高雄醫學大學 106 學年度學士後醫學系招生考試試題

科目：英文　　考試時間：80 分鐘

說明:一、「選擇題」用2B鉛筆在「答案卡」上作答，修正時應以橡皮擦擦拭，不得使用修正液（帶），未遵照正確作答方法而致電腦無法判讀者，考生自行負責。

二、「非選擇題」部分以「答案卷」作答，作答時不得使用鉛筆，違者該科答案卷不予計分；限用黑色或藍色墨水的筆書寫。

三、試題、答案卡及答案卷必須繳回，不得攜出試場。

I. Vocabulary: 20 points

【單選題】每題 1 分，共 20 題，答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

A. Please choose the BEST answer to match with each underlined word.

1. The Prime Minister has **repudiated** racist remarks made by a member of the Conservative Party.
(A) approved (B) assented (C) confirmed (D) spurned (E) ratified

2. In the face of a **recession** of the business, he decided to travel to the other countries to learn about foreign production methods.
(A) stagnation (B) reflation (C) devotion (D) emigration (E) inflation

3. A series of **atrocious** acts committed by ISIS have provoked anger around the globe.
(A) destructive (B) appalling (C) virtuous (D) falling (E) alluring

4. The President's speech has **prompted** an angry response from both political parties.
(A) provoked (B) extinguished (C) discouraged (D) restrained (E) celebrated

5. A great proportion of laborers, having lost their plots of lands, had no **subsidiary** earnings to cushion themselves against unemployment.
(A) advantageous (B) managing (C) supreme (D) supplementary (E) dominant

6. Freedom of expression is the **matrix**, the principle substance, of nearly every form of invention.
(A) mixture (B) origin (C) effect (D) custom (E) adjustment

7. There have been many leaders in the world, but Adolf Hitler is considered the ultimate **monstrous** dictator who entered the extraordinary stage of history.
(A) glorious (B) magnificent (C) gigantic (D) outrageous (E) miniature

8. Oil was used instead of water in magnetic compass to stabilize the compass disk from **erratic** movement.
(A) noticeable (B) mercurial (C) constant (D) unoriginal (E) threadbare

9. The gardening art in Central Florida makes the landscape **vibrant** and bright.
(A) muffled (B) vigorous (C) inactive (D) sluggish (E) apathetic

10. People in Minneapolis have called for a **boycott** of a local shopping mall over the unfair treatment of employees of color in hiring, promotion, and discipline.
(A) champion (B) advocate (C) patronage (D) repression (E) protest

B. Please choose the BEST answer to complete each sentence.

11. One of the new smartphone's features is a magnetic wireless data transfer feature which keeps accessories from being made _____ by new connection standards.
(A) obsolete (B) navigating (C) essential (D) graphic (E) sensational

12. The key to avoid resource exhaustion is _____ — finding new and efficient ways of conserving more and consuming less.
(A) reasonability (B) profitability (C) achievability (D) attainability (E) sustainability

13. If the product doesn't work, the customers are given an option of a refund or a _____.
(A) transaction (B) redemption (C) commission (D) provision (E) replacement

14. Leonardo Da Vinci _____ us with his knowledge of invention, painting, sculpting, architecture, science, music, and mathematics.
(A) dazzled (B) deemed (C) abolished (D) addicted (E) obliged

15. You must have heard about *The Phantom of the Opera*. Its German language production _____ at the *Theater an der Wien* in December 1988.
(A) premiered (B) predicted (C) preceded (D) precluded (E) pre-oriented

16. A _____ of artists gathered in Berlin to display their innovative and grotesque artworks.
(A) block (B) form (C) coterie (D) loner (E) barrel

17. The general manager of the company refuted the _____ of misdirected investment concerning the decline of sales performance in the first quarter.
(A) allegations (B) elongation (C) allocation (D) deletion (E) adulation

18. Jack the Ripper was one of Britain's most _____ serial killers who took prostitutes' lives away in the slums of the East End of London.
(A) exquisite (B) notorious (C) qualitative (D) tedious (E) nutritious

19. The erudite scholar always delivers his speech in a _____ way, which always makes audience get lost in the labyrinth of lore.
(A) profound (B) frivolous (C) transparent (D) disturbing (E) propitious

20. After the occurrence of the 10th North Korean missile launch, UN Security Council _____ to call an emergent meeting.
(A) colluded (B) counseled (C) tumbled (D) scrambled (E) disposed

II. Grammar and Structure: 10 points

【單選題】每題 1 分，共 10 題，答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

A. Please choose the <u>BEST</u> answer to complete each sentence.

21. The bookstore _____ closed many years ago but for the insistence of the customers to keep it open.
(A) would be (B) were (C) would have been (D) had been (E) has been

22. Laughter can reduce the effects that stress brings to us. Experts recommend that the stress sufferer _____ something funny nearby.
(A) keeping (B) to keep (C) has to keep (D) keep (E) is to keep

23. Mary is criticized as a "fallen woman" for her extramarital affair with the boss. _____ hard she tries to prove her ability in the workplace, she never gains the credit she deserves.
(A) However (B) Whatever (C) How (D) Whoever (E) No matter what

24. _____ journalists manipulate the order of the information to achieve more drama or other effects in their writing is inherent in all journalism.
(A) While (B) Which (C) That (D) However (E) Thus

25. Researchers built computer stimulations to compare 63 fossilized skulls from ancient times — each _____ to a different species — to 13 modern whales.
(A) correspond (B) corresponding (C) is corresponding (D) corresponded (E) corresponds

B. For each sentence, please choose one underlined part that contains <u>FAULTY</u> English.

26. <u>On</u> (A) the evening of the poll, all candidates tried their best to <u>address to</u> (B) the public <u>concerning</u> (C) their political views and future prospects with a view to <u>winning</u> (D) a <u>landslide victory</u> (E).

27. For every inch you tilt your head <u>forward</u> (A), the pressure <u>on</u> (B) your spine <u>doubles</u> (C). So if you're looking at a smartphone <u>in</u> (D) your lap, your neck is holding up <u>which</u> (E) feels like 20 or 30 pounds.

28. Singapore's only landfill is a <u>20-minute</u> (A) ferry ride <u>south from</u> (B) the main island. It is the home of coconut trees and banyan bushes. <u>All</u> (C) the trash from Singapore's <u>4.4 million</u> (D) residents <u>has dumped</u> (E) here 24 hours a day, seven days a week.

29. Neither Prince <u>nor</u> (A) Molly <u>were wearing</u> (B) seatbelts, according to the accident reports, and <u>it is likely</u> (C) that Molly <u>would have survived</u> (D) the crash <u>had</u> (E) she been wearing her seatbelt.

30. The perception of attractiveness is multimodal, <u>meaning</u> (A) it <u>does not reliant on</u> (B) just one factor, <u>such as</u> (C) physical appearance, <u>but rather</u> (D) multiple factors, <u>including</u> (E) body order and voice.

III. Reading Comprehension: 40 points

【單選題】每題 2 分，共 20 題，答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

Please read the following chart/excerpts/passages closely and then choose the <u>BEST</u> answer for each of the questions according to the contents.

When humans first ventured out of Africa some 60,000 years ago, they left genetic footprints still visible today. By mapping the appearance and frequency of genetic markers in modern peoples, we create a picture of when and where ancient humans moved around the world. These great migrations eventually led the descendants of a small group of Africans to occupy even the farthest reaches of the Earth.

Our species is an African one: Africa is where we first evolved, and where we have spent the majority of our time on Earth. The earliest fossils of recognizably modern *Homo sapiens* appear in the fossil record at Omo Kibish in Ethiopia, around 200,000 years ago. Once the climate started to improve, the population expanded, and some intrepid explorers ventured beyond Africa. These early beachcombers expanded rapidly along the coast to India, and reached Southeast Asia and Australia by 50,000 years ago. Around 20,000 years ago a small group of these Asian hunters entered the East Asian Arctic during the Last Glacial Maximum. At this time the great ice sheets covering the far north had literally sucked up much of the Earth's moisture in their vast expanses of white wasteland, dropping sea levels by more than 300 feet. This exposed a land bridge that connected the Old World to the New, joining Asia to the Americas. People's journey never ended. By 14,000 years ago they had penetrated the land south of the ice, and made it all the way to the tip of South America. Is this part of story amazing?

31. This essay falls into the research field of _____.
(A) genetic engineering (B) biotech engineering (C) romantic history (D) travel literature (E) migration studies

32. Please tell the reason why we human species can be called "African one".
(A) Because we were all born in Africa.
(B) Because genetic footprints proved that humans first evolved in Africa.
(C) Because Ethiopian people have a longer history of civilization.
(D) Because Africans moved to Asia.
(E) Because the population of Africans is larger.

33. What is the purpose of this essay?
(A) The author suggests we should take a trip to Africa.
(B) The author's purpose is to theorize the importance of human over other animals.
(C) The author argues about human rights.
(D) The author proposes a map of human migration.
(E) The author wants to discover America.

34. According to the essay, which statement is correct?
(A) Some 50,000 years ago, people knew how to reach Asia by reading the stars in the sky.
(B) Humans moved to South America two thousand years ago.
(C) Migration studies can help us understand human history and geographical exploration.
(D) One group of people chose to stay in Iceland.
(E) Asian hunters were brave enough to reach the Arctic.

35. In what way can the scientists produce the migration theory of *Homo sapiens*?
(A) Genetic analysis
(B) Horoscope
(C) Historical records
(D) Fiction
(E) Story tellers

The statue of the "raging bull" is world renown. Seeing it and taking a photo of it is a must for tourists. Its popularity, however, is not just about its huge size and expressive pose.

Do you know where the "raging bull", a 3,175 kg bronze, is located? What is the reason for its obvious might? It was created by the American-Italian sculptor Arturo di Modica and was meant to stand for "strength, power, and hope of the American people for the future".

The figure was first delivered to the New York Stock Exchange, Wall Street, on December 15, 1989 as a Christmas present to the citizens. It was **confiscated** by city government, but the public vocalized their opinions so loudly that it was displayed in Bowling Green Park where it still remains, just south of the Stock Exchange and facing Broadway. Di Modica gave the gift because of the hopelessness felt by the people after the 1987 financial crisis on Wall Street. The bull became much more applicable in 2008 than in 1989 when it was first given.

36. What did Arturo di Modica believe the bull could do when he created it?
(A) Show that anger cannot help you succeed.
(B) Teach you that the Stock Exchange is difficult to rein, like a bull.
(C) Remind people of the mistakes they made during 1987.
(D) Outcry for the public about their rage against the impotent government during the financial crisis.
(E) Give the American people hope and the realization that they have the strength to overcome difficulties.

