國立中山大學99學年度碩士班招生考試試題

科目：普通生物學【海資系碩士班甲組】

一、選擇題 （單選、不倒扣、每題2分）(共50分)

1) Which of these provides evidence of the common ancestry of all life?
   A) the universality of the genetic code
   B) the ubiquitous use of catalysts by living systems
   C) the structure of cilia
   D) the structure of chloroplasts
   E) the structure of the nucleus

2) Which of the following is *not* one of the four major groups of macromolecules found in living organisms?
   A) proteins
   B) glucose
   C) lipids
   D) nucleic acids
   E) carbohydrates

3) What limits the resolving power of a light microscope?
   A) the type of heavy metal or dye that is used to stain the specimen
   B) the ratio of an object's image to its real size
   C) the shortest wavelength of light used to illuminate the specimen
   D) the type of lens used to magnify the object under study
   E) the type of lens that focuses a beam of electrons through the specimen

4) An enzyme that attaches a phosphate group to another molecule is called a
   A) phosphorylase.
   B) kinase.
   C) cyclase.
   D) ATPase.
   E) phosphatase.

5) What is one of the ways that the membranes of winter wheat are able to remain fluid when it is extremely cold?
   A) by increasing the percentage of cholesterol molecules in the membrane
   B) by decreasing the number of hydrophobic proteins in the membrane
   C) by increasing the percentage of unsaturated phospholipids in the membrane
   D) A and B only
   E) A, B, and C

6) Approximately what proportion of the DNA in the human genome codes for proteins or functional RNA?
   A) 83%　　B) 46%　　C) 13%　　D) 2%　　E) 32%

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7) Which of the following compounds require the presence of the nuclear pores to move between the cytoplasm and the interior of the nucleus?
   A) messenger RNA
   B) proteins synthesized in the cytoplasm that are part of ribosomes
   C) ribosomal RNA
   D) A and B only
   E) A, B, and C

8) Organelles other than the nucleus that contain DNA include
   A) ribosomes.
   B) chloroplasts.
   C) mitochondria.
   D) B and C only
   E) A, B, and C

9) What is a genome?
   A) the complete complement of an organism's genes
   B) an ordered display of chromosomes arranged from largest to smallest
   C) a specific segment of DNA that is found within a prokaryotic chromosome
   D) a specific sequence of polypeptides within each cell
   E) a specialized polymer of four different kinds of monomers

10) You are working on a team that is designing a new drug. In order for this drug to work, it must enter the cytoplasm of specific target cells. Which of the following would *not* be a factor that determines whether the molecule enters the cell?
   A) size of the drug molecule
   B) charge on the drug molecule
   C) polarity of the drug molecule
   D) similarity of the drug molecule to other molecules transported by the target cells
   E) lipid composition of the target cells' plasma membrane

11) Where does glycolysis takes place?
   A) mitochondrial inner membrane
   B) cytosol
   C) mitochondrial outer membrane
   D) mitochondrial matrix
   E) mitochondrial intermembrane space

12) Viruses with single-stranded RNA that acts as a template for DNA synthesis are known as
   A) bacteriophages.
   B) retroviruses.
   C) lytic phages.
   D) proviruses.
   E) viroids.

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13) What is the term for metabolic pathways that release stored energy by breaking down complex molecules?

A) catabolic pathways
B) anabolic pathways
C) fermentation pathways
D) bioenergetic pathways
E) thermodynamic pathways

14) Carrier molecules in the membrane and metabolic energy are required for

A) active transport.
B) facilitated diffusion.
C) osmosis.
D) B and C only
E) A, B, and C

15) In yeast (*Saccharomyces cerevisiae*), the two sexes are called

A) a and b.
B) b and β.
C) male and female.
D) a and α.
E) S plus and S minus.

16) What is a chromatid?

A) a chromosome in G_1 of the cell cycle
B) another name for the chromosomes found in genetics
C) a special region that holds two centromeres together
D) a replicated chromosome
E) a chromosome found outside the nucleus

17) How is the S phase of the cell cycle measured?

A) counting the number of cells produced per hour
B) determining the length of time during which DNA synthesis occurred in the cells
C) determining when the S chromosome is synthesized
D) stopping G_1 and measuring the number of picograms of DNA per cell
E) comparing the synthesis versus the breakdown of S protein

18) How does the sexual life cycle increase the genetic variation in a species?

A) by allowing random fertilization
B) by allowing independent assortment of chromosomes
C) by allowing crossing over
D) A and B only
E) A, B, and C

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科目：普通生物學【海資系碩士班甲組】

19) What does a frequency of recombination of 50% indicate?

A) Abnormal meiosis has occurred.

B) The two genes likely are located on different chromosomes.

C) Independent assortment is hindered.

D) All of the offspring have combinations of traits that match one of the two parents.

E) The genes are located on sex chromosomes.

20) What are prions?

A) viral DNA that has had to attach itself to the host genome

B) a mobile segment of DNA

C) tiny molecules of RNA that infect plants

D) misfolded versions of normal brain protein

E) viruses that invade bacteria

21) Under the electron microscope, unfolded chromatin resembles "beads on a string." What do the "beads" represent?

A) ribosomes

B) molecules of DNA polymerase

C) molecules of RNA polymerase

D) nucleosomes

E) beadosomes

22) Two potential devices that eukaryotic cells use to regulate transcription are DNA _____ and histone _____.

A) acetylation; methylation

B) amplification; acetylation

C) amplification; methylation

D) methylation; acetylation

E) methylation; amplification

23) RFLP analysis can be used to distinguish between alleles based on differences in

A) the amount of DNA amplified from the alleles during PCR.

B) restriction enzyme recognition sites between the alleles.

C) the ability of the alleles to be replicated in bacterial cells.

D) the proteins expressed from the alleles.

E) the ability of nucleic acid probes to hybridize to the alleles.

24) The first genetic material was most likely a(n)

A) DNA oligonucleotide B) DNA polymer C) protein enzyme

D) protein E) RNA polymer

25) Corals are most closely related to which group?

