
- B. Battery Y
- C. Battery Z
- D. All three batteries have the same output power.

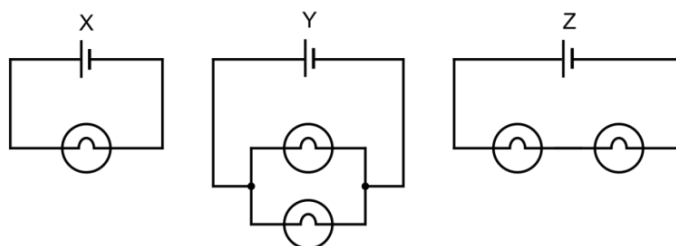
14. 在下圖中，一個盒子在 X 點從靜止開始，沿光滑的斜面 (XY) 向下方滑行，隨後在粗糙的水平表面移動，並在 Z 點停止。



如果斜面的坡度增加，以致盒子在 X' 點從靜止開始 (X' 點和 X 點的高度相同)。
以下哪一敘述是正確描述盒子新的停止位置？

- A. 盒子在 Z 點左邊停止。
- B. 盒子在 Z 點停止。
- C. 盒子在 Z 右邊停止。
- D. 題目沒有提供足夠的資料以確定新的停止位置。

15. 三個電路以相同的電池和相同的燈泡組成（如下圖）。哪個電池的輸出功率最大？



- A. 電池 X
- B. 電池 Y
- C. 電池 Z
- D. 三個電池的輸出功率相等

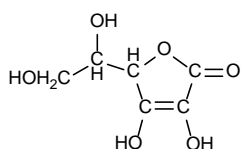
16. Which of the following is an example of a physical change?

- A. A cake is baked from flour, sugar, eggs and milk.
- B. Milk left outside a refrigerator overnight turns sour.
- C. Sheep are sheared, and the wool is spun into yarn.
- D. Spiders eat flies and make silk.

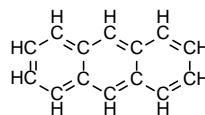
17. Lead can enter drinking water when service pipes that contain lead corrode. According to the World Health Organization, the maximum allowable concentration of lead in drinking water is 10 ppb. What is the value of 10 ppb?

- A. 1×10^{-6}
- B. 1×10^{-7}
- C. 1×10^{-8}
- D. 1×10^{-9}

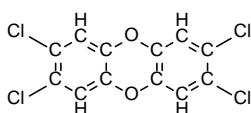
18. Which of the following molecules contains the greatest number of atoms?



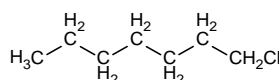
A.



B.



C.



D.

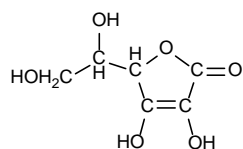
16. 下列何者是一個物理變化的例子？

- A. 用麵粉、糖、雞蛋及牛奶來烘蛋糕。
- B. 放置在冰箱外一整晚的牛奶變酸。
- C. 將綿羊的毛剪下，並把羊毛紡成紗。
- D. 蜘蛛把蒼蠅吃掉並吐絲。

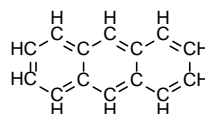
17. 當含鉛輸水管腐蝕時，會讓鉛引入食水中。根據世界衛生組織的標準，食水含鉛不可超過 10 ppb。10 ppb 的值是多少？

- A. 1×10^{-6}
- B. 1×10^{-7}
- C. 1×10^{-8}
- D. 1×10^{-9}

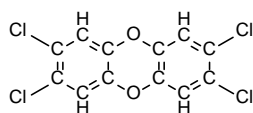
18. 以下哪一個分子有最大數目的原子？



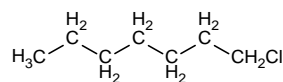
A.



B.



C.



D.

19. The carbon content on the Earth, including the atmosphere, is:
- A. constant.
 - B. decreasing due to consumption of carbon based fuels, such as natural gas, petroleum and coal.
 - C. increasing due to growing of plants and animals.
 - D. fluctuating due to changes of seasons.
20. 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, what is the total mass of the substance in the container after the reaction is completed?
- A. 40 g
 - B. 16 g
 - C. 100 g
 - D. 116 g
21. The half-life of a radioactive isotope is the time taken for half of the number of atoms to undergo radioactive decay. If there is 40 g of ^{45}Ca , how much ^{45}Ca will be left after 489 days?
(Note: The half-life of ^{45}Ca is 163 days.)
- A. 20 g
 - B. 5 g
 - C. 13.3 g
 - D. 10 g

19. 在地球上，包括大氣層，碳含量是：

- A. 不變的。
- B. 減少的（基於碳的燃料，如天然氣，石油和煤的消耗）。
- C. 增加的（基於動植物的生長）。
- D. 波動的（基於季節的變化）。

20. 32 g 元素 X 與 48 g 元素 Y 反應，生成 80 g 的化合物 Z。若在一个密閉容器中，讓 16 g 元素 X 與 100 g 元素 Y 反應，待反應完畢後，在該容器內物質的總質量是多少？

- A. 40 g
- B. 16 g
- C. 100 g
- D. 116 g

21. 放射性同位素的半衰期是指半數的原子進行放射性衰變所需的時間。若 40 g 的 ^{45}Ca 進行放射性衰變，489 天後將會有多少 ^{45}Ca 剩餘下來？
(提示： ^{45}Ca 的半衰期是 163 天。)

- A. 20 g
- B. 5 g
- C. 13.3 g
- D. 10 g

22. The following table shows the pH values of three beverages:

Beverages	pH value
Orange juice	3.5
Soft drink	3.0
Lemon juice	2.5

Acidic beverage with higher acidity contains a higher concentration of hydrogen ions. The calculation of the concentration of hydrogen ions requires the use of power of 10:

concentration of hydrogen ions (unit: M) = $10^{(-\text{pH})}$

According to the given information, the ratio of concentration of hydrogen ions in orange juice to that in lemon juice is:

- A. 1:2
- B. 5:1
- C. 10:1
- D. 1:10

22. 下表列出三種酸性飲料的 pH 值：

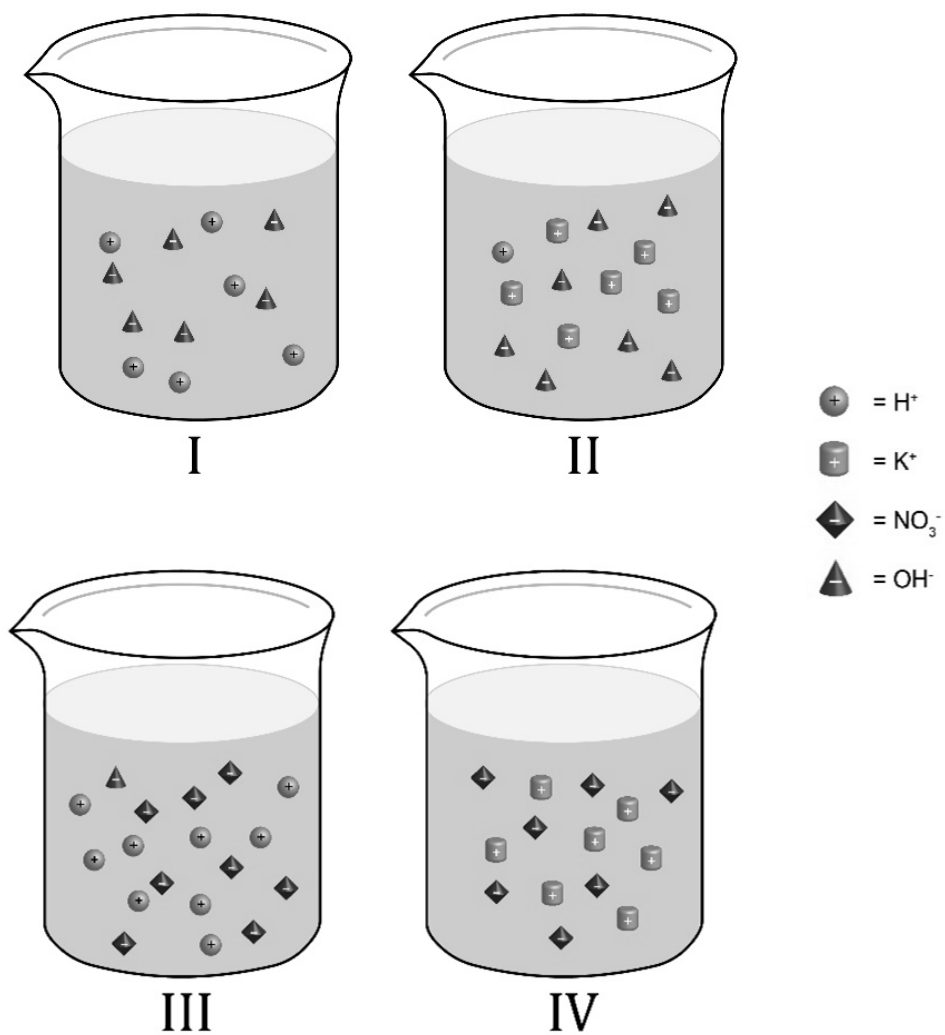
飲料	pH 值
橙汁	3.5
汽水	3.0
檸檬汁	2.5

酸度較高的酸性飲料含有較高濃度的氫離子。氫離子濃度的計算需要運 10 的次方：
氫離子濃度（單位: M）= $10^{(-\text{pH})}$

根據所給資料，橙汁氫離子濃度對檸檬汁氫離子濃度的比例是：

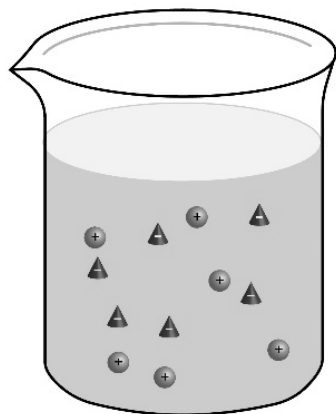
- A. 1:2
- B. 5:1
- C. 10:1
- D. 1:10

23. Which of the following solutions is/are acidic?

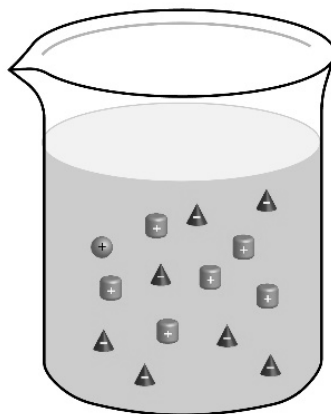


- A. I and III only
- B. II only
- C. III only
- D. IV only

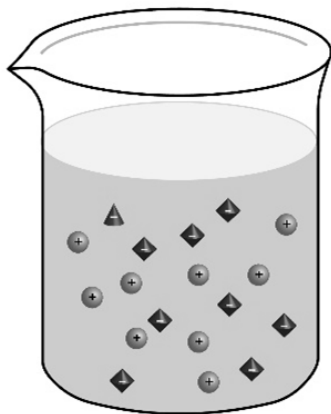
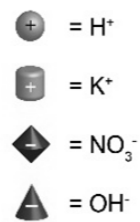
23. 以下哪一杯/幾杯溶液是酸性的？



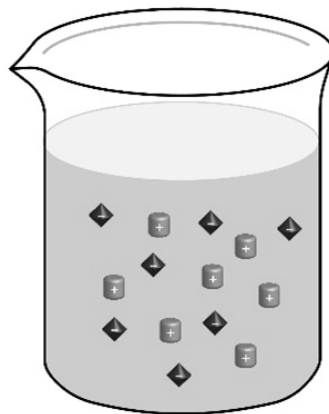
I



II



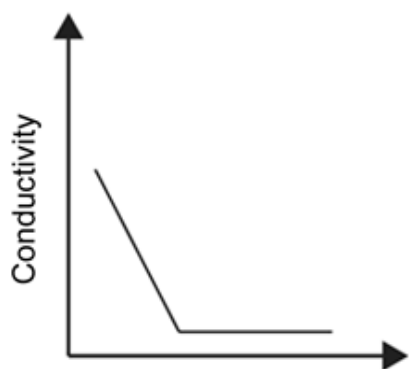
III



IV

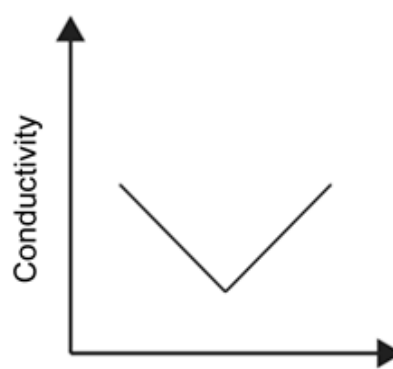
- A. 只是 I 和 III
- B. 只是 II
- C. 只是 III
- D. 只是 IV

24. In an experiment to explore the reaction between dilute sodium hydroxide solution and dilute hydrochloric acid, a conductometer is connected to the experimental setup and dilute sodium hydroxide solution is gradually added to dilute hydrochloric acid. Which of the following graphs correctly shows the change of the conductivity throughout the experiment?



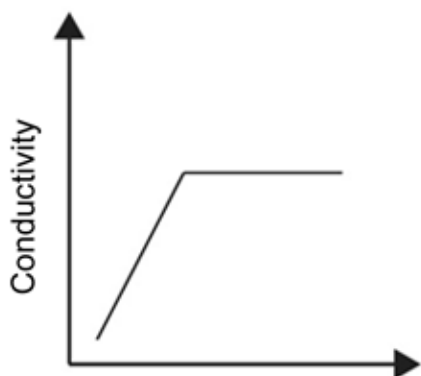
Volume of sodium
hydroxide solution added to
the hydrochloric acid

A.



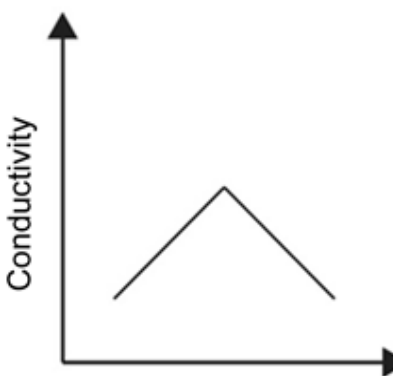
Volume of sodium
hydroxide solution added to
the hydrochloric acid

B.