37. In the third paragraph, what is the synonym of the word “confiscate”?
(A) relinquish (B) abuse (C) expropriate (D) displace (E) forfeit

38. Why do you think this article was written about the “raging bull”?
(A) The author was relaying a message to readers about the strength of the bull compared to the struggles of financial institutions in the stock market.
(B) It was written for lovers of art and sculpture who want to include viewing the statue as a part of a cultural event.
(C) The author intended to show the power of a bull to those who live in a big city and are not able to see such animals in person.
(D) The author wanted to send a message that America’s future is bright, because the bull stands for perfection in its financial system.
(E) The author aimed to narrate America’s financial history in the 1970s by the story of the bull.

39. According to the article, which of the following statements about the bull is **incorrect**?
(A) It was a Christmas gift for the New York people.
(B) It has been standing in Bowling Green Park for more than two decades.
(C) No tourist would want to skip the iconic sight of the famous bull when they visit the Wall Street.
(D) The raging bull is only temporarily permitted to stand on the city property and will be moved to Broadway in 2008.
(E) The pose of the bull is a symbol of financial optimism, encouraging New York citizens not to lose hope.

40. What is the author’s opinion about the “raging bull” as part of the culture of New York City and America at large?
(A) It is a controversial but inspiring piece of artistic object.
(B) It is supposed to be confiscated by the city government.
(C) It is a sarcastic showing of pride given the details of the stock market’s financial crises.
(D) It stands for the public protest against the heartless financial market.
(E) It is a very worthy, meaningful piece of art by a sculptor with good intentions.

In India’s capital, new housing sprawls as far as the eye can see, a symbol of the world’s fastest growing major economy. There also are towering symbols of the environmental cost of all this. Ghazipur, one of the city’s landfills, more than 10 stories high, an accumulation by now of more than 10 million tons of waste, is one of the biggest problems in India now. Trucks are bringing in an additional 2,000 tons of unsorted garbage here every day.

The trash problem is now a crisis at many levels. First, India is on the _____ zone, so if there is an earthquake, the mound of trash would slide down. Even without an earthquake, **festering** garbage would spew toxins into the air while a stew of heavy metals and organic and inorganic pollutants washes into the soil when it rains.

Now a company, contracted by Indian government, attempts to tackle this crisis by a power plant to convert waste to energy, sent to the electric grid. However, this is not the first attempt at creating energy from waste. Previous ones haven’t worked, according to environmental activists, because of the inability to sort and segregate the waste which is then used for **incineration**. If the trash isn’t sorted properly, you may have both very toxic emissions that come out of the plant and fuel of very poor quality that is generated. The proper segregation of the trash fails because in a caste society like India, waste has been the domain of people on the lowest rung of the age-old social hierarchy, not the middle classes who generate most of it.

41. According to the article, which of the following statements is correct?
(A) Cleaners have to sort 2,000 tons of garbage in Ghazipur everyday.
(B) The tallest skyscraper in the capital of India is 10 stories high.
(C) The economic growth encourages India to abolish its age-old caste system.
(D) The landfill is a consequence accompanying the rising awareness of eco-friendliness.
(E) Toxic emissions out of the power plant may have to do with the heavy metals in the burned waste.

42. In the second paragraph, which of the following words best fits the blank?
(A) buffer
(B) landslide
(C) temperate
(D) seismic
(E) infertile

43. What is the main reason for the failure to segregate trash in India?
(A) The speed of generating trash is way much faster than cleaning it.
(B) Waste is always treated as someone else's problem.
(C) There is only one company in India in charge of 10 million tons of trash.
(D) Too many earthquakes in India cause the landfills to collapse.
(E) The toxic waste from the burning trash prevents the cleaners' job.

44. In the second paragraph, what is the meaning of the word "festering"?
(A) massive
(B) thriving
(C) venomous
(D) flourishing
(E) rotten

45. Which of the underlined words in the following sentences has the **similar** meaning of the word "incineration" in the third paragraph?
(A) Add the ingredients from your favorite recipe, boil for a few minutes, and then turn the heat down to <u>simmer</u> all day.
(B) The Florida Forest Service says more than 100 active wildfires <u>scorch</u> part of Florida, urging Governor Rick Scott to declare a state of emergency.
(C) Samsung claimed that one cause of <u>combustion</u> of the Galaxy Note 7 is a problem with the "battery management system".
(D) <u>Desiccation</u> damage in this season is a common problem that can lead to the death of formerly healthy plants.
(E) Microbes <u>decompose</u> organic waste into a mixture of methane and carbon dioxide.

Almost 2 billion people lack access to essential medicines. This deprivation causes immense and avoidable suffering: ill health, pain, fear, loss of dignity and life. Improving access to existing medicines could save 10 million lives each year, 4 million of them in Africa and South-East Asia. Besides deprivation, gross inequity in access to medicines remains the overriding feature of the world pharmaceutical situation. Average per capita spending on medicines in high income countries is 100 times higher than in low-income countries: about US$ 400 compared with US$ 4. WHO estimates that 15 percent of the world's population consumes over 90 percent of the world's production of pharmaceuticals. Especially, national supply systems for medicines often do not reach those living in poverty.

The human right to health means that everyone has the right to the highest attainable standard of physical and mental health, which includes access to all medical services, sanitation, adequate food, decent housing, healthy working conditions, and a clean environment. The human right to health guarantees a system of health protection for all. Everyone has the right to the health care they need and to living conditions that enable us to be healthy, such as adequate food, housing, and a healthy environment.

Existing national and international policies, rules and institutions give rise to these massive deprivations and inequalities. Our current goals include reducing child mortality, improving maternal health, and combating HIV/AIDS, malaria and other diseases in the world.

46. Which is the most appropriate title of this essay?
(A) Human Right to Health and Health Care
(B) Importance of Human Right
(C) A Need for a Healthy Environment
(D) Health Care for Public Good
(E) Medical and Health Care

47. According to the essay, what is the cause of inequalities of medicine and public care?
(A) Gross inequity
(B) Military expanses
(C) Personal saving
(D) Too many high income countries
(E) War

48. WHO estimates that 15 percent of the world's population consumes over 90 percent of the world's production of pharmaceuticals. What is the implication of this sentence?
(A) It is easy to use data from national surveys.
(B) Increases in the cost of medical treatment make healthcare increasingly unaffordable.
(C) Socioeconomic problems of health disparities can be solved easily.
(D) People in under-developed places have difficulties getting access to health care.
(E) People from South-East Asia have better access to healthcare.

49. The human right to health means that everyone has the right to the highest attainable standard of physical and mental health. What is **NOT** considered as the example of attainable physical and mental health?
(A) opportunities to play sports
(B) sanitation
(C) adequate food
(D) clean environment
(E) healthy working conditions

50. Which statement is true?
(A) Cases of lacking medicine involve the right to freedom.
(B) We need to depend on rich merchants to eliminate inequalities.
(C) National supply system always functions well.
(D) Very few people in the world need access to medicine.
(E) Deprivation causes immense suffering of people.

IV. Essay Writing: 20 points

Please write a well-organized essay with at least 200 words to comment on part of the speech, "The Peril of Indifference," delivered by Elie Wiesel in 1999.

"Of course, indifference can be tempting — more than that, seductive. It is so much easier to look away from victims. It is so much easier to avoid such rude interruptions to our work, our dreams, our hopes. It is, after all, awkward, troublesome, to be involved in another person's pain and despair. Yet, for the person who is indifferent, his or her neighbors are of no consequence. And, therefore, their lives are meaningless. Their hidden or even visible anguish is of no interest. Indifference reduces the other to an abstraction".

高雄醫學大學 106 學年度學士後醫學系招生考試試題

科目：普通生物學及生化概論　　考試時間：100 分鐘

說明：一、選擇題用 2B 鉛筆在「答案卡」上作答，修正時應以橡皮擦擦拭，不得使用修正液(帶)，未遵照正確作答方法而致電腦無法判讀者，考生自行負責。
二、試題及答案卡必須繳回，不得攜出試場。

I.【單選題】每題 1 分，共計 30 分。答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。
1~15 題為普通生物學，16~30 題為生化概論。

1. _____ is to xylem as _____ is to phloem.
(A) Sclerenchyma cell; parenchyma cell (B) Apical meristem; vascular cambium
(C) Vessel element; sieve-tube member (D) Cortex; pith
(E) Vascular cambium; cork cambium

2. What type of microscopy is used to take the following image?

(A) Confocal microscopy (B) Transmission electron microscopy
(C) Scanning electron microscopy (D) Epifluorescence microscopy
(E) Light sheet microscopy

3. What do hagfishes and lampreys have in common with the extinct conodonts?
(A) lungs (B) the jawless condition (C) bony vertebrae
(D) their mode of feeding (E) swim bladders

4. The advent of facile genome engineering using the bacterial RNA-guided CRISPR-Cas system in many organisms is transforming biology. Which one is **NOT** part of the class 2 CRISPR gene editing tool?
(A) crRNA (B) Cas9 endonuclease (C) miRNA
(D) tracrRNA (E) sgRNA

5. The growth model of a logistic population, dN/dt=rN[(K-N)/K], describes a population's growth when an upper limit to growth is assumed. While N numerically approaches the value of K, _____.
(A) dN/dt increases rapidly (B) dN/dt decreases rapidly
(C) dN/dt increases slowly (D) dN/dt approaches 0
(E) the population is extincted

6. How many of the following is/are **NOT** found in extracellular matrix (ECM) of animal?
I. Fibronectins II. Collagens III. Laminins IV. Proteoglycans V. Pectin
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

7. How many of the following is/are antagonistic function?
I. sympathetic and parasympathetic nerves II. biceps and triceps muscles
III. insulin and glucagon IV. thyroid and parathyroid
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

8. In an electrocardiogram (ECG), there are three major signals. The first one is called P wave, the second one is QRS complex, and the third one is T wave. Which part of the ECG represents the delay of the activation of the atrioventricular node?
(A) P wave (B) Interval between P wave and QRS complex
(C) QRS complex (D) Interval between QRS complex to T wave
(E) T wave

9. What is **NOT** a criterion for evolution to happen in a natural population?
(A) Natural selection occurs
(B) Traits are inheritable
(C) Random mating happens
(D) Phenotypic difference exists
(E) Organisms produce more offspring than the environment can support

10. Which interaction between species would decrease the fitness of both species?
(A) Parasitism (B) Mutualism (C) Herbivory (D) Altruism (E) Competition

11. Protists are _____.
(A) larger prokaryotes
(B) the organisms first found by Antoni van Leeuwenhoek
(C) multicellular groups of eukaryotes
(D) the groups of organisms do not have Golgi apparatus but have mitochondria in cell
(E) the groups of organisms that lack cytoskeleton in cell

12. What are the levels of biodiversity?
(A) Phenotypic diversity, species diversity, ecosystems diversity
(B) Genetic diversity, species diversity, ecosystems diversity
(C) Genetic diversity, habitat diversity, ecosystems diversity
(D) Phenotypic diversity, species diversity, trophic-level diversity
(E) Genetic diversity, species diversity, trophic-level diversity