A) barnacles B) jellies C) sea anemones D) sponges E) freshwater hydras

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科目：普通生物學【海資系碩士班甲組】

二、請以能量學觀點詳細說明生物由單細胞演化為多細胞個體的優勢。(20 分)

三、請以基因體觀點說明導致癌症的可能機制。(10 分)

四、詳述 DNA 與 RNA 的化學結構差異。(10 分)

五、繪圖說明神經細胞的跳躍式傳導 (saltatory propagation)。(10 分)

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科目：生理學【海資系碩士班甲組選考】

一、 詳述人體控制血壓的生理機制。(30 分)

二、 詳述面對 stress 時，生物體啟動的神經內分泌反應機制。(20 分)

三、 詳述並繪圖說明

1. 靜膜電位 (resting membrane potential)。(10 分)
2. 動作電位 (action potential)。(10 分)
3. Excitatory postsynaptic potential。(5 分)
4. Inhibitory postsynaptic potential。(5 分)

四、詳述人體如何控制每天的飲水量。(20 分)

國立中山大學99學年度碩士班招生考試試題

科目：生物化學【海資系碩士班甲組選考】

1. There are several enzymes involved in cholesterol biosynthetic pathway. Please draw the cholesterol structure (2%). Which of these is subject to feedback regulation (3%)? How does this enzyme regulate cholesterol levels? (5%)
2. Separation of most blood cells is difficult, if not impossible, to achieve because they have similar properties and/or densities. What procedure is used to separate T-cells of the immune system from the many other different types of white blood cells or spleen cells? What feature of the T-cell facilitates the isolation protocol ? (10%)
3. Describe the function of the malate–aspartate shuttle in our body? (5%)
4. Describe the equilibrium constant Keq, Michaelis constant Km and dissociation constant Kd (9%)
5. Describe the allosteric effect of hemoglobin in capillaries of active muscles and alveoli of lungs (6%)
6. Some drugs are mixtures of the stereoisomers in which only one stereoisomer has the biological activity of interest. The use of pure single stereoisomer of the chemical in place of mixture can result in a more potent drug with reduced side effects. For example, one stereoisomer of ketamine is an anesthetic, whereas the other causes hallucinations. Darvon is a pain killer, whereas its stereoisomer Novard, is a cough suppressant. Please describe the possible mechanisms of stereoisomer in body. (5%)
7. Describe the differences between glycoprotein and proteoglycans (10%)
8. What is the basis for separation of proteins by two-dimensional gel electrophoresis? (3%) Why is this better for resolving a mixture of proteins? (3%) How to identify the protein in 2-D gel ? (4%)
9. What is Western blotting ? How can this technique be used to detect proteins ? (5%)
10. What is EMSA (Electrophoretic Mobility Shift Assays) ? It's application (5%)
11. What is real-time PCR? How can this technique be used to detect mRNA? (5%)
12. 英翻中：About 1-2 percent of the oxygen metabolized by **aerobic** organisms, rather than being converted to water, is partially reduced to the **superoxide anion radical** (O_2^-). Superoxide is unstable in aqueous biological liquids, breaking down into especially toxic hydrogen peroxide (H_2O_2) and then **hydroxyl radicals**. These and other ***reactive oxygen spices*** **(ROS)**, which contribute to what is often called ***cellular oxidative stress***, can be highly toxic, because they chemically modify proteins, DNA, and unsaturated fatty acyl groups in membrane lipids, thus interfering with normal function. Indeed, ROS are purposefully

generated by body defence cells (e.g., **macrophages**) to kill pathogens. In humans, excessive or inappropriate generation of ROS has been implicated in many diverse diseases, alcohol-induced liver disease, diabetes, and aging. Although ROS can be generated by a number of metabolic pathways, the major source of ROS appears to be the **electron transport chain**, in particular mechanisms coupled to complexes I and III. The semiquinone form of ubiquinone, **$CoQ^{\cdot}$**, an intermediate form of CoQ generated in the **Q cycle**, may play a particularly important role in superoxide generation. To help protect against ROS toxicity, mitochondria have evolved several defense mechanisms, including the use of enzymes that inactivate superoxide first by converting it in to H_2O_2 and then to H_2O_2. Cardiac mitochondria also have catalase (normally only found in peroxisomes) to help breakdown H_2O_2. This is not surprising, because the most oxygen-consuming organ in mammals is the heart. In addition, the small molecule antioxidants α-lipoic acid and vitamin E help protect the mitochondrion from ROS. (20 %)

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科目：生態學【海資系碩士班乙組】

一、請詳細解釋下列的生態專有名詞 (40 %，每題 5 分)

1. Ecosystem
2. Pollution
3. Umbrella species
4. Infauna
5. Succession
6. Opportunistic species
7. Life history
8. Littoral Zone

二、問答 (60%，每題 20 分)

1. 何謂生物多樣性？請說明其包含的內容及意義?

2. 何謂溫室效應？請說明其對全球環境的影響及如何防患其持續惡化?

3. 請說明臺灣四周的海洋生態系統，並論述其環境特色及生物組成？

國立中山大學99學年度碩士班招生考試試題

科目：生物統計學【海資系碩士班乙組】

所有答案請寫出計算過程；統計檢定答案應包含假說；所有統計檢定α=0.05。

一、使用拖網中調查東沙附近海域7個樣區的無脊椎動物種數如下: 25, 37, 18, 29, 41, 32, 54

(一)求東沙附近海域無脊椎動物種數的平均數、中數、標準差、全距 (range)、變異係數(coefficient of variation) (10 分)

(二)求無脊椎動物平均種數 95%的信賴區間 (5 分)

二、某種的鯛的體長是常態分佈，μ=15公分，σ=3公分，若隨機選出一的鯛，其體長超過17公分的機率為何? (5分)

三、魚體長通常為常態分布，若大眼演海鯉體長μ=158.5 mm，σ=8.5 mm;以樣本數100隻抽樣,回答有關樣本平均數$\bar{x}$的問題。

(一) $\mu_{\bar{x}}$ =? $\sigma_{\bar{x}}$ =?(4分)

(二)P($\bar{x}$>162 mm)=?(6分)