Volume of sodium
hydroxide solution added to
the hydrochloric acid

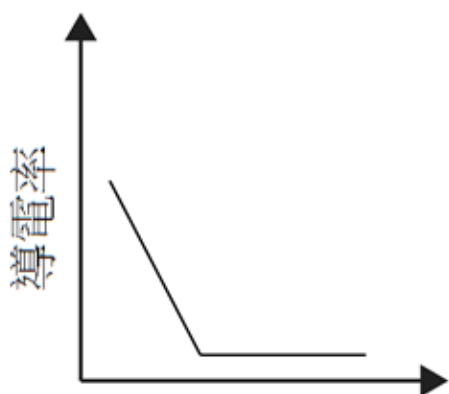
C.



Volume of sodium
hydroxide solution added to
the hydrochloric acid

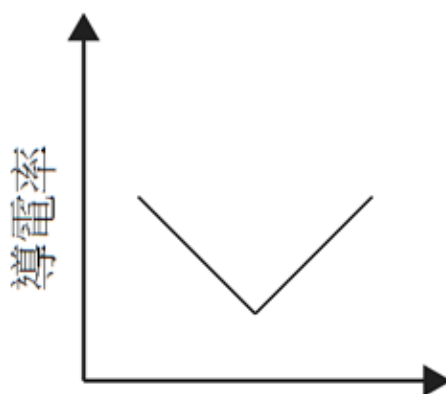
D.

24. 在一個探究稀氫氧化鈉溶液與稀氫氯酸反應的實驗，一個導電計接上實驗裝置，稀氫氧化鈉溶液則逐漸加進稀氫氯酸。以下何者是在整個反應過程中，導電率變化的正確圖表？



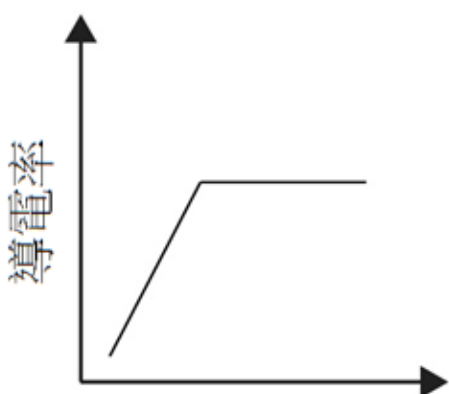
加進氫氯酸的
氫氧化鈉溶液的體積

A.



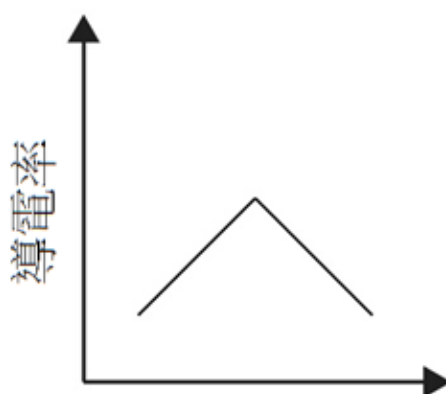
加進氫氯酸的
氫氧化鈉溶液的體積

B.



加進氫氯酸的
氫氧化鈉溶液的體積

C.



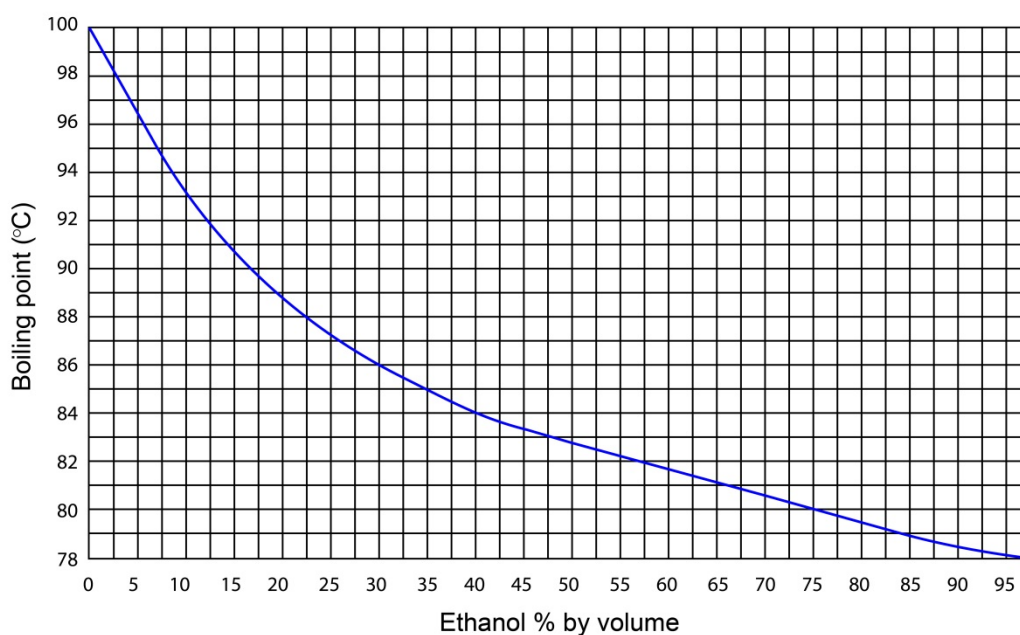
加進氫氯酸的
氫氧化鈉溶液的體積

D.

25. Ozone layer depletion is the wearing out of the amount of ozone in the stratosphere. This ozone layer is crucial because it prevents the damaging ultraviolet radiation from reaching the Earth's surface. Which of the following gases causes the ozone depletion?

- A. Nitrogen
- B. Carbon dioxide
- C. Chlorofluorocarbons
- D. Methane

26. The boiling point of aqueous solution of ethanol at different concentrations is shown below.



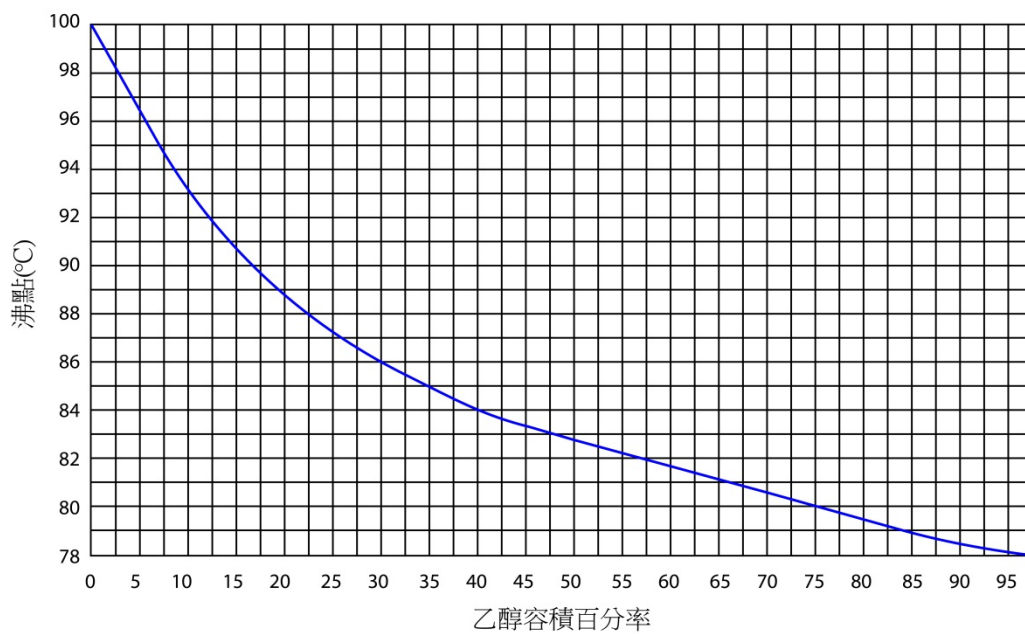
What is the boiling point of an aqueous solution of ethanol which is 60% (by volume) in water?

