下列單選選擇題每題 2 分，**答錯者倒扣 0.5 分**

1. Anabolism 是指生物(a)氧化物質化學作用(b)將物質加以分解提供能量作用(c)將物質合成貯存能量作用(d)以上皆非。
2. Bone 上的 Haversian canal 是指(a)marrow cavity 之管道(b)spongy bone 上之空隙(c)compact bone 上之同心圓之中心(d)以上皆非。
3. photosynthesis 中之 proton gradient 是(a)電子傳遞(b)氫離子通過 thylakoid (c)水分子分解(d)接受 photon。
4. photosynthesis 會進行 cyclic potophosphorylation 是因為缺乏(a)ADP (b)ATP (c)NADPH (d)以上皆非。
5. photorespiration 是指(a)合成 ATP 及產生 CO_2(b)合成 ATP 及產生 O_2(c)不合成 ATP，但產生 CO_2(d)不合成 ATP，但產生 O_2。
6. cyanobacteria 之營養合成是由(a)heterotrophy (b)chloroplast (c)photosynthetic lamellae (d)以上皆非。
7. bacteria 之生殖法中那一種需要 bacteriophage 之協助(a) transduction (b) transformation (c)conjugation (d)以上皆非。
8. bacteria 之 mesosome 與何者無關(a)metabolism (b)nutrition (c)reproduction (d)respiration。
9. 那一類生物之 spore 不屬於生殖行為(a)bacteria (b)protozoa (c)fungus (d)sponge。
10. protostomes 生物之發生為(a)spiral cleavage, determinate(b)spiral cleavage, indeterminate(c)radial cleavage, determinate(d)radial cleavage, indeterminate。
11. 烏賊是屬於那一個動物門(a) Mollusca (b) Annelida (c) Arthropoda (d) Echinodemata。
12. 牡蠣是屬於那一個動物門(a) Mollusca (b) Annelida (c) Arthropoda (d) Echinodemata。

13. multicellular 生物形成之主因(a)增加體重(b)增加體積(c)增加表面積(d)增加生物活性。

14. 不屬於 pancreas 分泌者為(a)sodium bicarbonate solution (b)Enzyme (c)insulin (d)以上皆非。

15. glucose 變為 glycogen 稱為(a)gluconeogensis (b)glycogenesis (c)glycolysis (d)以上皆非。

16. 那一種功能不屬於 circulatory system(a)transport nutrients (b)transport carbon dioxide (c)defense (d)以上皆非。

17. Leukocytes 中 Basophils 之功能為(a)phogocytosis (b)macrophages (c)produce antibodies (d)以上皆非。

18. Leukocytes 中 Lymphocyt 之功能為(a)phogocytosis (b)macrophages (c)produce antibodies (d)以上皆非。

19. 使心臟如同一個巨大細胞般之收縮是因為有(a)intercalated disc (b)pacemaker (c)heart valves (d) 以上皆非。

20. 動物經代謝後產生之廢物中那一種毒性最高(a)ammonia (b)urea (c)uric acid (d)keto acid。

21. Bowman's capsule 中之濾液成分與血液比較則(a)完全一樣(b)缺少蛋白質(c)缺少醣類(d)缺少礦物質。

22. Endoderm 可成(a)nervous system (b)reproductive system (c)circulatory system (d)respiratory system。

23. Hardy-Weinbery Law 所設定的 gentic equilibrium 之條件是(a)在小族群下(b)在大族群下(c)兩個不同族群比較(d) 以上皆非。

24. Genetic drift 會發生於(a)小族群(b)大族群(c)個體(d)細胞。

25. subtidal region 是指(a)河口區(b)高潮線以上區(c)低潮線以下區(d)淡水侵入區。

填充題，每格 2 分

1. 細胞的 resting membrane potential 是指_____的電位差，形成機制是因 cell membrane 具_____pump。
2. 動物體的 chemical signals 依其化學成分可分為_____類和_____類。其合成方法分別為_____和_____，其 receptor 分別分佈在細胞的_____和_____。
3. 蝦的 circulatory system 是屬_____；魚是屬 closed circulatory system，有_____system 和_____system。
4. Heart 的 stroke volume 是指_____。其大小是由_____和_____決定。
5. Capillary 的 filtration rate 是由管壁內外的_____和_____pressure 決定。
6. 細胞膜的 fluid mosaic model 是指_____其 fluidity 可受_____、_____等的影響。
7. 依能量觀點說明單細胞演化為多細胞生物的原因為_____和_____。
8. 細胞間聯結的方式有_____、_____、_____和_____。

共 25 題選擇題（單選），每題 4 分，不做答以 0 分計，答錯倒扣 1 分。

1. 1 μm (micrometer) is ①1000 m ②1 m ③$10^{-3}$ m ④$10^{-6}$ m ⑤$10^{-9}$ m

2. The name of H^- is ①hydrogen ②hydride ③proton ④hydrogen minus ⑤hydrogen negative

3. A silicon chip used in an integrated circuit of a microcomputer has a mass of 5.68 mg. How many silicon (Si) atoms are present in the chip? (The atomic weight of Si is 28.08). ①0.202 ②$2.02\times10^{-1}$ ③$1.22\times10^{20}$ ④$1.22\times10^{23}$ ⑤$1.22\times10^{26}$

4. What volume of 16 M sulfuric acid must be used to prepare 1.5 L of a 0.10 N H_2SO_4 solution? ①9.4 L ②9.4 mL ③4.7 L ④4.7 mL ⑤none of the above

5. Which of the following reactions is not a redox reaction?
   ①$Ag^+ + Cl^- \rightarrow AgCl$
   ②$2Na + Cl_2 \rightarrow 2NaCl$
   ③$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
   ④$2S_2O_3^{2-} + I_3 \rightarrow S_4O_6^{2-} + 3I^-$
   ⑤none of the above

6. Calculate the equilibrium constant K at 25℃ for the reaction
   $3Tl^+_{(aq)} \rightarrow Tl^{3+}_{(aq)} + 2Tl_{(s)}$ $E^0 = -1.60V$
   ①$K=10^{-1.60}$ ②$K=10^{1.60}$ ③$K=10^{-27}$ ④$K=10^{27}$ ⑤none of the above

7. A sample of methane gas that has a volume of 5 L at 20 °C is heated to 40°C at constant pressure. Calculate its new volume. ①5 L ②5.34 L ③10 L ④10.34 L ⑤10.68 L

8. When a reaction results in the evolution of heat, it is said to be ①exothermic ②endothermic ③isothermic ④hyperthermic ⑤hypothermic

9. Which of the following ion (atom) has the largest radius? ①O^{2-} ②F^- ③Ne ④Na^+ ⑤Mg^{2+}

10. Which of the following electron transfer process between the different energy levels of hydrogen atom requires least energy? ①level n=1 to level n=2 ②n=2 to n=3 ③ n=3 to n=4 ④ n=4 to n=5 ⑤ n=5 to n=6 (level n=1: ground state, n=2: first excited state, etc.)

11. Which of the following is a possible set of quantum numbers for an electron?
①n= 2, ℓ= 1, m_ℓ= 0, m_s= 0
②n= 1, ℓ= 1, m_ℓ= 1, m_s= +1/2
③n= 3, ℓ= 2, m_ℓ= -3, m_s= +1/2
④n= 4, ℓ= 0, m_ℓ= 0, m_s= -1/2
⑤n= 1, ℓ= 1, m_ℓ= 1, m_s= +1/2

12. Which of the following molecule has the largest dipole moment? ①F_2 ②Br_2 ③HF ④HBr ⑤FBr

13. A buffer solution was prepared by mixing 1 L of 0.01 M HCOOH solution and 1L of 0.1 M HCOONa solution. The pH value of 4.7 was observed for this buffer solution. The pKa of HCOOH should be around ①5.7 ②4.7 ③3.7 ④0.47 ⑤47

14. What is the pH of a 0.1 N CH_3COOH solution? (pKa of CH_3COOH is 5) ①1 ②2 ③3 ④4 ⑤5

15. pKa value is a common way of describing the strength of an acid. Which one of the following acids has the largest pKa value? ① CH_3COOH ② CH_2FCOOH ③ $CH_2BrCOOH$ ④ CH_2FCOOH ⑤ $CHBr_2COOH$

16. Give the correct relationship between the change in standard free energy (ΔG^o) and the equilibrium constant (K) for a given reaction. ①ΔG^o=0, K=0 ②ΔG^o=0, K=1 ③ΔG^o=1, K=1 ④ΔG^o<0, K<0 ⑤ΔG^o>0, K>0

17. Which one is not an organic compound? ①CH_4 ②HCHO ③HCOOH ④H_2CO_3 ⑤CH_3NH_2

18. The name of polymer $(CH_2-CHCl)_n$ is ①PE ②PP ③PVC ④Teflon ⑤Polystyrene

19.For the reaction

$$A \rightarrow \text{Products}$$

we have found that the rate law is

$$\text{Rate} = -\Delta[A] / \Delta t = k\,[A]$$

If the initial concentration of A is 0.1M and 99 % of A has been consumed 20 minutes later, what is the half-life of this reactant A? ①1.0 min ②1.5 min ③2.0 min ④2.5 min ⑤3.0 min

20.For a general reaction involving a single reactant,

$$A \rightarrow \text{Products}$$

which is second order in A, the rate law is

$$\text{Rate} = -\Delta[A] / \Delta t = k\,[A]^2$$

The half-life of this reactant is ①$1/k$ ②$1/ k[A]_0$ ③$1/2k[A]_0$ ④$1/k[A]^2_0$ ⑤$1/2k[A]^2_0$

($[A]_0$ is the initial concentration of A)

21.A balloon is being inflated to is full extent by heating the air inside it. In the final stages of this process, the volume of the balloon changes from 4.00×10^6 L to 4.50×10^6 L by addition of 1.3×10^6 J of energy as heat. Assuming the balloon expends against a constant pressure of 1.0 atm, then, ΔE for this process is ①$1.3\times10^6$ J ②-1.8×10^8 J ③-8×10^7 J ④$1.8\times10^8$ J ⑤$8\times10^7$ J

(To convert between L×atm and J, use 1 L×atm=101.3 J)

22.At constant pressure, the change in enthalpy (ΔH) of a system is equal to ①q ②w ③q + w ④ΔE ⑤ΔE- q (ΔE represents the change in internal energy, q represents heat and w represents work.)

23.Which molecule has the lowest oxidation state in carbon?
①H_2CO_3 ②HCOOH ③HCHO ④CH_3OH ⑤HCOONa

24.Which of the following processes is called saponification?
①$RCOOR' + OH^- \rightarrow$
②$RCOOR' + H^+ \rightarrow$
③$RCOOH + OH^- \rightarrow$
④$RCOOH + H^+ \rightarrow$
⑤$RCOOH + H_2O \rightarrow$

25.The reaction

$$A + B \underset{k_r}{\overset{k_f}{\rightleftharpoons}} C + D$$

has the forward rate constant k_f and reverse rate constant k_r. The equilibrium constant K of this reaction is ① k_fk_r ②$1/ k_fk_r$ ③ k_f/ k_r ④ k_r / k_f ⑤ $k_f - k_r$