四、調查兩種誘餌捕獲兩種黏盲鰻在的數量如下:

	誘餌一	誘餌二
中華黏盲鰻	6	2
布氏黏盲鰻	3	5

(一)用 Fisher's exact 檢驗兩種誘餌捕獲黏盲鰻比例是否相同? (10 分)

(二)求誘餌一對誘餌二捕獲中華黏盲鰻的勝算比(odds ratio) (5 分)

五、兩養殖池的溶氧取樣測值資料如下:

n_1= 9, $\bar{x}_1$=11.0 ppm, s_1^2= 4.0,

n_2= 7, $\bar{x}_2$=9.0 ppm, s_2^2= 3.0,

假設溶氧是常態分布，請問兩養殖池的溶氧

(一)母群體變異數是否相等? (10 分)

(二)平均數是否有差異? (15 分)

六、在研究 20 隻半蹼濱鷸的非體脂肪重量(fat free mass)時，發現非體脂肪重量 Y(單位:克)與全身導電度大小 X 線性關係的統計值如下:

變數	自由度	估計值	標準誤差(s.d.)
b_0	1	5.51	4.10
b_1	a	-2.02	3.37

r^2= 0.37

(一)線性迴歸模式為何?如何解釋? (8 分)

(二)自由度 a = ? (5 分)

(三)檢驗兩者是否有顯著的線性迴歸關係? (6 分)

(四)r^2= 0.37 代表甚麼? (5 分)

(五)試求相關係數 (6 分)

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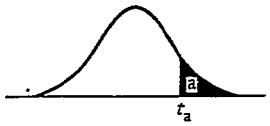
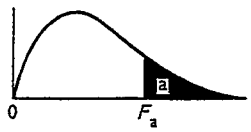
Percentage points of the t distribution



df	a = .10	a = .05	a = .025	a = .010	a = .005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
inf.	1.282	1.645	1.960	2.326	2.576

Percentage points of the F distribution



Degrees of freedom ($a = .05$)

df_2 \ df_1	1	2	3	4	5	6	7	8	9
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42

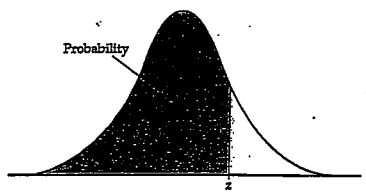


Table entry for z is the area under the standard normal curve to the left of z.

TABLE A

Standard normal probabilities (continued)

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

國立中山大學99學年度碩士班招生考試試題

科目：普通地質學【海資系碩士班丙組選考】

一、選擇題（30%，每小題2分，單選題）

1、火山島弧（volcanic island arcs）常出現在以下哪種地體構造位置：(A) 板塊分離界線 (B) 板塊聚合界線--大陸地殼和大陸地殼聚合 (C) 板塊聚合界線--大陸地殼和海洋地殼聚合 (D) 板塊聚合界線--海洋地殼和海洋地殼聚合 (E) 轉型斷層界線。

2、解理（cleavage）是礦物重要的物理性質之一，以下哪一種礦物不具有良好的解理：(A) 方解石 (B) 黑雲母 (C) 橄欖石 (D) 輝石 (E) 角閃石。

3、包氏反應系列（Bowen's reaction series）中的連續系列包含哪一種礦物：(A) 石英 (B) 斜長石 (C) 黑雲母 (D) 輝石 (E) 角閃石。

4、以下那一種岩石是屬於葉理狀（foliated）變質岩石？(A) 板岩 slate (B) 千枚岩 phyllite (C) 片岩 schist (D) 片麻岩 gneiss (E) 以上皆是。

5、一般在板塊分離界線處（在海底稱為洋脊）噴發的岩漿是屬於：(A) 花岡岩質岩漿 (B) 安山岩質岩漿 (C) 玄武岩質岩漿 (D) 碳酸鹽質岩漿 (E) 以上皆非。

6、決定河流會發生侵蝕作用或堆積作用之最主要和最直接因素是：(A) 流速 (B) 流量 (C) 河道形狀 (D) 河道粗糙度 (E) 以上皆非。

7、台灣西部發生的地震主要是斷層錯動所引發，例如車龍埔斷層的錯動引發921地震，請問台灣西部這些斷層的類型主要是屬於：(A) 正斷層 (B) 逆斷層 (C) 平移斷層 (D) 轉型斷層 (E) 以上皆非。

8、長石是構成地殼非常普遍的造岩礦物，長石在地表附近受到化學風化作用時最常見的產物是：(A) 方解石 (B) 黏土礦物 (C) 輝石 (D) 黑雲母 (E) 角閃石。

9、以下有關火山噴發的敘述何者為正確？(A) 基性（玄武岩質）岩漿容易形成爆炸式噴發 (B) 溫度越低，岩漿黏滯性也越低 (C) 二氧化矽含量高的岩漿，黏滯性比較高，常形成爆炸式噴發 (D) 形成複式（層狀）火山的岩漿通常含很少量氣體 (E) 以上皆非。

10、地球表面的板塊的移動速率大約是 (A) 每年3-4公尺 (B) 每年1-2公里 (C) 每年1000公里 (D) 每年1-10公分 (E) 每年1-5豪米。

11、在岩石的循環中，新生岩石通常會誕生在以下哪一種地質環境：(A) 大陸上的裂谷 (B) 海底的洋脊 (C) 火山島弧 (D) 地函熱柱上升至地表處--熱點 (E) 以上皆是。

12、有一種藍閃石片岩（glaucophane schist）通常形成於高壓和低溫的環境，以下哪一種地質環境較適合其產出：(A) 大陸地殼的下部 (B) 洋脊 (C) 板塊隱沒帶 (D) 岩漿侵入沈積岩圍岩的接觸帶上 (E) 以上皆是。