13. Mutations in which of the following genes lead to transformations in the identity of entire body parts?
(A) segmentation genes (B) inducers (C) homeotic genes
(D) egg-polarity genes (E) none of the above

14. Which organelle contains single membrane?
(A) ribosome (B) chloroplast (C) mitochondrion (D) nucleus (E) peroxisome

15. The uptake of low-density lipoproteins is through _____.
(A) pinocytosis (B) facilitated transport (C) receptor-mediated endocytosis
(D) simple diffusion (E) ion channel guided mechanism

16. What complex can be inhibited by hydrogen cyanide (HCN)?
(A) Complex I (B) Complex II (C) Complex III (D) Complex VI (E) Complex V

17. The linking number of supercoiled DNA can be changed by _____.
(A) DNA polymerase (B) Histone acetylase (C) DNA ligase (D) Topoisomerase (E) Ribozyme

18. What is the main place for fatty acid biosynthesis in cells?
(A) Mitochondria (B) Peroxisome (C) Cytosol
(D) Endoplasmic reticulum (E) Golgi

19. What following compounds is **NOT** required for purine biosynthesis?
(A) CO_2 (B) Glutamate (C) Aspartate
(D) N^5, N^{10}-Methenyl tetrahydrofolate (E) N^{10}-Formyl tetrahydrofolate

20. Binding of insulin to its receptor, which one of the following statements is correct?
(A) occurs on the β-subunit
(B) induces autophosphorylation
(C) reduces binding of cytosolic substrate proteins
(D) leads to the formation of cGMP
(E) produces DAG and IP_3

21. A lipid derived from isoprenoid precursors is _____.
(A) palmitate (B) cholesterol (C) arachidonate (D) prostaglandin E (E) sphingosine

22. The biological function of the pentose phosphate pathway is to _____.
(A) act as a source of ADP biosynthesis (B) supply energy (C) supply NADH
(D) supply ribose and NADPH (E) supply NAD

23. What is the direct product of pyruvate carboxylase?
(A) Acetyl-CoA (B) Citrate (C) Lactate (D) Phosphoenolpyruvate (E) Oxaloacetate

24. Which of the following enzymes of the citric acid cycle listed below results in the formation of a high energy phosphate compound?
(A) Succinate dehydrogenase (B) Succinyl-CoA synthetase (C) Isocitrate dehydrogenase
(D) Citrate synthase (E) α-Ketoglutarate dehydrogenase

25. Which of the following amino acids is a key gluconeogenic amino acid that is synthesized in muscle by transamination of glucose-derived pyruvate, released into the bloodstream, and taken up by the liver?
(A) Gly (B) Val (C) Ala (D) Leu (E) Pro

26. Fatty acid synthesis uses which unit for each stepwise addition?
(A) Acetyl-CoA (B) Malonyl-CoA (C) Methylglutaryl-CoA
(D) Methylmalonyl-CoA (E) Hydroxybutyryl-CoA

27. Which compound represents the most highly concentrated form of stored biological energy?
(A) Protein (B) Carbohydrate (C) Fatty acid (D) Nucleic Acid (E) Collagen

28. What following amino acid residues in some proteins can be hydroxylated?
(A) Serine (B) Tyrosine (C) Proline (D) Methionine (E) Glutamine

29. What following compounds can enhance inorganic iron absorption from our meal?
(A) Vitamin C (B) Vitamin A (C) Thiamine (D) Vitamin B_{12} (E) Vitamin B_6

30. If the isoelectric point (pI) of a protein is 5.8 at buffer pH=7.5, how is the protein electrically charged?
(A) positively-charged (B) negatively-charged
(C) electrically neutral (D) Not sure, depending on the size of the protein
(E) Not sure, depending on the buffer composition

Ⅱ.【單選題】每題 2 分，共計 120 分。答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。
31~60 題為普通生物學，61~90 題為生化概論。

31. Which structure is common to both gymnosperms and angiosperms?
(A) stigma (B) carpel (C) ovule (D) ovary (E) anthers

32. Which plant hormone is **NOT** correctly paired with its function?
(A) auxin － promotes stem growth through cell elongation
(B) cytokinins － initiate programmed cell death
(C) gibberellins － stimulate seed germination
(D) abscisic acid － promotes seed dormancy
(E) ethylene － inhibits cell elongation

33. Tidal volume in respiration is analogous to what measurement in cardiac physiology?
(A) cardiac output (B) heart rate (C) stroke volume (D) systolic pressure (E) diastolic pressure

34. Which combination of hormones helps a mother to produce milk and nurse her baby?
(A) prolactin and calcitonin
(B) oxytocin and prolactin
(C) follicle-stimulating hormone and luteinizing hormone
(D) luteinizing hormone and oxytocin
(E) oxytocin, prolactin, and luteinizing hormone

35. There are two main types of diabetes mellitus: type 1 and type 2. Each is marked by high blood glucose levels, but with different causes. Which of the following statement is **NOT** correct?
(A) Type 1 diabetes also called insulin-dependent diabetes.
(B) Type 2 diabetes is an autoimmune disorder in which immune system destroys the beta cells of pancreas.
(C) Insulin injections can control type 1 diabetes.
(D) Excess body weight and lack of exercise significantly increase the risk of developing type 2 diabetes.
(E) The majority of people have diabetes are type 2.

36. According to Hamilton's rule, kin selection causes genes to increase when $C < Br$, where C is the reproductive cost to the individual performing the act, B is the additional reproductive benefit gained by the recipient of the altruistic act, and r is the _____.
(A) genetic relatedness of the recipient to the actor (B) frequency of the altruistic allele
(C) inbreeding coefficient (D) rate of recombination
(E) return on investment

37. Sponges are composed of several distinct types, the activities of which are coordinated. Which of the following cell types of a sponge possesses a flagellum?
(A) Amoebocyte (B) Choanocyte (C) Epithelial (D) Spicule (E) Nematocyte

38. In a special population, 16 out of every 900 people has a cancer caused by a completely recessive allele, *b*. Assuming the population is in Hardy-Weinberg equilibrium, which of the following is the predictable percentage of individuals who carry the *b* allele but are **NOT** expected to develop the cancer?
(A) 4/900 (B) 32/900 (C) 208/900 (D) 676/900 (E) 884/900

39. Lichens have been the model organisms of symbiosis. What kind(s) of organisms is/are involved in the symbiosis?
(A) Ascomycete (B) Alga or cyanobacteria (C) Basidiomycete yeast
(D) A and B (E) A, B and C

40. How many of the following neurotransmitters is/are neuropeptide(s)?
I. Acetylcholine II. Gamma-aminobutyric acid (GABA) III. Norepinephrine
IV. Dopamine V. Serotonin VI. Endorphin
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

41. About plant endosperm, which statement is **NOT** correct?
(A) Endosperm is produced by the union of a central cell with a sperm cell.
(B) In angiosperms, an endosperm formed by the union of a sperm with three polar nuclei during double fertilization.
(C) The endosperm provides nourishment to the developing embryo in angiosperm seeds.
(D) The endosperm is a nutrient source for the embryo.
(E) Wheat endosperm is ground into flour for bread.

42. How many of the following about bacterial gene regulation is/are correct?
I. Tryptophan acts as a repressor in *trp* operon.
II. Allolactose acts as an activator in *lac* operon.
III. Catabolite activator protein (CAP) is activated by allolactose.
IV. The *lac* operon is turned on by an increase in glucose and an increase in cAMP.
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

43. The Nobel Prize winners provide great contribution to human. How many of the following people is/are Nobel Prize winner(s)?
I. Rosalind Franklin — provided X-ray photo of DNA for Watson and Crick.
II. Shinya Yamanaka — established induced pluripotent stem cells.
III. Brenner, Horvitz and Sulston — used *Caenorhabditis elegans* to study apoptosis.
IV. Barbara McClintock — found transposon.
V. Earl W. Sutherland — discovered signal transduction.
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

44. DNA double-strand breaks can lead to genome instability. Which DNA repair mechanism is error-free system to repair this kind of lesion in the growth phase of the G2 phase cell cycle?
(A) Homologous recombination
(B) Non-homologous end-joining
(C) Microhomology-mediated end joining
(D) Base mismatch repair
(E) Excision repair

45. How many of the following about the virus(es) is/are correct?
I. Papillomavirus — cause warts and cervical cancer; belong to dsDNA virus.
II. Poxvirus — cause cowpox; belong to dsDNA virus.
III. Picornavirus — cause hepatitis A; belong to ssRNA virus serves as mRNA.
IV. Coronavirus — cause SARA; belong to ssRNA virus serves as mRNA.
V. Paramyxovirus — cause measles and mumps; belong to ssRNA virus serves as template for mRNA synthesis.
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

46. What is the most appropriate genetic maker to measure the genetic variation within human populations using the comparative genomic methods?
(A) Ultra-conserved elements
(B) Single nucleotide polymorphisms
(C) Targeted enriched DNA fragments
(D) Protein-coding genes
(E) Transcriptomes

47. What is **NOT** an effect of genetic drift?
(A) Genetic drift is more significant in small populations.
(B) Genetic drift causes allele frequency to change and to fix in a population randomly.
(C) Genetic drift prefers advantageous alleles to fix in a population.
(D) Genetic drift could cause the loss of genetic variation in a population.
(E) Genetic drift may be one of the reasons that a harmful allele becoming fix in a population.

48. All animals are considered as a monophyletic clade that originated around 770 million years ago. In terms of their biology and diversity, which one below is **NOT** true?
(A) All animals have true tissues.
(B) Most of the diversity in animals occurs in Bilateria clade.
(C) In Bilateria, invertebrates do not share a common ancestor.
(D) In Bilateria, vertebrates share a common ancestor.
(E) Sponges are basal of all animals.

49. The elytron colors of ground beetles are polygenically inherited. If one male ground beetle was genotyped as AaBbCc and a female was genotyped as AaBbCc. The uppercase letters in the genotype are the dark-color alleles, and the lowercase letters are the light-color alleles. What is the probability of second darkest colored elytra in their immediate offspring?
(A) 6/64 (B) 15/64 (C) 20/64 (D) 12/64 (E) 1/64

50. Why do some social bees sacrifice their chance of reproduction and help the individuals in a group that are not their offspring? Which one below is **NOT** true about the evolution of this altruistic behavior?
(A) It is best explained by kin selection.
(B) The operating theory is called Hamilton's rule.
(C) The accounting of the fitness is called inclusive fitness.
(D) When the benefit to the recipient of altruism weighted by the relatedness of the individuals is smaller than the cost of fitness of altruist, altruism in the system would evolve.
(E) The coefficient of relatedness equals the fraction of genes that share among individuals.