- A. 80 °C
- B. 82 °C
- C. 84 °C
- D. 86 °C

25. 臭氧層消耗是指消耗了平流層內臭氧量。該臭氧層是關係重大的，因為它防止具破壞性的紫外幅射照達地表地球表面。下列哪一氣體導致臭氧消耗？

- A. 氮
- B. 二氧化碳
- C. 氯氟碳化合物
- D. 甲烷

26. 不同濃度的乙醇水溶液的沸點如下所示：



在一個乙醇水溶液中，水的容積百分率是 60%，它的沸點是多少？

- A. 80 °C
- B. 82 °C
- C. 84 °C
- D. 86 °C

27. Reduction is a chemical process in which a substance loses oxygen atoms or gains hydrogen atoms. In which of the following is the reactant undergoing reduction? (Note: They are not balanced chemical equations.)

- A. $\text{C}_2\text{H}_4\text{O} \rightarrow \text{C}_2\text{H}_4\text{O}_2$
- B. $\text{C}_2\text{H}_4\text{O} \rightarrow \text{C}_2\text{H}_6\text{O}$
- C. $\text{CO} \rightarrow \text{CO}_2$
- D. $\text{CH}_4 \rightarrow \text{C}$

28. The following table shows the reaction of different metals with cold water, steam and hydrochloric acid.

Metal	Reaction with		
	Cold water	Hydrochloric acid	Steam
A	✓	✓	✓
B	X	X	X
C	X	✓	✓
D	X	✓	X

✓ : Reaction occurs

X : Reaction does not occur

Arrange the reactivity of the metals in ascending order.

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

27. 還原反應是指有物質失去氧或獲得氫的一個化學過程。下列何者是反應物進行了還原反應？

(注意：它們並不是平衡的化學方程式。)

- A. $\text{C}_2\text{H}_4\text{O} \rightarrow \text{C}_2\text{H}_4\text{O}_2$
- B. $\text{C}_2\text{H}_4\text{O} \rightarrow \text{C}_2\text{H}_6\text{O}$
- C. $\text{CO} \rightarrow \text{CO}_2$
- D. $\text{CH}_4 \rightarrow \text{C}$

28. 下表列出不同金屬與冷水、水蒸汽及氫氯酸的反應。

金屬	與冷水反應	與氫氯酸反應	與水蒸汽反應
A	✓	✓	✓
B	X	X	X
C	X	✓	✓
D	X	✓	X

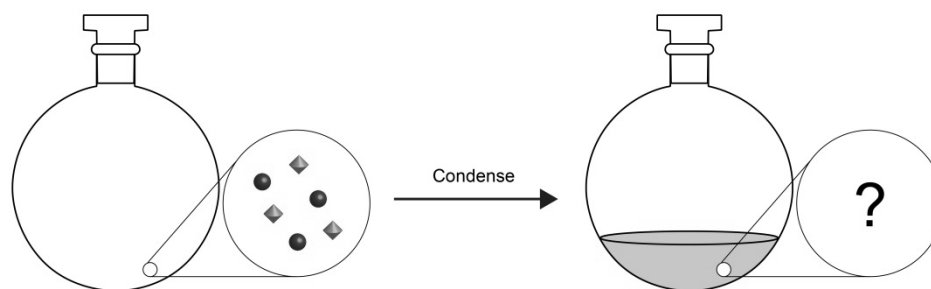
✓：發生反應

X：不發生反應

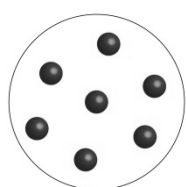
把這些金屬按其活性由低至高排列。

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

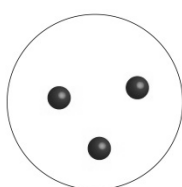
29. The following closed container contains two gases. When the container is cooled down to 5°C , one of the gases condenses.



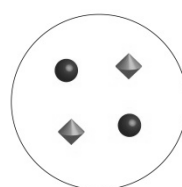
Which of the following diagrams best represents the same area of the magnified view of the liquid?



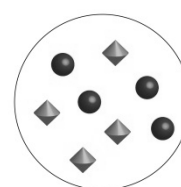
A.



B.

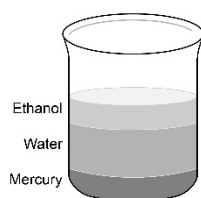


C.

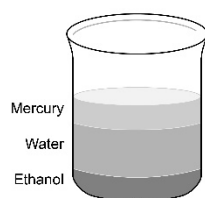


D.

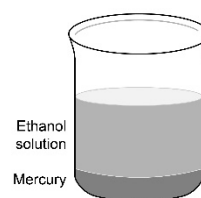
30. Suppose you put 40 mL of mercury, 40 mL of ethanol and 80 mL of water in a 250-mL beaker. Which of the following is the correct sketch of the mixture in the beaker?



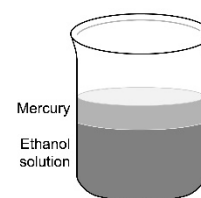
A.



B.

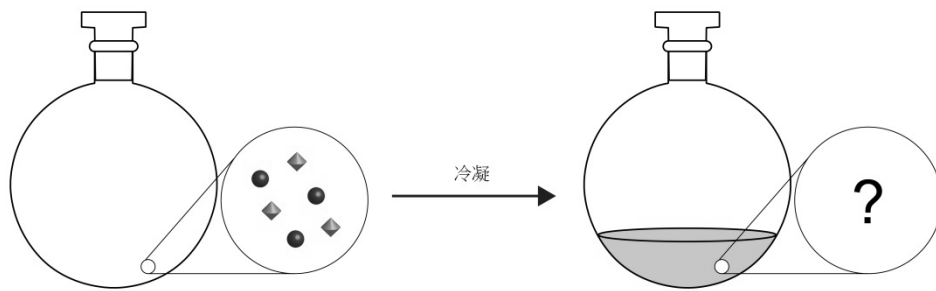


C.

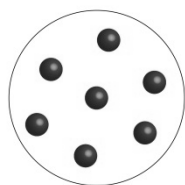


D.

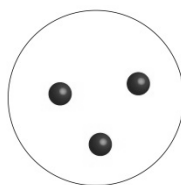
29. 下面的密閉容器盛有兩種氣體。當把該容器冷卻至 5°C 時，其中一種氣體凝結了。



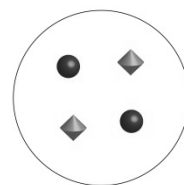
以下哪一幅圖是最適合代表該液體在同一範圍的放大圖？



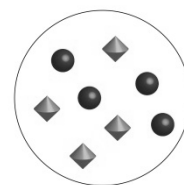
A.