13、現今大洋中已知最老的海洋地殼的年齡大約為：(A) 兩百萬年 (B) 六千五百萬年 (C) 兩億年 (D) 三十八億年 (E) 四十五億年。

14、底下哪一種岩石會是非常好的 Aquifer (A) 頁岩 (B) 泥岩 (C) 角頁岩 (D) 砂岩 (E) 以上皆非。

15、台灣中央山脈的組成岩石主要是屬於：(A) 火山噴出岩 (B) 火成的深成岩 (C) 碎屑性沈積岩 (D) 化學性沈積岩 (E) 低度到中度的變質岩。

國立中山大學99學年度碩士班招生考試試題

科目：普通地質學【海資系碩士班丙組選考】

二、解釋名詞（15%，每小題3分）

1、weathering
2、epicenter
3、uniformitarianism
4、glacier
5、cross bedding

三、問答題（55%，第1小題15分，第2~5題每小題10分）

1、地球的四個次系統--氣圈、水圈、岩石圈、與生物圈之間有密切關連，試以碳（C）為例子，舉例說明碳在四大圈層的棲身之地或其賦存的物質，並詳細說明碳在地球四大圈層的循環過程與交互作用，例如碳是如何進入地球內部，又如何回到地表。（15%）

2、台灣地區每逢颱風豪雨或地震常發生塊體運動（mass wasting，或稱山崩地滑），因而造成嚴重的地質災害，試敘述：(a)影響塊體運動的因素，(b)如何防治塊體運動？（10%）

3、(a)火成岩依據其化學成份（二氧化矽的含量）以及組織特徵（結晶顆粒大小）可以分成哪幾種類型的火成岩？(b)台灣地區包含離島地區分別有哪些不同類型的火成岩產出？試列舉產地和火成岩類型。（10%）

4、試說明有哪些證據或野外觀察得到的資料支持板塊地體構造學說（plate tectonics）。（10%）

5、全球暖化已經成為一個影響近期的未來人類和其他生物生存的嚴重問題，請問：(a)為什麼會發生嚴重的全球暖化現象？(b)人類應該如何面對和因應全球暖化？(c)我們每一個人可以做什麼來幫助減緩全球暖化？（10%）

國立中山大學99學年度碩士班招生考試試題

科目：海洋物理學【海資系碩士班丙組選考】

一.有一艘研究船從 A 站(位於 60°N,160°E)出發以 20 節的速度向東行駛,目的地爲 B 站(60°N,160°W)中途每隔一個經度便停兩小時作 CTD 探測,A 站和 B 站不做 CTD 探測,請問總計費時多久?(5 分)

二.有一個波長爲 156 公尺的波浪,從 2000 公尺深的太平洋傳送到台灣東岸水深 1 公尺的淺灘,週期都保持固定,則在這兩處的波浪傳送速度各是多少?在淺灘的波長是多少?(8 分)

三.有一個水型 A(溫度 5°C,塩度 35.5)與水型 B(溫度 2°C 塩度 34.5)混合後產生了溫度 3°C 塩度 34.85 的混合物,請問水型 A 和 B 的比例各是多少?可用圖解法大致估算(6 分)

四.描述赤道海區的流場分佈?(8 分)

五.潮汐依照其週期可分成哪幾種型別?台灣西海岸屬於何種類型?潮流和潮汐有何相關?沿岸海域的潮流通常有何特性?(8 分)

六.以北太平洋爲例,說明其風場與表層流場的分佈狀況,它的西方邊界流(WBC)和東方邊界流(EBC)分別叫做什麼名字?WBC 和 EBC 的特性有何差別?造成 WBC 特性的原因是什麼?用渦度如何解釋 WBC?(15 分)

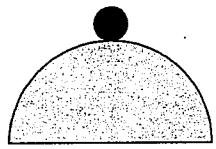
七.簡答題或解釋名詞:(第 8 和第 9 題 5 分其餘每題 4 分)

(1)T-S diagram (4分)
(2)Coriolis effect (4分)
(3)tsunamis (4分)
(4)spring tide (4分)
(5)geostrophic current (4分)
(6)potential temperature (4分)
(7)三種常見的深層和底層水團 (4分)
(8)深水波和淺水波如何定義?水分子如何運動? (5分)
(9)月球對地球的引潮力如何形成?大小分佈狀況? (5分)
(10)Ekman spiral (4分)
(11)溫室效應 (4分)
(12)聖嬰現象 (4分)

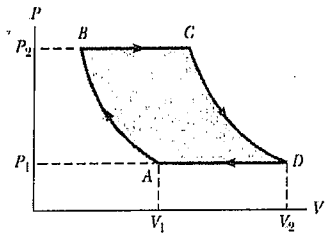
國立中山大學99學年度碩士班招生考試試題

科目：普通物理學【海資系碩士班丙組選考】

1. A small ball is initially seated on the top of a hemispherical ice mound of radius $R = 15$ m, shown in the right figure. It begins to slide down the ice, with a negligible initial speed. Approximate the ice as being frictionless. At what height does the small ball lose contact with the ice? (14%)

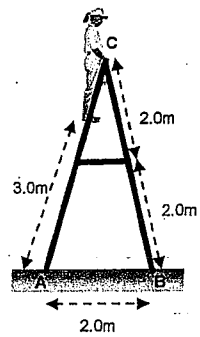


2. An ideal gas is carried through a thermodynamic cycle consisting of two isobaric and two isothermal processes as shown in the right figure. What is the net work done on the gas in the entire cycle? (14%)



3. Suppose a meteor of mass 3.00×10^{13} kg, moving at 30.0 km/s relative to the center of the Earth, strikes the Earth. What is the order of magnitude of the maximum possible decrease in the angular velocity of the Earth due to this collision? The mass of the Earth is 5.98×10^{24} kg. The radius of the Earth is 6.37×10^{6} m. (14%)

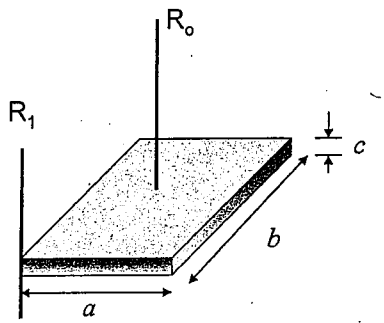
4. A stepladder of negligible weight is constructed as shown in the right figure. A painter of mass 70.0 kg stands on the ladder 3.0 m from the bottom. Assuming the floor is frictionless, find (a) (5%) the tension in the horizontal bar connecting the two halves of the ladder (b) (5%)the normal forces at A and B, and (c) (4%) the components of the reaction force at the single hinge C that the left half of the ladder exerts on the right half. (subtotal :14%)