51. What listed below can **NOT** lead to speciation?
(A) Allopatric distribution of two populations (B) Sexual selection among phenotypes
(C) Panmictic population (D) Polyploidy of the local species
(E) Hybridization of two species

52. During the history of the Earth, what is the time sequence of originations (from old to young) of the animals below?
(A) trilobites, dragonflies, reptiles, dinosaurs, primates
(B) trilobites, reptiles, dragonflies, dinosaurs, primates
(C) trilobites, dragonflies, dinosaurs, reptiles, primates
(D) dragonflies, trilobites, reptiles, dinosaurs, primates
(E) dragonflies, trilobites, dinosaurs, reptiles, primates

53. What is correct about the haploid or diploid of the cells during human gametogenesis?
(A) Spermatogonium is haploid. (B) Primary spermatocyte is haploid. (C) Oogonium is haploid.
(D) Primary oocyte is haploid. (E) Primary oocyte is diploid.

54. Which one could be the pollinator of the flower that has long floral tube?
(A) Bats (B) Flies (C) Bees (D) Hawk moths (E) Ants

55. Choose the correct match of glial cell type and function.
(A) Oligodendrocytes produce the myelin sheaths of myelinated neurons in the peripheral nervous system.
(B) Schwann cells provide nutritional support to non-myelinated neurons.
(C) Radial glia is the source of immunoprotection against pathogens.
(D) Astrocytes metabolize neurotransmitters and modulate synaptic effectiveness.
(E) None of the above.

56. Which plant group is **NOT** vascular plant?
(A) Ginkgo (B) Mosses (C) Conifers (D) Angiosperms (E) Ferns

57. Which protein is **NOT** involved in the fusion and fission process of mitochondria?
(A) COX (B) Drp1 (C) Opa1 (D) Mfn1 (E) Fis1

58. Olfactory receptors in mammals belong to _____.
(A) receptor tyrosine kinases (B) ion channels (C) G protein-coupled receptors
(D) proton pumps (E) small GTPase

59. HIV is the virus that causes AIDS. In the mid-1990s, researchers discovered an enzyme in HIV called protease. Once the enzyme's structure was known, researchers began looking for drugs that would fit into the active site and block it. If this strategy for stopping HIV infections were successful, it would be an example of what phenomenon?
(A) allosteric regulation (B) competitive inhibition (C) vaccination
(D) denaturation (E) synergistic effect

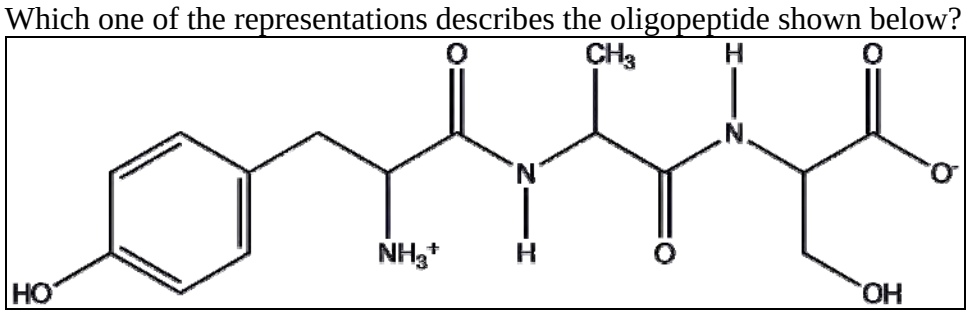
60. The Nobel Prize in physiology or medicine was awarded to Dr. Yoshinori Ohsumi for his discovery of mechanisms for _____.
(A) apoptosis (B) mitochondrial fusion and fission (C) vesicular transport
(D) signal transduction in the nervous system (E) autophagy

61. In replication, which of the followings is used for polymerization of both leading strand and lagging strand?
(A) DNA ligase (B) DNA polymerase I (C) DNA polymerase III (D) Gyrase (E) DNA helicase

62. Many coenzymes are derived from vitamins. Which of the following statements are correct?
① FAD is derived from vitamin B_6.
② Pyridoxal phosphate is derived from vitamin B_1.
③ Coenzyme A is derived from pantothenic acid.
④ 5'-Deoxyadenosyl cobalamin is derived from vitamin B_{12}.
⑤ NAD is derived from nicotinic acid.
(A) ①②③ (B) ②③④ (C) ③④⑤ (D) ①④⑤ (E) ①③⑤

63. Vitamin B_1 (thiamine) is the precursor to the coenzyme thiamine pyrophosphate (TPP). Thiamine deficiency would decrease which one of the following enzyme activities?
(A) Fumarase (B) Isocitrate dehydrogenase (C) Malate dehydrogenase
(D) Succinate dehydrogenase (E) α-Ketoglutarate dehydrogenase

64. Which one of the representations describes the oligopeptide shown below?



(A) Tyr-Ala-Thr (B) Tyr-Ala-Ser (C) Phe-Ala-Thr (D) Phe-Gly-Cys (E) Phe-Ala-Tyr

65. Which of the following statements regarding Michaelis-Menten kinetic analyses of enzyme action are correct?
① The total enzyme concentration studied at each substrate concentration is fixed in analysis of enzyme kinetics.
② Formation of enzyme-substrate complex does not appreciably decrease the concentration of substrate.
③ κ_{cat} reduces with competitive inhibition.
④ Maximal velocity is reached when the enzyme-substrate complex is equal to the total concentration of enzyme present.
⑤ The initial reaction velocity should be measured because most of the substrate has not been converted to product.
(A) ①②③④ (B) ①②③⑤ (C) ①②④⑤ (D) ②③④⑤ (E) ①③④⑤

66. The high free energy change for the hydrolysis of a thiol ester, as found in acetyl-CoA, compared with that for the hydrolysis of a simple ester, is partly due to _____.
(A) the greater resonance stability in a simple ester due to better π-electron overlap in a CO linkage than in a CS linkage
(B) the gain in resonance energy in the product, acetate
(C) the high value for the bond energy in S-C bond
(D) reduction of the unfavorable electrostatic interaction in the acetyl-CoA
(E) the high value for the bond energy in S-P bond

67. Phosphate (Pi) is transported into the mitochondria from the cytosol by a phosphate carrier which is driven by the _____.
(A) hydrolysis of ATP
(B) simultaneous transport of H^+ into the mitochondrion
(C) simultaneous transport of ADP into the mitochondrion
(D) simultaneous transport of H^+ out of the mitochondrion
(E) simultaneous transport of ATP out of the mitochondrion

68. Which of the following statements regarding metabolism is **NOT** correct?
(A) The metabolism can be classified as either catabolic or anabolic reactions.
(B) Enzymes are usually required for cells to carry out reaction under condition of moderate temperature, pressure, and pH.
(C) Glucose, fatty acids, and some amino acids are reduced to form acetyl-CoA, which enters the citric acid cycle.
(D) The energy of metabolism is used to synthesize ATP from ADP and Pi.
(E) Reactions occur spontaneously only when the free energy change is negative.

69. Which of the following statements about membrane proteins are correct?
① Membrane proteins can be extracted from cell membrane using sodium dodecyl sulfate.
② Integral proteins can span the membrane with α-helical structure or β-sheet structure.
③ Estrogen receptor is a membrane protein.
④ The membrane proteins are not associated with membrane through glycosylphosphatidylinositol anchor.
⑤ The transmembrane helix of membrane proteins can be predicted from hydropathic index of amino acid sequence.
(A) ①②③ (B) ①②⑤ (C) ①②④ (D) ②④⑤ (E) ①③④

70. Which following post-translational modifications would **NOT** be found in histone?
(A) Acetylation (B) ADP-ribosylation (C) Farnesylation (D) Methylation (E) Monoubiquitylation

71. In order to analyze transcription factor-DNA interaction in gene expression, the following experiments can be conducted.
① Promoter luciferase activity assay
② Electrophoretic mobility shift assay
③ Southern blotting
④ Chromatin immunoprecipitation
⑤ DNA affinity purification
(A) ①③④⑤ (B) ①②③④ (C) ①②③⑤ (D) ①②④⑤ (E) ②③④⑤

72. Which of the following descriptions regarding DNA transcription is **NOT** correct?
(A) DNA transcription is catalyzed by RNA polymerase consisting of a multi-subunit core and a σ factor.
(B) The most common σ factor is σ^{70} that binds at the promoter sequence.
(C) The consensus sequence of the promoter includes a TATA box 10 base pairs upstream of the transcription start site.
(D) Termination of RNA synthesis can be either rho-dependent or rho-independent.
(E) RNA polymerase catalyzes mononucleotide transfer to the 5'-end.

73. Which of the following statements regarding lipids is **NOT** correct?
(A) Lipids are usually water soluble.
(B) Fatty acids are relatively long-chain monocarboxylic acids with even carbon numbers ranging from 12 to 20.
(C) Fatty acids are generally stored as complex lipids called triacylglycerols.
(D) Glycerophospholipids are the major amphipathic lipid components of biological membranes.
(E) Cis-form unsaturated fatty acids can change the membrane fluidity a lot.

74. Which of the following statements regarding lipid metabolism is **NOT** correct?
(A) The degradation pathway consists of oxidation, hydration, further oxidation, and thiolysis.
(B) Before that, fatty acids are activated by esterification to coenzyme A.
(C) Fatty acid degradation produces large amounts of ATP.
(D) Fatty acids are degraded to acetyl-CoA by the sequential removal of two-carbon fragments, a process called α-oxidation.
(E) Fatty acids are usually synthesized from the acetyl-CoA.

75. Which of the followings is on the surface of a lipoprotein particle?
(A) Cholesterol and phospholipids (B) Cholesterol and triacylglycerol
(C) Cholesteryl ester and triacylglycerol (D) Cholesteryl ester and phospholipids
(E) Triacylglycerol and phospholipids

76. DNA polymerase I synthesizes new DNA with very high fidelity, due to its _____.
(A) high processivity (B) 3'→5' exonuclease activity
(C) helicase association with the primase (D) 5'→3' exonuclease activity
(E) all of the above

77. Which of the following statements about urea cycle are correct?
① Urea is the end product of the urea cycle.
② Inherited defects in urea cycle cause hyperammonemia.
③ The synthesis of fumarate by the urea cycle can be used as a precursor for glucose synthesis.
④ The urea cycle begins with the formation of ornithine in mitochondria.
⑤ ATP is not consumed in urea cycle.
(A) ②③④ (B) ②③⑤ (C) ①②③ (D) ①④⑤ (E) ③④⑤

78. Which of the following statements is correct regarding the blood glucose level of non-insulin dependent diabetics tend to compare to that of normal individuals?
(A) Blood glucose levels of diabetics tend to be very stable, but at a higher level.
(B) Blood glucose levels of diabetics tend to be variable and higher.
(C) Blood glucose levels decrease more rapidly following a meal, often dropping lower than is tolerable.
(D) Blood glucose levels average the same level in diabetics, but reach higher peaks for short periods.
(E) None of the above.