B.

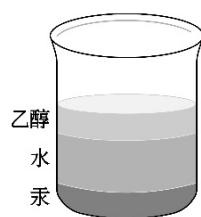


C.



D.

30. 假設把 40 mL 的汞、40 mL 的乙醇及 80 mL 的水放進一個 250-mL 的燒杯。以下何者是在該燒杯內混合物的草圖？



A.



B.



C.



D.

31. In the Antarctic Ocean the water temperature is typically -2°C in winter. Some Antarctic inhabitants such as the Antarctic Icefish protect themselves from frozen by having anti-freeze proteins in their body. Interestingly the Icefish was found to lack red blood cells which is important for oxygen transport in animals, this phenomenon can be accounted for by the following statements except

- A. the extreme coldness facilitates the dissolving of oxygen in water and blood.
- B. red blood cells are eliminated to reduce the viscosity of blood.
- C. the Icefish has very low metabolic rate so that they can live on oxygen dissolved in blood plasma.
- D. lack of red blood cells is compensated by extremely high rate of blood circulation.

32. Hydrothermal vents are ecosystems found in deep oceans where various metals and sulphur compounds dissolved in extremely hot water and ejected from the cracks in the bed rock. Interestingly some bacteria are found to be able to produce energy with chemical reactions involving the sulphur compounds (a process known as chemosynthesis) in the absence of light. The bacteria are either free living or living symbiotically with other organisms so that an ecosystem with high biodiversity can be established. The modes of nutrition found in hydrothermal vents will be

- (1) Autotrophic
- (2) Heterotrophic
- (3) Photosynthetic
- (4) Chemosynthetic

- A. (2), (3) and (4) only
- B. (1), (3) and (4) only
- C. (1), (2) and (4) only
- D. (1), (2) and (3) only

31. 南冰洋冬季的水溫通常是 -2°C 。有些南冰洋生物例如南極冰魚，其體內有抗凍蛋白，可以保護牠們免於結冰。有趣的是，冰魚沒有紅血球這種對動物體內運送氧而言具有重要意義的結構，下列哪項不能用以解釋這個現象？

- A. 極低的溫度促使氧溶於水和血液。
- B. 將紅血球除去能令血液的黏稠度降低。
- C. 冰魚的代謝率很低，可依賴溶於血漿的氧存活。
- D. 沒有紅血球可以靠極高速率的血液循環來補償。

32. 深海熱泉是見於深海的生態系，在這些火山口，各種不同的金屬和硫化化合物溶於極熱的水中，由海床的縫隙噴出來。有趣的是，有些細菌能在沒有光的條件下，藉著進行涉及硫化化合物的化學反應而產生能量(一個被稱為化學合成的過程)，這些細菌或是自生(自由生活)的，又或與其他生物形成共生的關係，使高度的生物多樣性得以在生態系中建立起來。見於深海熱泉的生物的營養模式將會是

- (1) 自養營養
- (2) 異養營養
- (3) 光合營養
- (4) 化能合成營養

- A. 只有(2)，(3)和(4)
- B. 只有(1)，(3)和(4)
- C. 只有(1)，(2)和(4)
- D. 只有(1)，(2)和(3)

33. A student set up an experiment to study the effect of sunlight on plant growth. He firstly measured the initial height of two plants. Then, one of the plants was put under sunlight while the other was kept in a dark room. After 3 days, he measured their height again and calculated the percentage increase in plant height. Which of the following modifications of the experiment would you consider to be most effective in improving the accuracy of the experiment?
- A. The length of leaves should be measured as well.
 - B. Both plants should be kept under sunlight but one should be put into a chamber which walls can reflect all sunlight but allows movement of air and moisture.
 - C. The plants should be fertilized to promote growth.
 - D. The weight of the plants should be measured as well.
34. Geckos are well known for their ability to walk on vertical surfaces. Scientists have found that the surfaces of gecko toes are covered with millions of pad-like structures, which greatly increase the effective contact area with the surface they are walking on. Based on this evidence it was proposed that the holding force of gecko feet is derived from the attractive force (known as van der Waals force) between the atoms of the pad-like structures and those at the surface on which they walk. However it is found that the holding force will lose when geckos are walking on wet surfaces. This is most likely due to
- A. the absence of van der Waals force between water molecules and the atoms of the pad-like structures on gecko toes.
 - B. the reduction of effective contact surface area of the pad-like structures on gecko toes upon interaction with water.
 - C. the absence of friction between the surface and the pad-like structures on gecko toes.
 - D. None of the above statements is correct.

33. 某學生進行一項實驗，以研究日光對植物生長的影響。他首先量度兩株植物的起始高度，然後將其中一株植物置於日光下，另一株則置於黑房中；三天後，他再量度兩株植物的高度，並計算植物高度的增加百分率。你認為下列哪項對實驗的改進措施，會最有效提高實驗的準確度？
- A. 同時量度葉的長度。
 - B. 兩株植物同時置於日光下，但其中一株放進一個箱中，箱壁能反射所有日光、但容許空氣和水氣流通。
 - C. 向植物施肥，以促進植物生長。
 - D. 同時量度植物的重量。
34. 壁虎以擅於在垂直的表面行走而著名，科學家發現壁虎腳趾的表面覆有以百萬計的軟墊狀構造，令壁虎與其行走表面的有效接觸面積大幅增加。基於這項證據，有人提出壁虎腳部的吸附力，源自其腳趾的軟墊狀構造的原子與其行走表面的原子之間的吸引力(名為范德華力)。但是，當壁虎在濕的表面行走時，就會喪失了腳部的吸附力。這最可能是因為
- A. 水分子與壁虎腳趾的軟墊狀構造的原子之間不存在范德華力。
 - B. 壁虎腳趾上軟墊狀構造與水接觸時，會減少有效接觸面積。
 - C. 壁虎腳趾的軟墊狀構造與其行走表面之間不存在摩擦力。
 - D. 以上陳述無一正確。

35. The swim bladder is a structure with which the majority of fish regulate their buoyancy. When the depth (and hence static pressure) is changed, gas is either secreted into or removed from the swim bladder so that the volume of the swim bladder is maintained. This mechanism allows the fish to have the same density as that of water at various depths. However it is known that fish living at depths below 1000m regulate their buoyancy by storing lipids in their body instead of using swim bladders. This is most likely due to

- A. The difficulty of secreting gas into the swim bladder under extremely high static pressure.
- B. The different origins of surface fish and deep sea fish.
- C. The lack of dissolved gases in deep sea.
- D. None of the above statements is correct.

36. Insects, bats and birds all have wings and are able to fly. In general zoologist believes that the flying ability in different groups of animals had been evolved independently. This can be supported by the following statements except

- A. The wings are structurally different in the groups of animals mentioned above.
- B. These groups of animals do not have a common ancestor which can fly.
- C. Different aerodynamic principles are used to fly by the groups of animals mentioned above.
- D. None of the above statements is correct.

37. Banana placed in closed bags will ripen earlier than those put in open air. Which of the following statements can best explain this phenomenon?