5. Two uniformly charged, infinite, non-conducting planes are parallel to a yz plane and positioned at x=-50 cm and x =+50 cm. The charge densities on the planes are -50nC/m^2 and +25 nC/m^2, respectively. What is the magnitude of the potential difference between the origin and the point on the x axis at x= +80 cm? (14%)

6. A 3.00 MΩ resistor and a 1.00 μF capacitor are connected in series with an ideal battery of emf $\mathscr{E}$= 4.00 V. At 1.00 s after the connection is made, what is the rate at which (a) (4%) the charge of the capacitor is increasing, (b) (4%) energy is being stored in the capacitor, (c) (3%) thermal energy is appearing in the resistor, and (d) (3%) energy is being delivered by the battery? (subtotal:14%)

7. The uniform solid block has mass 0.2 kg and edge lengths $a = 3.0$ cm, $b = 8.0$ cm, and $c = 1.0$ cm. (1) (10%) Derive the ***equation*** of the rotation inertia about an axis R_o, which goes through the center of the mass as shown in the right figure. (2) (6%) Calculate the rotational inertia about an axis R_1 at one corner. (subtotal:16%)



國立中山大學99學年度碩士班招生考試試題

科目：微積分【海資系碩士班丙組選考】

請依題號順序作答，不會作答題目請寫下題號並留空白。

（一）是非題：共 20 題，每題 2 分。正確請劃 **O**，錯誤請劃 **X**。

1. A vertical line intersects the graph of a function at most once.
2. If $\lim_{x\to 6}[f(x)g(x)]$ exists, then the limit must be $f(6)g(6)$.
3. $\frac{\mathrm{d}}{\mathrm{d}x}|x^2+x| = |2x+1|$
4. $\frac{\mathrm{d}}{\mathrm{d}x}(\tan^2 x) = \frac{\mathrm{d}}{\mathrm{d}x}(\sec^2 x)$
5. If f has an absolute minimum value at c, then $f'(c) = 0$.
6. If $f''(2) = 0$, then $(2, f(2))$ is an inflection point of the curve $y = f(x)$.
7. $\int_{-1}^{1}\left(x^5 - 6x^9 + \frac{\sin x}{(1+x^4)^2}\right)\mathrm{d}x = 0$
8. If f is continuous on $[a, b]$, then
$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\int_a^b f(x)\,\mathrm{d}x\right) = f(x)$$
9. $\tan^{-1}(-1) = \dfrac{3\pi}{4}$
10. $\lim\limits_{x\to\pi^-}\dfrac{\tan x}{1-\cos x} = \lim\limits_{x\to\pi^-}\dfrac{\sec^2 x}{\sin x} = \infty$
11. If f is continuous on $[0,\infty)$ and $\int_1^\infty f(x)\,\mathrm{d}x$ is convergent, then $\int_0^\infty f(x)\,\mathrm{d}x$ is convergent.
12. If $\int_a^\infty f(x)\,\mathrm{d}x$ and $\int_a^\infty g(x)\,\mathrm{d}x$ are both convergent, then $\int_a^\infty [f(x)+g(x)]\,\mathrm{d}x$ is convergent.
13. If $x = f(t)$ and $y = g(t)$ are twice differentiable, then
$$\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} = \frac{\mathrm{d}^2 y/\,\mathrm{d}t^2}{\mathrm{d}x^2/\,\mathrm{d}t^2}.$$
14. The polar curves $r = 1 - \sin 2\theta$ and $r = \sin 2\theta - 1$ have the same graph.
15. If $\lim\limits_{n\to\infty} a_n = 0$, then $\sum\limits_{n=1}^{\infty} a_n$ is convergent.
16. If $\sum\limits_{n=1}^{\infty} c_n 6^n$ is convergent, then $\sum\limits_{n=1}^{\infty} c_n(-2)^n$ is convergent.
17. The series $\sum\limits_{n=1}^{\infty} n^{-\sin 1}$ is convergent.

國立中山大學99學年度碩士班招生考試試題

科目：微積分【海資系碩士班丙組選考】

18. $\sum_{n=0}^{\infty} \frac{(-1)^n}{n!} = \frac{1}{e}$

19. For any vectors $\mathbf{u}$, $\mathbf{v}$ and $\mathbf{w}$ in V_3, $\mathbf{u} \times (\mathbf{v} \times \mathbf{w}) = (\mathbf{u} \times \mathbf{v}) \times \mathbf{w}$.

20. Suppose f is twice continuously differentiable. At an inflection point of the curve $y = f(x)$, the curvature is 0.

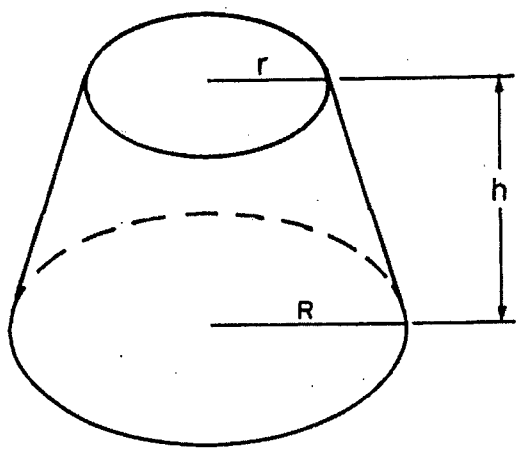
(二) 計算題：共 6 題，每題 10 分。答題時，每題都必須寫下題號與詳細步驟。

1. A man wants to fence off a rectangular plot of 800 ft^2 which will be open to a straight river so that only 3 sides need to be fenced. What dimensions should the plot have in order to minimize the amount of fencing required?