79. One turn of the citric acid cycle generates _____.
(A) 2 $FADH_2$, 3 ATP, 1 NADH (B) 1 NAD^+, 2 $FADH_2$, 1 ATP (C) 1 GTP, 3 NADH, 1 $FADH_2$
(D) 1 FAD, 2 ATP, 3 NADH (E) 1 $FADH_2$, 1 GTP, 2 NADH

80. Which of the following statements about citric acid cycle are correct?
① Pyruvate dehydrogenase links glycolysis to the citric acid cycle.
② The products of citric acid cycle are not used for the production of ATP in cells.
③ The product of glycolysis forms acetyl-CoA for entering citric acid cycle.
④ Its intermediates are not used by other metabolic reactions.
⑤ The citric acid cycle is also called as the Krebs cycle or the tricarboxylic cycle.
(A) ①②③ (B) ①②④ (C) ①②⑤ (D) ①③④ (E) ①③⑤

81. β-oxidation of fatty acids, which one of the following reactions is correct?
(A) Two NADH are produced for each acetyl-CoA.
(B) Oxidation of an 18-carbon fatty acid produces six molecules of propionyl-CoA.
(C) Uses only even–chain, saturated fatty acids as substrates.
(D) Uses $NADP^+$.
(E) Occurs by a repeated sequence of four reactions.

82. Which of the following is correct regarding the reaction shown below?
pyruvate + HCO_3^- + ATP → oxaloacetate + ADP + Pi
① It requires the direct transport of oxaloacetate across the membrane.
② It utilizes the malate-aspartate shuttle in some species.
③ It is essential for gluconeogenesis.
④ Its reactants require the function of enzymes which are only found in the cytosol.
(A) ①② (B) ②③ (C) ③④ (D) ①③ (E) ②④

83. In the process of glycolysis, several reactions take place. Which of the following statements related to them are correct?
① Two molecules of pyruvate are produced by glycolysis.
② Under anaerobic condition, pyruvate can be oxidized to CO_2, generating more ATP molecules.
③ Hexokinase is involved in glycolysis.
④ Frucose-1,6-biphosphate is not generated from glucose-1,6-biphosphate.
⑤ 1,3-Bisphosphoglycerate is generated from glycolysis.
⑥ Eight ATP molecules are generated from the conversion of glucose to pyruvate.
(A) ②④⑤⑥ (B) ①②③④ (C) ②③④⑥ (D) ①③④⑤ (E) ①②④⑥

84. Which of the following descriptions regarding genetic code is **NOT** correct?
(A) The genetic code is degenerate, and many codes can specify a certain amino acid.
(B) The first two positions of a codon are more important, and mutation in the third position often does not change the sense of the codon.
(C) One codon consists of three bases.
(D) Missense mutation changes only one codon and sometimes does not cause phenotypic change.
(E) Frameshift mutations can be suppressed by a suppressor tRNA molecule.

85. What moiety can **NOT** be found in a sphingomyelin?
(A) Sphingosine (B) Acetylcholine (C) Ceramide (D) Fatty acid (E) Phosphoric acid

86. Which of the following compounds is **NOT** derivative of cholesterol?
(A) Bile acids (B) Estrogens (C) Androgens (D) Glucocorticoids (E) Prostaglandins

87. Which of the following statements regarding gluconeogenesis is **NOT** correct?
(A) Gluconeogenesis is the pathway for glucose synthesis from noncarbohydrate precursors such as lactate and pyruvate.
(B) Conversion of pyruvate to phosphoenolpyruvate requires pyruvate carboxylase and phosphoenolpyruvate carboxykinase and is spontaneous.
(C) Pyruvate carboxylase is mainly located in mitochondria.
(D) Glycogen is the glucose-storage polymer of animals.
(E) Pentose phosphate pathway provides an alternative pathway for glucose metabolism.

88. Collagen is the most abundant protein with over 28 distinct types in the animal world. What are the three necessary amino acids that exist in the mature collagens?
(A) Methionine, cysteine, glycine (B) Alanine, glutamate, arginine
(C) Glycine, proline, lysine (D) Methionine, phenylalanine, cysteine
(E) Serine, glycine, cysteine

89. What two amino acids can be directly converted each other by a single biochemical reaction?
(A) Glutamine and asparagine (B) Glycine and serine (C) Leucine and isoleucine
(D) Alanine and glycine (E) Phenylalanine and alanine

90. Which of the following statements about proteins is correct?
(A) Hydrogen bonds are not important in the structure of proteins.
(B) Hydrophobic amino acids generally are arranged on the surface.
(C) In water soluble proteins, hydrophobic amino acids are generally buried.
(D) Globular proteins are generally very loosely structured.
(E) Proteins consist of amino acids linked by disulfide bonds.

高雄醫學大學 106 學年度學士後醫學系招生考試試題

科目:物理及化學　　考試時間: 100 分鐘

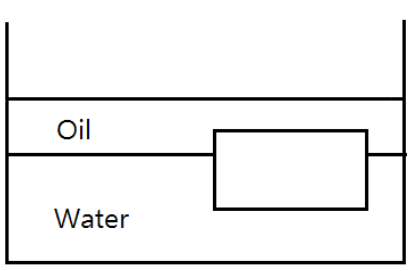
說明:一、選擇題用 2B 鉛筆在「答案卡」上作答，修正時應以橡皮擦擦拭，不得使用修正液(帶)，未遵照正確作答方法而致電腦無法判讀者，考生自行負責。
二、試題及答案卡必須繳回，不得攜出試場。

Choose one best answer for the following questions

【單選題】每題 1 分，共計 30 分，答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。
1~15 題為物理，16~30 題為化學。

1. The capacitance of a cylindrical capacitor can be increased by:
   (A) decreasing both the radius of the inner cylinder and the length.
   (B) increasing both the radius inner cylinder and the length.
   (C) increasing the radius outer cylindrical shell and decreasing the length.
   (D) decreasing the radius inner cylinder and increasing the radius of the outer cylindrical shell.
   (E) only by decreasing the length.

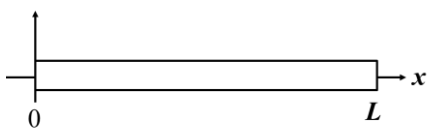
2. A layer of oil with density 800 kg/m^3 floats on top of a volume of water with density 1,000 kg/m^3. A block floats at the oil-water interface with 1/4 of its volume in oil and 3/4 of its volume in water, as shown in the figure below. What is the density of the block ?



(A) 200 kg/m^3　(B) 850 kg/m^3　(C) 950 kg/m^3
(D) 1,050 kg/m^3　(E) 1,800 kg/m^3

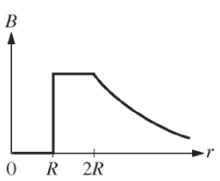
3. X rays of wavelength λ= 0.250 nm are incident on the face of a crystal at angle θ, measured from the crystal surface. The smallest angle that yields an intense reflected beam is θ = 14.5°. Which of the following gives the value of the interplanar spacing d? (sin 14.5° ≅ 1/4)
   (A) 0.125 nm　(B) 0.250 nm　(C) 0.500 nm　(D) 0.625 nm　(E) 0.750 nm

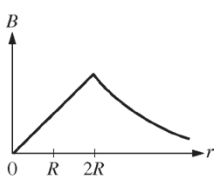
4. A rod of length *L* and mass *M* is placed along the *x*-axis with one end at the origin, as shown in the figure below. The rod has linear mass density $\lambda = \frac{2M}{L^2}x$, where *x* is the distance from the origin. Which of the following gives the *x*-coordinate of the rod's center of mass?

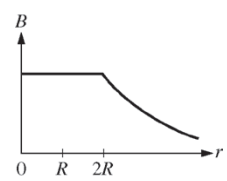


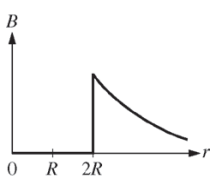
(A) $\frac{1}{12}L$　(B) $\frac{1}{4}L$　(C) $\frac{1}{3}L$　(D) $\frac{1}{2}L$　(E) $\frac{2}{3}L$

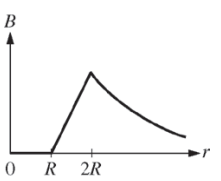
5. A long, straight, hollow cylindrical wire with an inner radius *R* and an outer radius 2*R* carries a uniform current density. Which of the following graphs best represents the magnitude of the magnetic field as a function of the distance from the center of the wire?

(A) 

(B) 

(C) 

(D) 

(E) 

6. The density of ice is 0.920 g/cm^3 while that of sea water is 1.025 g/cm^3. What fraction of an iceberg is submerged?
   (A) 0.898　(B) 0.927　(C) 0.976　(D) 1.087　(E) 1.114

7. A series RLC circuit, driven with a sinusoidal external emf with rms voltage 120 *V*, contains a resistance *R* = 200 Ω, an inductance *L* = 1.0 *H* , and a capacitance C = 16 μF. What is the resonance frequency of this circuit?
   (A) 960 *Hz*　(B) 1,600 *Hz*　(C) 40 *Hz*　(D) 6,400 *Hz*　(E) 250 *Hz*

8. A star radiates uniformly in all directions. At a distance of 5.0×10^{12} *m* from the star, the intensity of the radiation from the star is 15 W/m^2. What is the total power output of the star?
(A) 3.2×10^{38} *W* (B) 4.7×10^{27} *W* (C) 3.8×10^{26} *W* (D) 7.5×10^{13} *W* (E) 1.1×10^{15} *W*

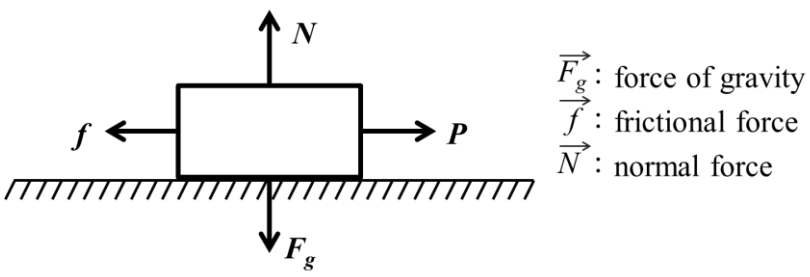
9. The focal length of a camera lens is 20.0 *cm*. How far from the lens should the subject for the photo be if the lens is 20.5 *cm* from the film?
(A) 8.20 *m* (B) 4.10 *m* (C) 2.10 *m* (D) 6.30 *m* (E) 10.0 *m*

10. Two different samples have the same mass and temperature. Equal quantities of energy are absorbed as heat by each. Their final temperatures may be different because the samples have different:
(A) thermal conductivities (B) coefficients of expansion (C) densities (D) volumes (E) heat capacities

11. A block whose mass m is 650 g is fastened to a spring whose spring constant k is 65 N/m. The block is pulled a distance x = 11 cm from its equilibrium position at x = 0 on a frictionless surface and released from rest at t = 0. What is the angular frequency of the resulting oscillation motion?
(A) 8 rad/s (B) 9 rad/s (C) 10 rad/s (D) 11 rad/s (E) 12 rad/s

12. The angular velocity vector of a spinning body points out of the page. If the angular acceleration vector points into the page then:
(A) the body is slowing down
(B) the body is speeding up
(C) the body is starting to turn in the opposite direction
(D) the axis of rotation is changing orientation
(E) none of the above

13. A boy pulls a wooden box along a rough horizontal floor at constant speed by means of a force $\vec{P}$ as shown. In the diagram f is the magnitude of the force of friction, N is the magnitude of the normal force, and F_g is the magnitude of the force of gravity. Which of the following must be true?