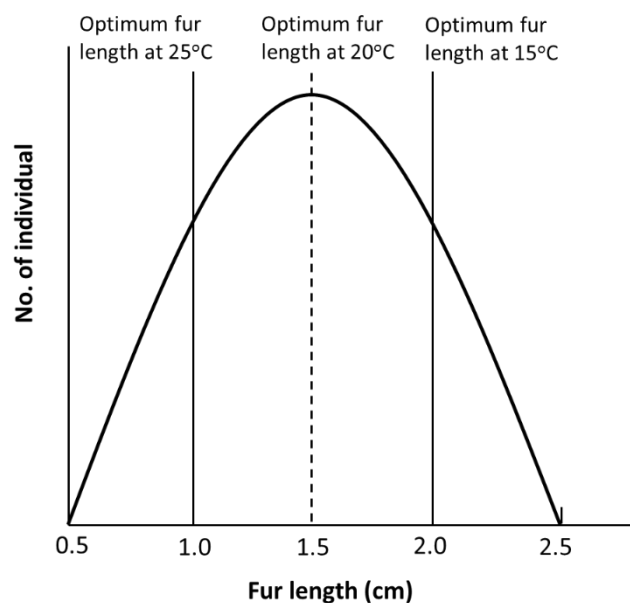
- A. The shortage of oxygen in closed bags will facilitate ripening of banana.
- B. The increased moisture in closed bags will facilitate ripening of banana.
- C. The plant hormone which promotes ripening will exist in higher levels in the enclosed bag.
- D. None of the above statements is correct.

35. 魚鰾是大多數魚類用來調節浮沉的構造。當水的深度(及因而產生的靜壓)改變時，氣體會被分泌進魚鰾，或由魚鰾移除，從而使魚鰾的容積保持不變，這個機制令魚類可以在不同深度的水中維持與水一樣的密度。但是，生活在水深 1000m 或更深水域的魚類，卻藉著在體內貯存的脂類而非魚鰾來調節浮沉，這最可能是因為
- A. 在極高的靜壓下，難以將氣體分泌入魚鰾。
 - B. 淺海魚類和深海魚類的物種起源不同。
 - C. 深海缺乏已溶於水的氣體。
 - D. 以上陳述無一正確。
36. 昆蟲、蝙蝠和鳥類都有翼並能夠飛行。動物學家一般都相信不同組別動物的飛行能力是經過各自獨立演化而得來，下列哪項陳述不能支持這個說法？
- A. 上述組別的動物的翼的結構均不相同。
 - B. 這些組別的動物並沒有一個能夠飛行的共同祖先。
 - C. 上述組別的動物利用不同的空氣動力學原理來飛行。
 - D. 以上陳述無一正確。
37. 置於密封袋內的香蕉，較放在空氣中的較快成熟。下列哪項陳述是這個現象最好的解釋？
- A. 密封袋內的氧氣短缺，會促使香蕉成熟。
 - B. 密封袋內的水氣增加，會促使香蕉成熟。
 - C. 在密封袋內，促使香蕉成熟的植物激素會存有較高的水平。
 - D. 以上陳述無一正確。

38. Given that, in a mouse species, the amount of DNA in a somatic cell just before undergoing mitosis is 20 arbitrary units, what is the amount of DNA in a mature sperm cell?

- A. 5 arbitrary units
- B. 10 arbitrary units.
- C. 20 arbitrary units
- D. 40 arbitrary units

39. Below is a graph about the fur length of a newly established population of a mammal in a habitat. In this habitat, the average temperature during day time is around 25°C and that of the night time is around 15°C. After many generations, two distinct sub-populations (diurnal and nocturnal) are formed. Predict the optimum fur lengths of the sub-populations.

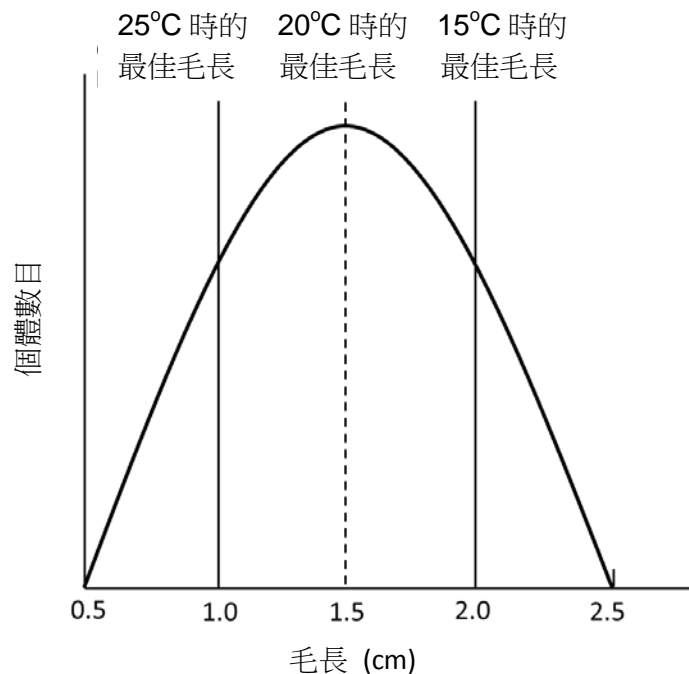


- A. 1.0 cm for the diurnal and nocturnal sub-populations.
- B. 2.0 cm for the diurnal sub-population and 1.0 cm for the nocturnal sub-population.
- C. 1.0 cm for the diurnal sub-population and 2.0 cm for the nocturnal sub-population.
- D. 2.0 cm for the diurnal and nocturnal sub-populations.

38. 已知某種老鼠的體細胞在開始進行有絲分裂之前，其 DNA 含量為 20 任意單位，那麼在成熟的精子細胞中的 DNA 含量是多少？

- A. 5 任意單位
- B. 10 任意單位
- C. 20 任意單位
- D. 40 任意單位

39. 以下曲線圖顯示在最初定居於某個生境時，一種哺乳動物的毛的長度。這個生境的平均溫度，日間約為 25°C ，夜間則約為 15°C 。經過多個世代之後，這種哺乳動物形成兩個截然不同的亞種群(晝出和夜行)，試預測這兩個亞種群的最佳毛長。



- A. 晝出和夜行亞種群都是 1.0 cm。
- B. 晝出亞種群是 2.0 cm，夜行亞種群則是 1.0 cm。
- C. 晝出亞種群是 1.0 cm，夜行亞種群則是 2.0 cm。
- D. 晝出和夜行亞種群都是 2.0 cm。

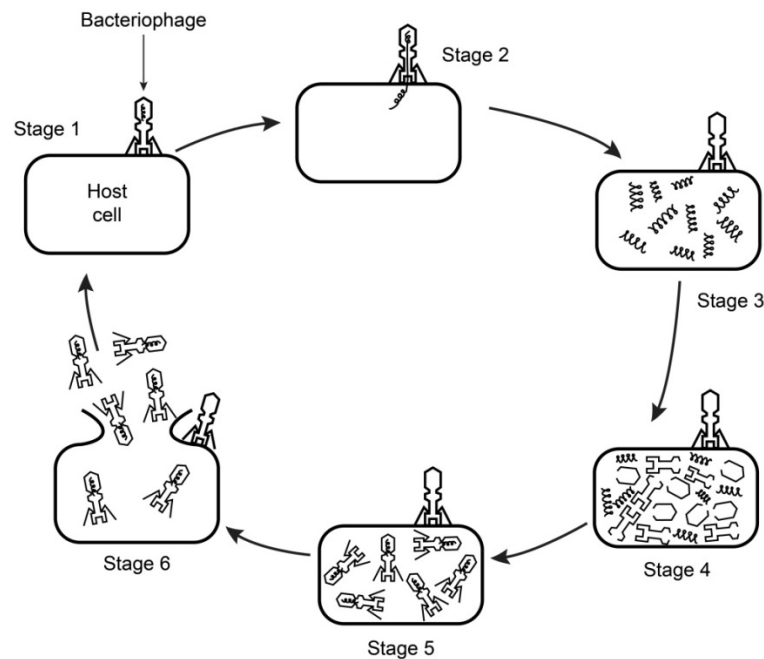
40. The following table compares three types of cells.