2. Evaluate $\frac{dy}{dx}$ for $y = \int_x^{x^2} \sin\sqrt{t}\,dt$.

3. Evaluate $I = \int \frac{3x^2-8x+13}{x^3+x^2-5x+3}\,dx$.

4. Compute the volume of the frustum of a cone as shown in the following graph.



5. Show whether the series $\sum_{n=1}^{\infty} \frac{\sqrt{n+1}-\sqrt{n}}{\sqrt{n}}$ converges or diverges.

6. $\iint_R (x+y)\,dA$, where R is the region that lies to the left of the y-axis between the circle $x^2+y^2=1$ and $x^2+y^2=4$.

~全卷完~

國立中山大學99學年度碩士班招生考試試題

科目：礦物學【海資系碩士班丙組選考】

問答題（第 1、2 題每題 15 分，第 3～9 題每題 10 分，共 9 題，滿分 100 分）

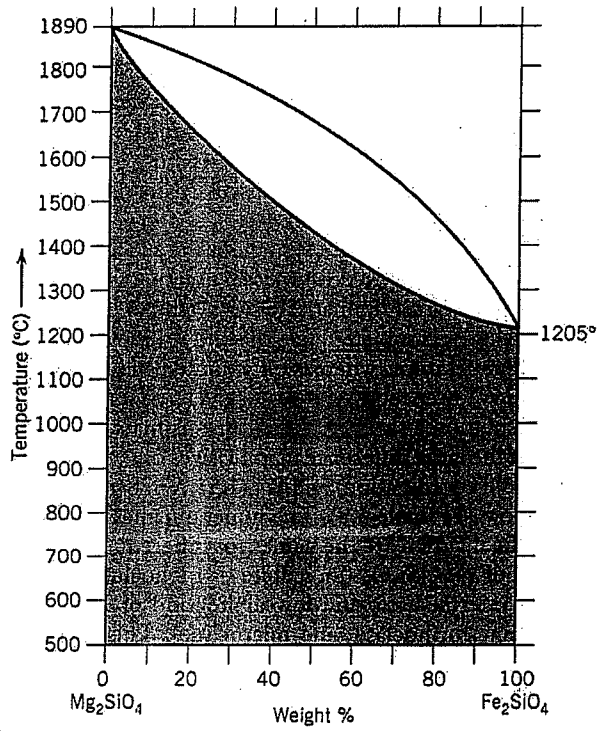
1、試解釋下列五個名詞的涵義：（15%）

（a）crystal form （b）twin （c）covalent bonding （d）point group （e）solid solution.

2、下圖為一個兩成份相圖（phase diagram），兩個端成份分別為鎂橄欖石（Mg_2SiO_4）和鐵橄欖石（Fe_2SiO_4），試回答下列問題：（15%）

（a）於答案卷上簡繪此圖，並於其上標示以下資訊（請勿直接於試題紙上作答）：（1）單一液相區、（2）單一固相區、（3）liquidus、（4）solidus、（5）兩相共存區。

（b）請說明這個相圖的意義。



3、（a）試敘述礦物（mineral）的定義。

（b）礦物資源在工業與民生有著無比的重要性，金屬與非金屬礦石礦物所提煉出來的金屬或純化製成的礦物製品都是人類每天生活中所不可或缺的，試舉出三種常用的金屬礦石礦物（非自然金屬），寫出其名稱與化學成份。（10%）

4、（a）一個礦物晶體完全由平整的結晶面所包覆，我們如何形容這樣的晶體？反之，如果一個礦物完全沒有平整的結晶面所包覆，我們又如何形容這樣的晶體？

（b）從上述結晶面發育良好的礦物晶體的外表所能展現的基本對稱性質（或對稱運作）有哪幾種？還有什麼對稱性質是無法從晶體外型看出來的？（10%）

國立中山大學99學年度碩士班招生考試試題

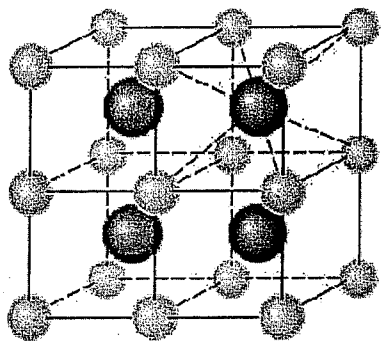
科目：礦物學【海資系碩士班丙組選考】

5、試說明下列兩個符號之意義（符號代表什麼意義？字母與數字各代表什麼性質？各個數字在空間中相對於晶體座標系統的關係為何？可繪圖輔助說明）（10%）
（a）*F*432 （b）*P*422

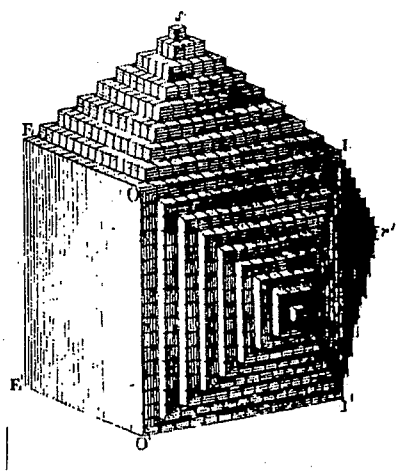
6、有一黑色短柱狀晶體，硬度大於玻璃，在垂直其長軸的截面上可見兩組相交約成 90 度之解理面，經由化學分析得知其化學成份為 SiO_2 = 50.98 %，TiO_2 = 2.17 %，Al_2O_3 = 5.36 %，FeO = 7.92 %，MgO = 13.27 %，CaO = 20.40 %（重量百分比），試利用計量化學之方法計算出此礦物之化學式，並判斷其為何種礦物（需寫出計算過程，原子量 O = 16.0，Si = 28.1，Ti = 47.9，Al = 27.0，Fe = 55.8，Mg = 24.3，Ca = 40.1）。（10%）

7、請說明下列符號的意義：（a）(*hkl*) （b）2/*m* 2/*m* 2/*m* （c）[*uvw*] （d）{*hkl*} （10%）

8、下圖中黑色大球和灰色小球分別代表陰離子和陽離子，請說明這個結構之（a）離子的堆積形式以及其 Bravais lattice 的類型，（b）陽離子和陰離子的配位數，（c）此結構之名稱。（10%）



9、在礦物學的發展史上，十八世紀末期賀依（Ren'e J. Haüy）提出一個結晶學上重要的觀念可以用下圖來表示，試說明（a）他所提出來的這個觀念，（b）這個觀念在現代結晶學的說法又是如何？（10%）



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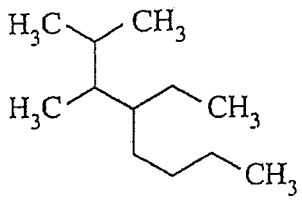
1-10 題爲單選題，每題 5%，答錯每題倒扣 1%。

1.