(A) $P = f$ and $N = F_g$ (B) $P = f$ and $N > F_g$ (C) $P > f$ and $N < F_g$
(D) $P > f$ and $N = F_g$ (E) None of the above.

14. The inertia of a body tends to cause the body to:
(A) speed up (B) slow down (C) resist any change in its motion
(D) fall toward the Earth (E) decelerate due to friction

15. A thin-walled hollow tube rolls without sliding along the floor. The ratio of its translational kinetic energy to its rotational kinetic energy (about an axis through its center of mass) is:
(A) 1 (B) 2 (C) 3 (D) 1/2 (E) 1/3

16. Select the answer with the correct number of decimal places for the following sum:
13.914 cm + 243.1 cm + 12.00460 cm =
(A) 269.01860 cm (B) 269.0186 cm (C) 269.019 cm (D) 269.02 cm (E) 269.0 cm

17. The difference between a student's experimental measurement of the density of sodium chloride and the known density of this compound reflects the _____ of the student's result.
(A) accuracy (B) precision (C) random error
(D) systematic error (E) indeterminate error

18. The average mass of a carbon atom is 12.011. Assuming you were able to pick up only one carbon unit, the chances that you would randomly get one with a mass of 12.011 is _____.
(A) 0% (B) 0.011% (C) about 12%
(D) 12.011% (E) greater than 50%

19. A catalyst _____.
(A) changes the enthalpy of the reaction
(B) does not change the activation energy
(C) provides an alternate pathway to the reaction
(D) does not change the effective collisions
(E) is consumed when more reacting molecules are added

20. For a gas sample, which conditions of *P* (pressure), *T* (temperature), and *n* (molar number), respectively, are most ideal?
(A) high *P*, high *T*, high *n* (B) low *P*, low *T*, low *n* (C) high *P*, low *T*, high *n*
(D) low *P*, high *T*, high *n* (E) low *P*, high *T*, low *n*

21. One mole of an ideal gas at 20 °C is expanded isothermally and reversibly from 100 L to 200 L. Which statement is correct?
(A) $\Delta S_{gas} = 0$ (B) $\Delta S_{surr} = 0$ (C) $\Delta S_{univ} = 0$ (D) $\Delta S_{gas} = R\ln 2$ (E) $\Delta S_{gas} = \Delta S_{surr}$

22. Which of the following ionic compounds has the largest lattice energy?
(A) LiF (B) NaCl (C) MgO (D) KBr (E) $BaCl_2$

23. Which of the following species has a trigonal bipyramid structure?
(A) IF_5 (B) I_3^- (C) NH_3 (D) PCl_5 (E) All of the above.

24. Naturally occurring copper exists in two isotopic forms: ^{63}Cu and ^{65}Cu. The atomic mass of copper is 63.55 amu. What is the approximate natural abundance of ^{63}Cu?
(A) 70% (B) 63% (C) 90% (D) 50% (E) 30%

25. Mixing 20 mL of a 4.0 M sodium chloride solution with 40 mL of a 2.0 M calcium chloride solution results in a solution with a chloride ion concentration of _____ M.
(A) 2.67 (B) 3.33 (C) 4.00 (D) 4.33 (E) 5.00

26. How many electrons in an atom can have the quantum numbers $n = 4$, $l = 1$?
(A) 2 (B) 6 (C) 10 (D) 18 (E) 32

27. The following reaction takes place at 120 °C: $H_2O_{(l)} \rightarrow H_2O_{(g)}$, $\Delta H = 44.0$ kJ/mol, $\Delta S = 0.119$ kJ/mol·K. Which of the following must be true?
(A) The reaction is not spontaneous. (B) The reaction is spontaneous. (C) $\Delta G < 0$
(D) Two of these. (E) None of the above.

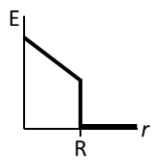
28. How many σ bonds and π bonds are there in $H_3C–CH_2–CH{=}CH–CH_2–C{\equiv}CH$?
(A) 16, 3 (B) 13, 2 (C) 10, 2 (D) 10, 3 (E) 14, 3

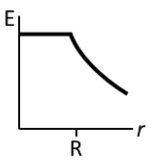
29. _____ is a method of separation that employs a system with two phases of matter, including a mobile phase and a stationary phase.
(A) Chromatography (B) Distillation (C) Homogenization
(D) Vaporization (E) Filtration

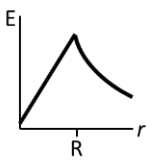
30. Which of the following is an example of nitrogen fixation?
(A) Absorption of NH_3 and its transformation into to N_2.
(B) Absorption of NH_3 and its transformation into to NO_2.
(C) Absorption of N_2 and its transformation into elemental nitrogen.
(D) Absorption of N_2 and its transformation into NH_3.
(E) Absorption of nitric acid and its transformation into N_2.

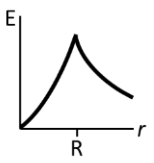
【單選題】每題 2 分，共計 120 分，答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。
31~60 題為物理，61~90 題為化學。

31. Two stationary tuning forks (350 and 352 *Hz*) are struck simultaneously. The resulting sound is observed to:
(A) beat with a frequency of 2 beats/s (B) beat with a frequency of 351 beats/s
(C) be loud but not beat (D) be Doppler shifted by 2 *Hz*
(E) have a frequency of 702 *Hz*

32. Which of the following graphs represents the magnitude of the electric field as a function of the distance from the center of a solid charged conducting sphere of radius R?
(A) 

(B) 

(C) 

(D) 

(E) 

33. A resistor in a circuit dissipates energy at a rate of 1 W. If the voltage across the resistor is doubled, what will be the new rate of energy dissipation?
(A) 0.25 W (B) 0.5 W (C) 1 W (D) 2 W (E) 4 W

34. Unpolarized light is incident on a pair of ideal linear polarizers whose transmission axes make an angle of 45° with each other. The transmitted light intensity through both polarizers is what percentage of the incident intensity?
(A) 100% (B) 75% (C) 50% (D) 25% (E) 0%

35. The mass of α particle is 6.601×10^{-27} kg. If the α particle falls through the 100 kV potential difference, then the velocity of the α particle is: ($e = 1.602\times10^{-19}$ C)
(A) 3.1×10^{6} m/s (B) 3.1×10^{5} m/s (C) 3.1×10^{4} m/s (D) 3.1×10^{3} m/s (E) 3.1×10^{2} m/s

36. What is the pressure on a swimmer 2 *m* below the surface of a swimming pool? (normal atmospheric pressure $P_{atm} = 1.013 \times 10^5$ Pa)
(A) 1.313×10^5 Pa (B) 1.278×10^5 Pa (C) 1.234×10^5 Pa (D) 1.209×10^5 Pa (E) 1.156×10^5 Pa

37. A wheel has a radius of 0.4 *m* and rotates at an angular velocity of 4 rad/s. A peg at the edge of the wheel is at the heighted point at t = 0. What is the period of the motion of the shadow?
(A) 1.51 *s* (B) 1.57 *s* (C) 2.05 *s* (D) 2.36 *s* (E) 3.14 *s*

38. A solenoid has an inductance 75 *mH* and a winding resistance 0.50 Ω. If a battery is connected to the solenoid, how long will the current reach half its final equilibrium value? ($\log 2 = 0.301$, $\ln 2 = 0.693$)
(A) 0.10 *s* (B) 45 *ms* (C) 4.6 *s* (D) 2.0 *s* (E) 26 *ms*

39. The electric potential in an xy plane is given by $V = (1.0V/m^2)x^2 - (2.0V/m^2)y^2$. What is the magnitude of the electric field at the point (3.0 *m*, 2.0 *m*)?
(A) 5.0 N/C (B) 6.0 N/C (C) 8.0 N/C (D) 10 N/C (E) 14 N/C

40. A cyclotron has a dee radius *R* and is operated at an oscillator frequency *f* in *Hz*. What is the magnitude of the magnetic field *B* needed for deuterons to be accelerated in the cyclotron? The mass of the deuteron is *m* in kilograms, *f* is in *Hz*, and *B* is in Tesla.
(A) $2\pi mfR/q$ (B) $2\pi mf/(Rq)$ (C) $2\pi mf/q$ (D) $2\pi mf/(R^2q)$ (E) $2\pi mfR^2/q$

41. A 2.0 *kg* particle moves along an x axis, being pushed by a variable force directed along that axis. Its position is given by $x = 2.0\ m - 3.0\ (m/s)t + 4.0\ (m/s^2)t^2 - 1.0\ (m/s^3)t^3$. What is the force on the particle at $t = 2.0\ s$?
(A) $4.0\ N\ \hat{i}$ (B) $-4.0\ N\ \hat{i}$ (C) $8.0\ N\ \hat{i}$ (D) $-8.0\ N\ \hat{i}$ (E) $2.0\ N\ \hat{i}$

42. A 5.0 *kg* block of steel slides down a ramp with acceleration 0.40 m/s^2 directed down the ramp. The ramp makes an angle of 37^o with the horizontal. What is the coefficient of kinetic friction between the block and the ramp?
(A) 0.50 (B) 0.70 (C) 0.25 (D) 0.75 (E) 5.0

43. A particle with position vector $\vec{r} = (4.0m)\hat{i} + (3.0m)\hat{j}$ is acted on by a force $\vec{F} = (3.0N)\hat{i} + (4.0N)\hat{j}$. What is the torque on the particle about the origin?
(A) $7.0\ (N \cdot m)\hat{k}$ (B) $-7.0\ (N \cdot m)\hat{k}$
(C) $7.0(N \cdot m)\hat{i} + 7.0(N \cdot m)\hat{j}$ (D) $-7.0(N \cdot m)\hat{i} - 7.0(N \cdot m)\hat{j}$
(E) $12(N \cdot m)\hat{i} + 12(N \cdot m)\hat{j}$

44. A disk with a rotational inertia of $5.0\ kg \cdot m^2$ rotates around its central axis while undergoing a torque given by $\tau = (3.0 + 4.0t)N \cdot m$. The disk's angular momentum is $2.5\ kg \cdot m^2/s$ at time $t = 1.0\ s$. What is the disk's angular momentum at $t = 2.0\ s$?
(A) 14 $kg \cdot m^2/s$ (B) 12 $kg \cdot m^2/s$ (C) 60 $kg \cdot m^2/s$ (D) 5.0 $kg \cdot m^2/s$ (E) 2.5 $kg \cdot m^2/s$