Sub-cellular structure	Bacterial cell	Animal cell	Plant cell
X	Absent	Present	Present
Y	Present	Absent	Present
Z	Present	Present	Present

X, Y and Z can possibly be

- A. cell membrane, cell wall and mitochondria, respectively.
- B. nuclear envelop, chloroplast and ribosome, respectively.
- C. cell membrane, lysosome and mitochondria, respectively.
- D. nuclear envelop, cell wall and ribosome, respectively.

41. A bacteriophage is a virus attacking bacterial cells. Below shows the life cycle of a bacteriophage.



Based on the life cycle, which of the following statements about bacteriophage is INCORRECT?

- A. The whole bacteriophage enters the host cell before replication.
- B. The nucleic acid and protein coat of bacteriophages are synthesized separately.
- C. The first step of the infection cycle is attachment of bacteriophage to a host cell.
- D. The bacteriophage has turned the bacterial cell into a factory of bacteriophage production.

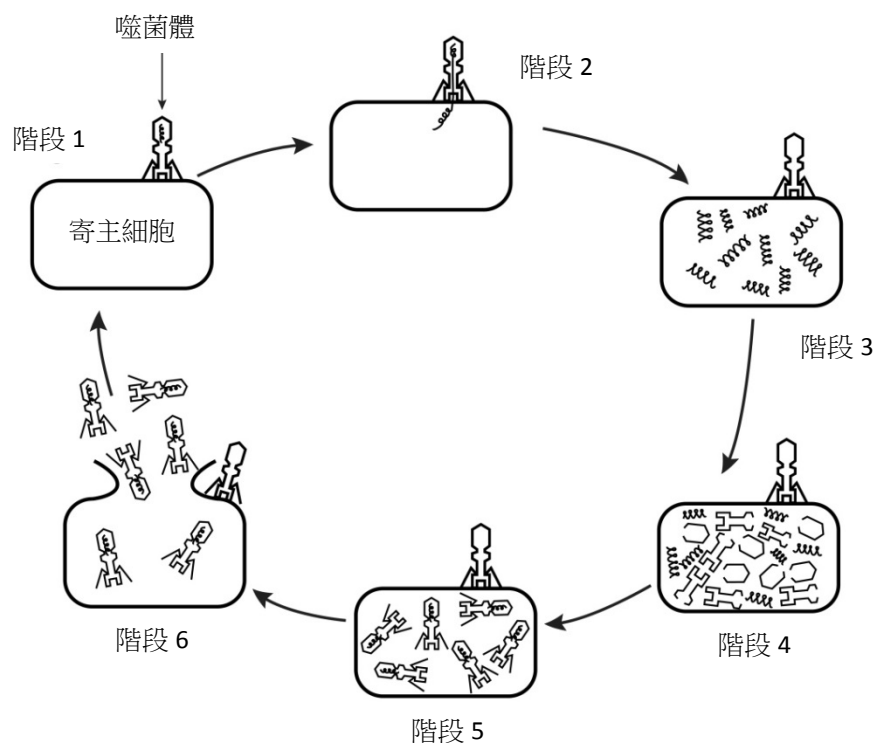
40. 下表是三類細胞的比較。

亞細胞結構	細菌細胞	動物細胞	植物細胞
X	無	有	有
Y	有	無	有
Z	有	有	有

X、Y 和 Z 可能分別是

- A. 細胞膜、細胞壁和線粒體。
- B. 核膜、葉綠體和核糖體。
- C. 細胞膜、溶酶體和線粒體。
- D. 核膜、細胞壁和核糖體。

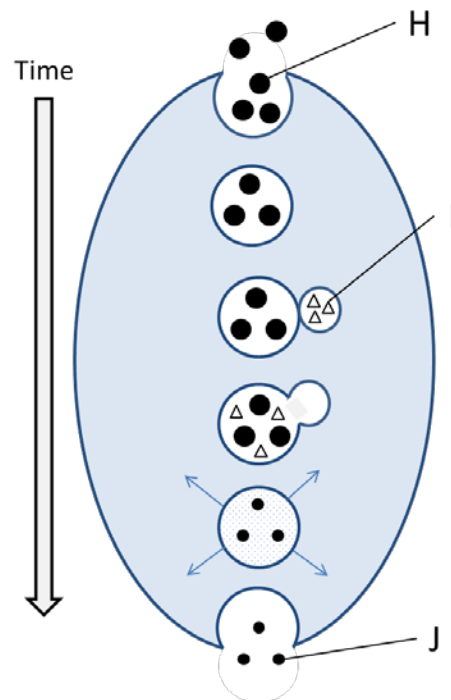
41. 噬菌體是一種能侵襲細菌細胞的病毒。噬菌體的生活史如下所示。



根據以上的生活史，下列哪項關於噬菌體的陳述是不正確的？

- A. 在進行複製之前，整個噬菌體會進入寄主細胞。
- B. 噬菌體的核酸和蛋白質外殼是分開合成的。
- C. 侵染週期的第一步是噬菌體附著到寄主細胞。
- D. 噬菌體將細菌細胞轉化為生產噬菌體的工廠。

42. The diagram below shows how a unicellular heterotrophic organism obtains nutrient.



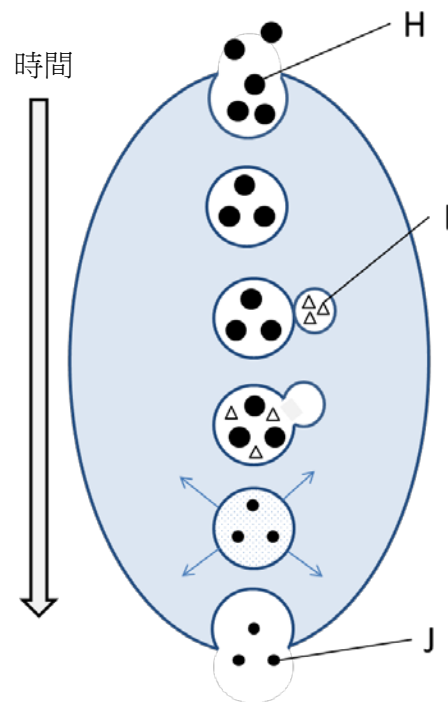
H, I and J are

- A. insoluble undigested material, food particle and enzyme, respectively.
- B. protein, protease and amino acid, respectively.
- C. food particle, enzyme and insoluble undigested material, respectively.
- D. amino acid, protease and protein, respectively.