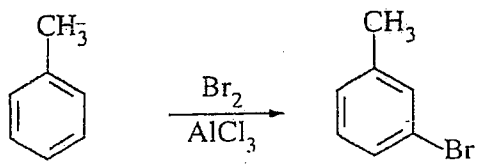


According to IUPAC nomenclature, which of the following is the name for the compound shown above?

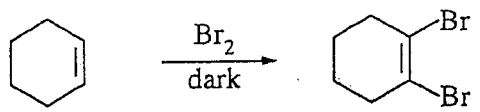
(A) 3-butyl-2-(1-methylethyl)pentane
(B) 2-isopropyl-3-butylpentane
(C) 2-isopropyl-3-ethylheptane
(D) 4-ethyl-2,3-dimethyloctane
(E) 2-isododecane

2. Which of the following reactions yields the indicated compound as a major product?

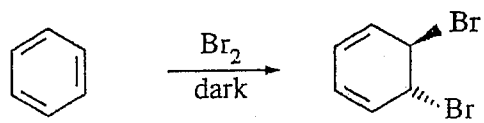
(A)



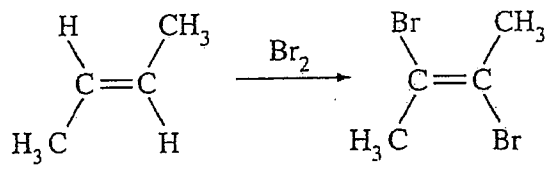
(B)



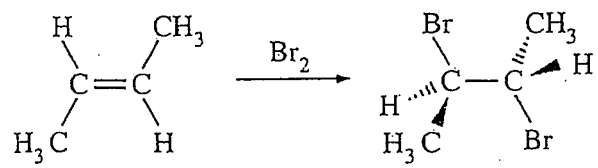
(C)



(D)

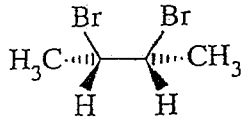


(E)

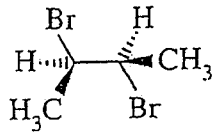


3. Which of the following substances is achiral?

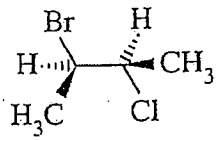
(A)



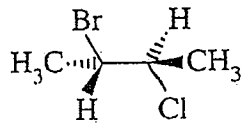
(B)



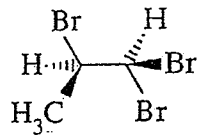
(C)



(D)

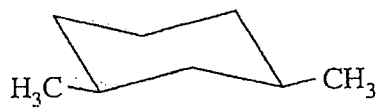


(E)

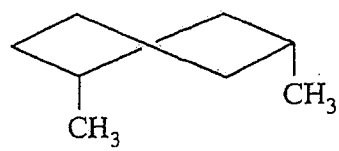


4. Which of the following structures is the most stable conformation of *cis*-1,3-dimethylcyclohexane?

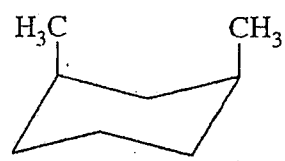
(A)



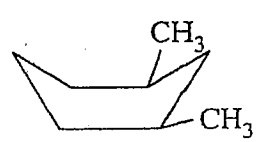
(B)



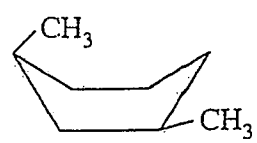
(C)



(D)



(E)



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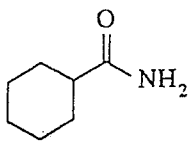
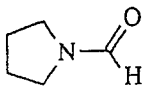
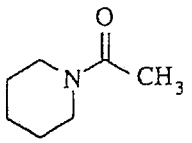
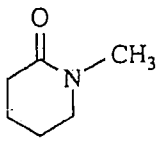
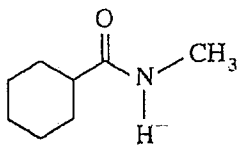
5. Which of the following reactions will produce a secondary amine?

(A)  1. $LiAlH_4$, diethyl ether; 2. H_2O

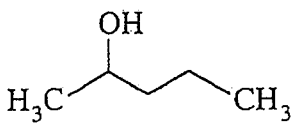
(B)  1. $LiAlH_4$, diethyl ether; 2. H_2O

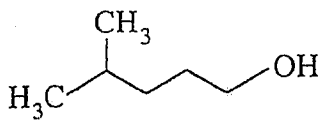
(C)  1. $LiAlH_4$, diethyl ether; 2. H_2O

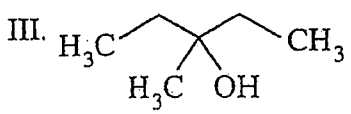
(D)  1. $LiAlH_4$, diethyl ether; 2. H_2O

(E)  1. $LiAlH_4$, diethyl ether; 2. H_2O

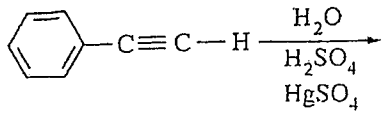
6. Which of the following is the correct order of reactivity, from fastest to slowest, toward acid-catalyzed dehydration?

I. 

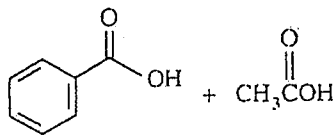
II. 

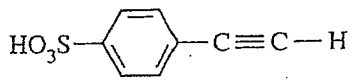
III. 

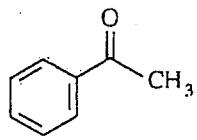
(A) I > II > III
(B) I > III > II
(C) II > III > I
(D) III > I > II
(E) III > II > I

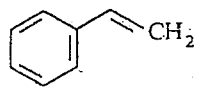
7. 

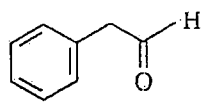
Which of the following is the major organic product of the reaction sequence shown above?

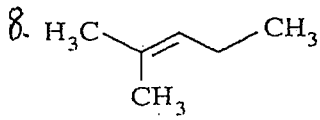
(A) 

(B) 

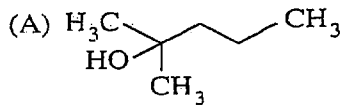
(C) 

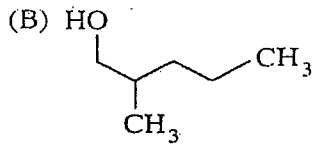
(D) 

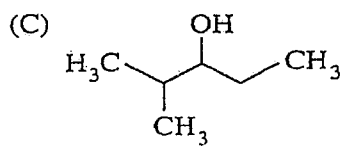
(E) 

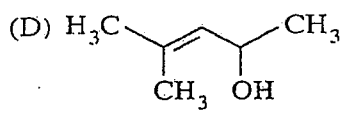
8. 

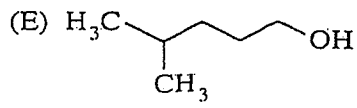
Which of the following is the major organic product of the reaction sequence shown above?

(A) 

(B) 

(C) 

(D) 

(E) 

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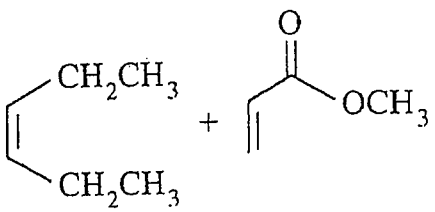
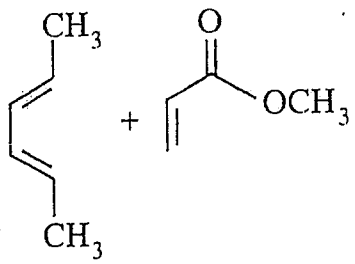
9. The best combination of reactants that will produce the product above via a Diels-Alder reaction is which of the following?

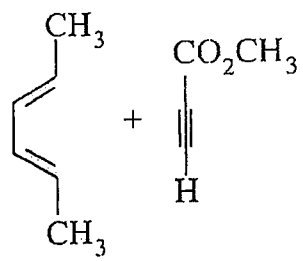
(A)



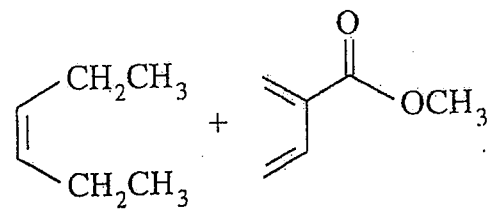
(B)



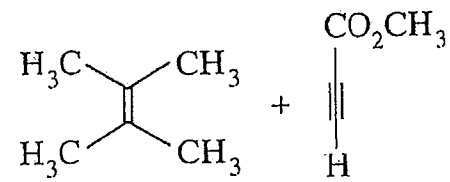
(C)



(D)



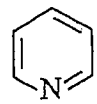
(E)



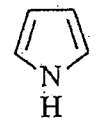
10. Of the following, which is the strongest base?

(A)

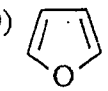
(B)



(C)



(D)



(E)

11. 試述有機化學及有機光譜學對海洋生技及資源研發之重要性。(50%)

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請注意: 考題中若涉及計算,請將演算過程列出,否則不予計分.

(對數資料： $\log 2 = 0.3010$; $\log 3 = 0.4771$)

(10%)1. Distinguish between
(a) the equivalence point and the end point of a titration.
(b) a primary standard and a secondary standard.

(10%)2. The solubility products for a series of iodides are

CuI	$K_{sp} = 1\times10^{-12}$
AgI	$K_{sp} = 8.1\times10^{-17}$
PbI_2	$K_{sp} = 7.1\times10^{-9}$
BiI_3	$K_{sp} = 8.1\times10^{-19}$

List these four compounds in order of decreasing molar solubility in
(a) water.
(b) 0.10M NaI.

(10%)3. What weight of sodium formate (HCOONa, 68 g/mol) must be added to 400.0 mL of 1.00M formic acid (HCOOH, Ka = 10^{-4})to produce a buffer solution that has a pH of 4.00?

(10%)4. List several sources of uncertainty in pH measurements with a glass/calomel electrode system.

(10%)5. Identify factors that cause the Beer's law relationship to depart from linearity.

(10%)6. Convert the following absorbance data into percent transmittance:
(a) 0.301 (b) 1.00

(10%)7. The distribution constant for X between *n*-hexane and water is 9.6. Calculate the concentration of X remaining in the aqueous phase after 50.0 mL of 0.150M X are treated by extraction with the following quantities of *n*-hexane:
(a)one 40.0-mL portion
(b)two 20.0-mL portions

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(10%)8. From the standard potentials

$$Ag_2SeO_4(s) + 2e^- \rightleftharpoons 2Ag(s) + SeO_4^{2-} \quad E^0 = 0.335\ V$$

$$Ag^+ + e^- \rightleftharpoons Ag(s) \quad E^0 = 0.799\ V$$

calculate the solubility product constant for Ag_2SeO_4.

(5%)9. Describe how an absorption photometer and a fluorescence photometer differ.

(5%)10. In NMR spectroscopy, what are the advantages of using a magnet with as great a field strength as possible?

(5%)11. How do gas-liquid and gas-solid chromatography differ?

(5%)12. What are the advantages of fused-silica capillary columns compared with glass or metal columns?