45. A tank containing water to a height of 16.0 m also contains air above the water at a gauge pressure of 1.00 atm. Water flows out from the bottom through a small hole. What is the water's speed?
(A) 13 m/s (B) 19 m/s (C) 4.2 m/s (D) 23 m/s (E) 6.5 m/s

46. A sound wave from a sound generator radiates uniformly in all directions in $22.0\ ^oC$ air. The sound intensity level is 50 *dB* at a distance of 4.00 *m* from the sound generator. The frequency of the sound wave is 500 *Hz*. At what distance from the sound generator is the sound intensity level 30 *dB*?
(A) 12.6 *m* (B) 40.0 *m* (C) 80.0 *m* (D) 6.67 *m* (E) 16.0 *m*

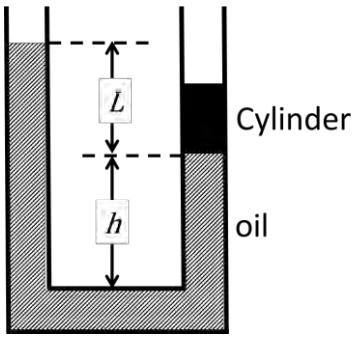
47. Coherent light with wavelength 0.40 μm passes through two very narrow slits. The distance between these two slits is 0.20 *mm*. The interference pattern is shown on a screen 5.0 *m* from the slits. What is the width of the central interference maximum?
(A) 7.5 *mm* (B) 5.0 *mm* (C) 20 *mm* (D) 10 *mm* (E) 2.5 *mm*

48. A cup of tea is made with 0.250 *kg* of $85.0\ ^oC$ water. Then, the cup of tea cools down to room temperature $20.0\ ^oC$. What is the entropy change of the water while it cools? (For water, $c = 4200 \frac{J}{kg \cdot K}$)
(A) 200 J/K (B) 230 J/K
(C) $1050 \ln(1.22)\ J/K$ (D) $1050 \ln(0.818)\ J/K$
(E) 190 J/K

49. A Carnot engine operates between two temperatures T_H and T_C. It takes in 600 *J* of heat from high-temperature reservoir at $T_H = 327\ ^0C$ in each cycle and gives up 200 *J* to the low-temperature (T_C) reservoir. What is the thermal efficiency of the cycle?
(A) 67% (B) 33% (C) 75% (D) 50% (E) 25%

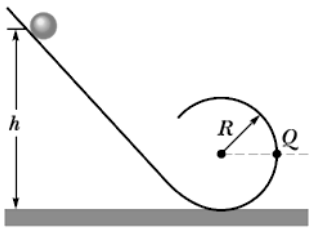
50. When a certain rubber band is stretched a distance *x*, it exerts a restoring force $F = ax + bx^2$, where *a* and *b* are constants. The work done in stretching this rubber band from $x = 0$ to $x = L$ is:
(A) $aL^2 + bLx^3$ (B) $aL + 2bL^2$ (C) $a + 2bL$ (D) bL (E) $aL^2/2 + bL^3/3$

51. The diagram shows a U-tube having cross-sectional area A and partially filled with oil of density ρ. A solid cylinder, which fits the tube tightly but can slide without friction, is placed in the right arm. The system reaches equilibrium. The weight of the cylinder is:



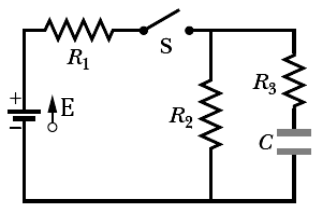
(A) $AL\rho g$ (B) $L^3\rho g$ (C) $A\rho(L+h)g$ (D) $A\rho(L-h)g$ (E) None of the above.

52. A solid brass ball of mass 0.280 g will *roll smoothly* along a loop-the-loop track when released from rest along the straight section. The circular loop has radius R = 14.0 cm, and the ball has radius r << R. What is *h* if the ball is on the verge of leaving the track when it reaches the top of the loop?



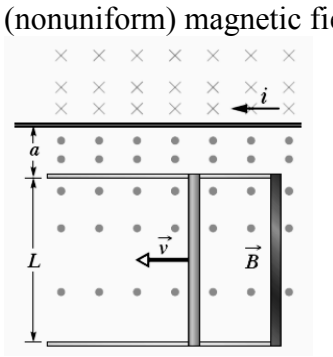
(A) 47.8 cm (B) 27.8 cm (C) 57.8 cm (D) 37.8 cm (E) 78.3 cm

53. The emf E = 1.2 kV, C = 6.5 μF, $R_1 = R_2 = R_3 = 0.73$ MΩ. With C completely uncharged, switch S is suddenly closed (at t = 0). At t = 0, what is current i_1 in resistor R_1?



(A) 3.3×10^{-3} A (B) 3.3×10^{-4} A (C) 1.1×10^{-4} A (D) 1.1×10^{-3} A (E) 2.2×10^{-3} A

54. The following shows a rod of length L = 10.0 cm that is forced to move at constant speed v = 5.00 m/s along horizontal rails. The rod, rails, and connecting strip at the right form a conducting loop. The rod has resistance 0.400 Ω; the rest of the loop has negligible resistance. A current *i* = 100 A through the long straight wire at distance *a* = 10.0 mm from the loop sets up a (nonuniform) magnetic field through the loop. Find the emf. ($\mu_0 = 4\pi\times10^{-7}$ T·m/A, ln 2 = 0.693, ln 10 = 2.303, ln 11 = 2.398)



(A) 2.4×10^{-4} V (B) 5.8×10^{-3} V (C) 4.8×10^{-5} V (D) 3.9×10^{-4} V (E) 8.8×10^{-4} V

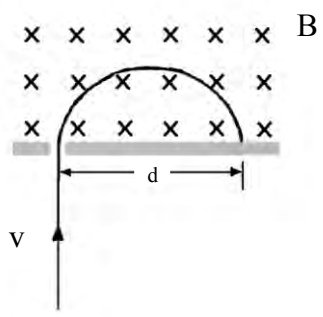
55. If the five lenses shown below are made of the same material, which lens has the shortest positive focal length?

(A)  (B)  (C) (D)  (E) 

56. For quantum model, E = hν = hc / λ, where E is photon energy in unit of eV, h is the Planck's constant (6.626×10^{-34} J s), ν is the frequency (s^{-1}), λ is the wavelength in meters (m), then E×λ (eV m) is:

(A) 1.24×10^{-3} (B) 1.24×10^{-4} (C) 1.24×10^{-5} (D) 1.24×10^{-6} (E) 1.24×10^{-7}

57. A particle with mass m and charge q, moving with a velocity v, enters a region of uniform magnetic field B, as shown in the figure below. The particle strikes the wall at a distance d from the entrance slit. If the particle's velocity stays the same but its charge-to-mass ratio is doubled, at what distance from the entrance slit will the particle strike the wall?



(A) 2d (B) $\sqrt{2}$ d (C) d (D) $\frac{1}{\sqrt{2}}$ d (E) $\frac{1}{2}$ d

58. The position of a particle moving on x-axis is given by $x = 3.0 + 2.5t - 1.0t^3$, with x in meters and t in seconds. Which statement in the following is correct?
(A) The particle is moving in the positive direction of x with a speed of $1.5\,m/s$ at $t = 1.0\,s$.
(B) The acceleration of the particle at $t = 1.0$ s is $-0.50\ m/s^2$.
(C) The acceleration of the particle is constant.
(D) The particle is moving in the negative direction of x with a speed of $0.50\,m/s$ at $t = 1.0\,s$.
(E) The velocity of the particle is constant.

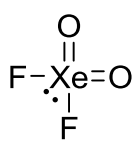
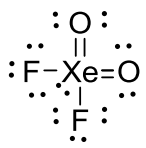
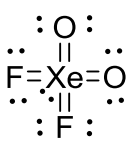
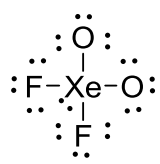
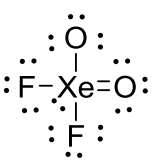
59. A wire loop of area 1000 cm^2 has a resistance of 10 ohms. A magnetic field B normal to the loop initially has a magnitude of 0.1 T and is reduce to zero at a uniform rate in 10^{-4} s. Thus, the resulting current is:
(A) 10000 A (B) 1000 A (C) 100 A (D) 10 A (E) 1 A

60. A rod of semiconducting material with length L and cross-sectional area A lies along the x-axis between $x = 0$ and $x = L$. Its resistivity varies with *x* according to $\rho(x) = \rho_0 \exp(-x/L)$. The material obeys Ohm's Law. What is the total resistance of the rod?
(A) $\rho_0(1-e^{-L})$ (B) $\rho_0(1-e^{-L})/A$ (C) $\rho_0(1-e^{-1})/A$ (D) $\rho_0 L(1-e^{-1})/A$ (E) $\rho_0 L(1-e^{-L})/A$

61. A solution contains the ions Ag^+, Ba^{2+}, and Ni^{2+}. Dilute solutions of NaCl, Na_2SO_4, and Na_2S are available to separate the positive ions from each other. In order to effect separation, the solutions should be added in which order?
(A) Na_2S, NaCl, Na_2SO_4 (B) Na_2SO_4, NaCl, Na_2S (C) Na_2SO_4, Na_2S, NaCl
(D) NaCl, Na_2S, Na_2SO_4 (E) NaCl, Na_2SO_4, Na_2S

62. Which of the statements below correctly describes the combustion of glucose, shown below?
$C_6H_{12}O_6 + 6O_2 \rightleftharpoons 6CO_2 + 6H_2O$
(A) Hydrogen in $C_6H_{12}O_6$ is being reduced.
(B) Oxygen in O_2 is being oxidized.
(C) Hydrogen in $C_6H_{12}O_6$ is the reducing agent.
(D) Oxygen in $C_6H_{12}O_6$ is the oxidizing agent.
(E) Carbon in $C_6H_{12}O_6$ is being oxidized.

63. Reaction intermediates differ from activated complexes in that _____.
(A) they are stable molecules with normal bonds and are frequently isolated
(B) they are molecules with normal bonds rather than partial bonds and can occasionally be isolated
(C) they are intermediate structures which have characteristics of both reactants and products
(D) they are unstable and can never be isolated
(E) all reactions involve reaction intermediates, but not all have activated complexes

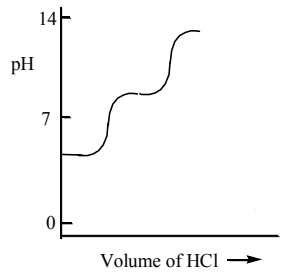
64. Select the Lewis structure for XeO_2F_2 which correctly minimizes formal charges.
(A) 
(B) 
(C) 
(D) 
(E) 

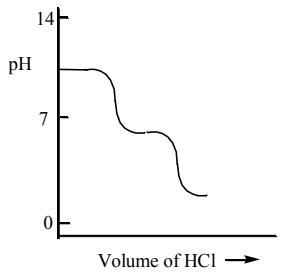
65. Which species has the **highest** bond order?
(A) NO^+ (B) O_2 (C) O_2^- (D) O_2^{2-} (E) NO^-

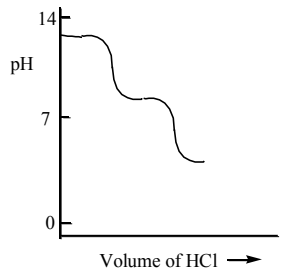
66. What hybridization is present in the phosphorus atom in PCl_3 and PCl_5, respectively?
(A) sp^2, d^2sp^3 (B) sp^2, dsp^3 (C) dsp, dsp^3 (D) sp^3, d^2sp^3 (E) sp^3, dsp^3

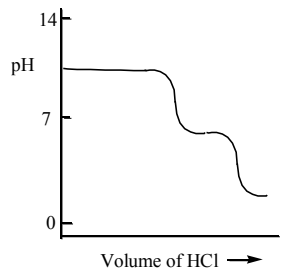
67. The spectrochemical series is $I^- < Br^- < Cl^- < F^- < OH^- < H_2O < NH_3 <$ en $< NO_2^- < CN^-$. Which of the following complexes will absorb visible radiation of the **highest** energy?
(A) $[Co(H_2O)_6]^{3+}$ (B) $[CoI_6]^{3-}$ (C) $[Co(OH)_6]^{3-}$ (D) $[Co(en)_3]^{3+}$ (E) $[CoCl_6]^{3-}$

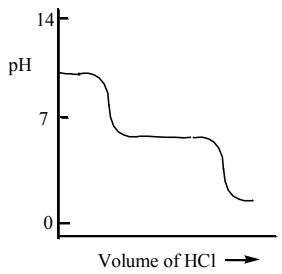
68. A diprotic acid H_2A has $K_{a1} = 1 \times 10^{-4}$ and $K_{a2} = 1 \times 10^{-8}$. The corresponding base A^{2-} is titrated with aqueous HCl, both solutions being 0.1 mol/L. Which one of the following diagrams best represents the titration curve which will be seen?

(A) 

(B) 

(C) 

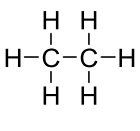
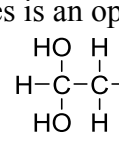
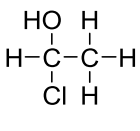
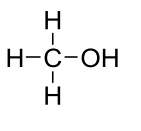
(D) 

(E) 

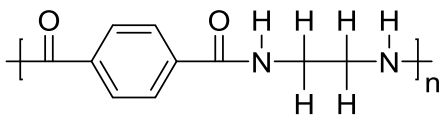
69. Which of the following coordination compounds will form a precipitate (AgCl) when treated with an aqueous solution of $AgNO_3$?
(A) $[Cr(NH_3)_3Cl_3]$ (B) $[Cr(NH_3)Cl]SO_4$ (C) $Na_3[Cr(CN)_6]$ (D) $[Cr(NH_3)_6]Cl_3$ (E) None of the above.

70. If a complex ion is square planar, which d-orbital is **highest** in energy?
(A) $d_{x^2-y^2}$ (B) d_{x^2} (C) d_{xy} (D) d_{yz} (E) d_{xz}

71. Which of the following statement is incorrect about hydrocarbons?
(A) Breaking the C─H bonds separately of CH_4 requires different energies.
(B) The average C─H bond energy of CH_4 is higher than that of H─H.
(C) Hydrocarbons are hydrophobic.
(D) Longer alkanes are with higher viscosities than shorter ones.
(E) Branched alkanes are with lower boiling points than their corresponding straight isomers.

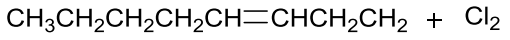
72. Which of the following molecules is an optically active molecule?
(A)  (B)  (C)  (D)  (E) None of the above.

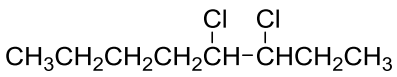
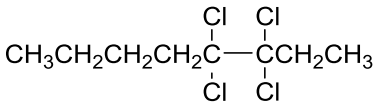
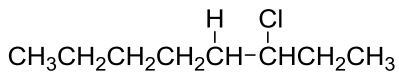
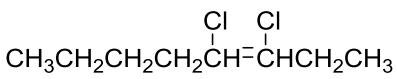
73. The structure below is the repeating unit of a



(A) homopolymer formed by an addition reaction.
(B) homopolymer formed by a condensation reaction.
(C) copolymer formed by an addition reaction.
(D) copolymer formed by a condensation reaction.
(E) polyester formed by an addition reaction.

74. Identify the products of the reaction of 3-octene with chlorine.



(A) 
(B) 
(C) 
(D) 
(E) $CH_3CH_2CH_2CH_2CH_2Cl + CH_3CH_2CH_2Cl$

75. Which of the following statements about molecular spectroscopies is **incorrect**?
(A) Ultraviolet-visible (UV-vis) spectra provides information about HOMO-LUMO gap.
(B) Infrared (IR) spectra gives information on bond vibrational transitions.
(C) Rotation transitions occur in the microwave region.
(D) Nuclear magnetic resonance (NMR) spectra provides information about the electronic transitions.
(E) UV-vis spectra involves both the molecular ground state and the excited state.

76. Consider the following reaction: $2NOCl_{2(g)} \rightleftharpoons 2NO_{(g)} + Cl_{2(g)}$. The equilibrium constant K is about 0.0196 at 115 °C. Calculate K_p at this temperature?
(A) 0.196 (B) 0.624 (C) 0.285 (D) 22.9 (E) 2.9

77. The equilibrium constant for reaction **(1)** is K. The equilibrium constant for reaction **(2)** is _____.
(1) $SO_{2\,(g)} + 1/2O_{2(g)} \rightleftharpoons SO_{3(g)}$ **(2)** $4SO_{3\,(g)} \rightleftharpoons 4SO_{2(g)} + 2O_{2\,(g)}$
(A) K^4 (B) 4K (C) 1/4 K (D) $1/K^4$ (E) $-K^4$

78. The pH of a 0.005 M K_2O aqueous solution should be _____.
(A) 11.7 (B) 7.0 (C) 2.3 (D) 12.0 (E) 5.0

79. How long will it take to produce 18.2 g of Ag (atomic mass = 107.87 amu) from a solution of $AgNO_3$ using a current of 10.00 amp? (F = 96500 C/mol)
(A) 3.26×10^3 s (B) 8.14×10^2 s (C) 4.88×10^3 s (D) 1.63×10^3 s (E) 5.43×10^3 s

80. Given $Cu_2O_{(s)} + 1/2O_{2(g)} \rightarrow 2CuO_{(s)}$, $\Delta H° = -144$ kJ and $Cu_2O_{(s)} \rightarrow Cu_{(s)} + CuO_{(s)}$, $\Delta H° = +11$ kJ
Calculate the standard enthalpy of formation of $CuO_{(s)}$.
(A) −155 kJ (B) +299 kJ (C) +155 kJ (D) −299 kJ (E) −166 kJ

81. Calculate $E°_{cell}$ and indicate whether the overall reaction shown is spontaneous or nonspontaneous.
$Co^{3+}_{(aq)} + e^- \rightleftharpoons Co^{2+}_{(aq)}$ $E° = 1.82$ V
$MnO_4^-{}_{(aq)} + 2H_2O_{(l)} + 3e^- \rightleftharpoons MnO_{2(s)} + 4OH^-_{(aq)}$ $E° = 0.59$ V
Overall reaction: $MnO_4^-{}_{(aq)} + 2H_2O_{(l)} + 3Co^{2+}_{(aq)} \rightleftharpoons MnO_{2(s)} + 3Co^{3+}_{(aq)} + 4OH^-_{(aq)}$
(A) $E°_{cell} = -1.23$ V, spontaneous (B) $E°_{cell} = -1.23$ V, nonspontaneous (C) $E°_{cell} = 1.23$ V, spontaneous
(D) $E°_{cell} = 1.23$ V, nonspontaneous (E) $E°_{cell} = -0.05$ V, nonspontaneous

82. The successive packing pattern for a hexagonal closest packed structures is which of the following?
(A) ABCABC (B) ABCCBA (C) ABABAB (D) ABAABA (E) AABBAA

83. Identify the missing particle in the following equation: $^{238}_{92}U \rightarrow {}^{4}_{2}He + ?$
(A) $^{242}_{94}Pu$ (B) $^{234}_{90}Th$ (C) $^{242}_{90}Th$ (D) $^{234}_{92}U$ (E) None of the above.

84. How many valence electrons are there in an atom with the electron configuration [noble gas]$ns^2(n-1)d^{10}np^3$?
(A) 2 (B) 3 (C) 5 (D) 10 (E) 15

85. For the process $CHCl_{3(s)} \rightarrow CHCl_{3(l)}$, $\Delta H° = 9.19$ kJ/mol and the melting point of chloroform is –64 °C. Calculate $\Delta S°$?
(A) 43.9 J/mol/K (B) 53.9 J/mol/K (C) 26.3 J/mol/K (D) 75.2 J/mol/K (E) None of the above.

86. Atomic orbitals developed using quantum mechanics _____.
(A) describe regions of space in which one is most likely to find an electron
(B) describe exact paths for electron motion
(C) give a description of the atomic structure which is essentially the same as the Bohr model
(D) allow scientists to calculate an exact volume for the hydrogen atom
(E) are in conflict with the Heisenberg Uncertainty Principle

87. Which of the following species requires the **highest** energy to remove an electron from its valence shell?
(A) Na^+ (B) F^- (C) K (D) Cl^- (E) Mg^{2+}

88. A reaction was found to be zero order in X. Increasing the concentration of X by a factor of 5 will cause the reaction rate to _____.
(A) remain constant (B) increase by a factor of 25 (C) increase by a factor of 5
(D) increase by a factor of 10 (E) decrease by a factor of the cube root of 5

89. Which of the following is not a factor determining the energy of activation according to the Arrhenius equation?
(A) temperature (B) frequency of collision of reacting molecules
(C) fraction of collisions with effective orientations (D) frequency factor
(E) None of the above.

90. A student needs a solution buffered at pH 4.30 ($[H^+] = 5.0\times10^{-5}$ M). This student can choose from the following weak acids and their salts to prepare the buffer. Which system will own the best buffering capacity?
(A) Benzoic acid ($K_a = 6.4 \times 10^{-5}$) (B) Chloroacetic acid ($K_a = 1.35 \times 10^{-3}$)
(C) Propanoic acid ($K_a = 1.3 \times 10^{-5}$) (D) Hypochlorous acid ($K_a = 3.5 \times 10^{-8}$)
(E) All of the above.