43. We use our teeth to break up food into small pieces. Such kind of mechanical breakdown can

- A. break carbohydrate & protein into sugar molecules and amino acids.
- B. result in food particles which are small enough to pass across the membrane.
- C. give the food a larger surface area which aids later physical digestion.
- D. give the food a larger surface area which aids later chemical digestion.

42. 下圖顯示某單細胞異養生物如何獲得營養物。



H、I 和 J 分別是

- A. 不溶性未被消化的物料、食物顆粒和酶。
- B. 蛋白質、蛋白酶和氨基酸。
- C. 食物顆粒、酶和不溶性未被消化的物料。
- D. 氨基酸、蛋白酶和蛋白質。

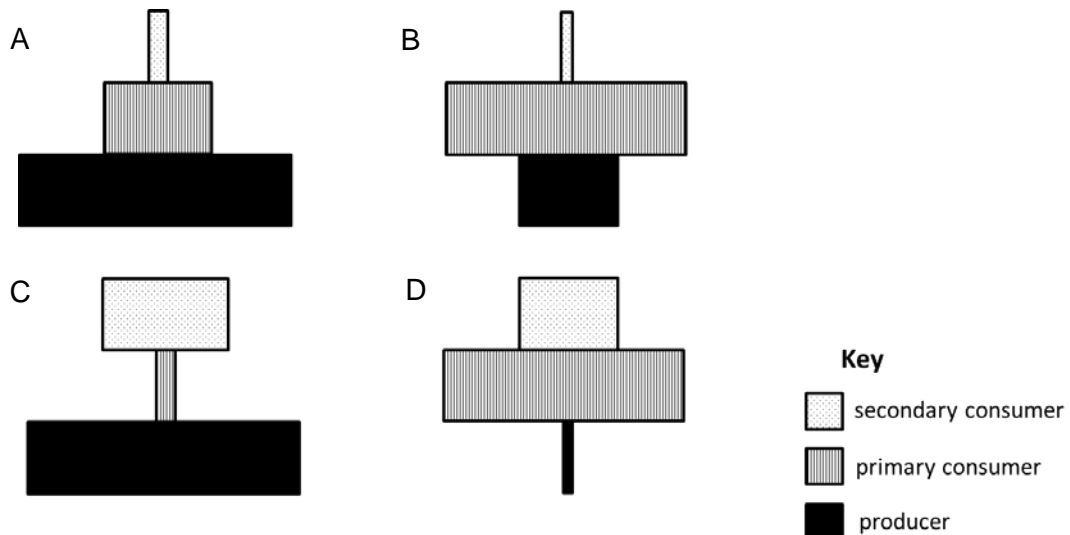
43. 我們用牙齒將食物分解成為小塊，這種機械性分解能夠

- A. 將碳水化合物和蛋白質分解為糖分子和氨基酸。
- B. 形成足夠細小的食物顆粒，使它們能穿過膜。
- C. 增加食物的表面積，有助隨後的物理消化。
- D. 增加食物的表面積，有助隨後的化學消化。

44. A food chain is observed as below:

Tree → Worms on tree → Birds

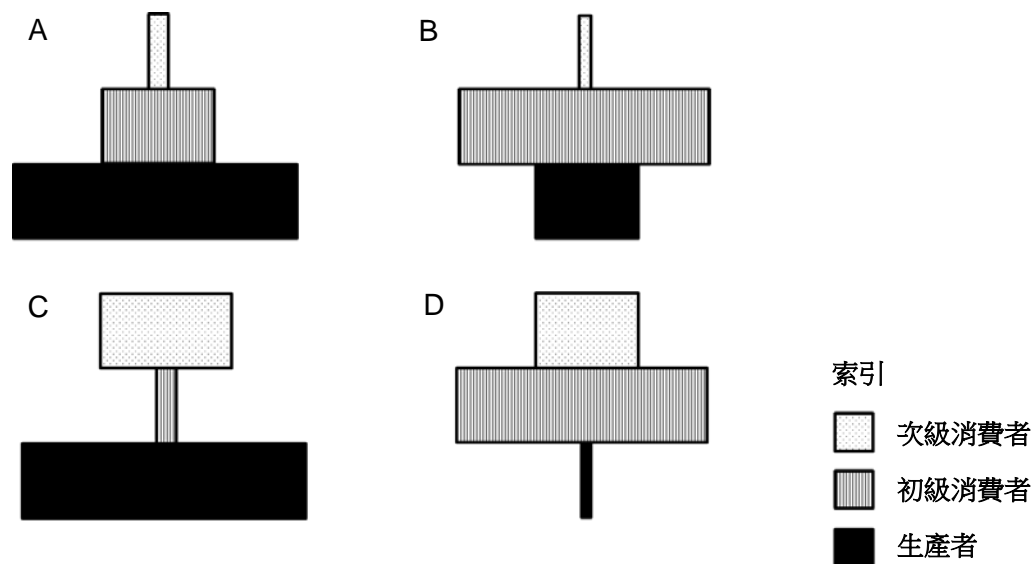
Given that a pyramid of numbers is a chart which shows the population size of each organism in a food chain, which diagram below is the best possible pyramid of numbers for this food chain?



44. 某食物鏈如下所示：

樹 → 樹上的蠕虫 → 鳥

已知數量錐體是一個圖表，用以顯示食物鏈中每種生物的族群大小。下列哪圖最可能是代表這個食物鏈的數量錐體？



45. Below is a table about sex determination in human:

Genotype	Phenotype
XY	Male
XX	Female
X	Female
XXY	Male

Based on the table, which of the following statements about sex determination in human are possibly CORRECT?

- I. Y chromosome makes a human male.
 - II. X chromosome makes a human female.
 - III. Y chromosome leads to the production of a substance which causes the undifferentiated gonads to become testes, not ovaries.
 - IV. X chromosome leads to the production of a substance which effectively inhibits the development of testes.
-
- A. I & II only.
 - B. I & III only.
 - C. I, II & III only.
 - D. I, II, III & IV.

End of Paper

45. 下表是有關人類性別決定的資料：

基因型	表現型
XY	男性
XX	女性
X	女性
XXY	男性

根據上表，下列哪項關於人類性別決定的陳述可能是正確的？

- I. Y 染色體令人類成為男性。
 - II. X 染色體令人類成為女性。
 - III. Y 染色體導致某種物質的合成，令尚未分化的生殖腺成為精巢而非卵巢。
 - IV. X 染色體導致某種物質的合成，有效抑制精巢的發育。
-
- A. 只有 I 和 II.
 - B. 只有 I 和 III.
 - C. 只有 I、II 和 III.
 - D. I、II、III 和 IV.

全卷完

2017 國際初中科學奧林匹克 – 香港選拔賽

問題簿

參賽者編號

:

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。

International Junior Science Olympiad 2017

Hong Kong Screening

Student Name _____ (English) _____ (Chinese)

School Name _____

MULTIPLE CHOICE ANSWER SHEET

USE AN HB PENCIL or PEN

Mark your answers as follows:

23. ☐ ☐ ☒ ☐

DO NOT FOLD THIS SHEET

- | | A | B | C | D |
|-----|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 6. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 7. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 12. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 14. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 17. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 18. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 21. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 23. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 24. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 26. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 27. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

- | | A | B | C | D |
|-----|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 28. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 31. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 32. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 33. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 37. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 38. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 40. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 41. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 42. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 43. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 44. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 45. | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |