

Part I. Question 1 to 10, please choose the answer closest to the underlined word or phrase. One Answer Only. 2 points each.

1. Leaders of the world's largest economies are close to an agreement to tackle the global financial crisis.
(A) fight (B) meditate (C) forbid (D) deal with
2. I think people realize the economy seemingly fell off the cliff.
(A) inclined (B) caught up (C) help up (D) slumped
3. In the future, globalization is going to be increasingly driven quickly to its processes and technologies, and start to march forward.
(A) directed (B) motivated (C) forced (D) manipulated
4. The home team kicked off the season with an easy win.
(A) interrupted (B) commenced (C) avoided (D) complicated
5. The use of stem cells is controversial - opponents object on the grounds that it is unethical to destroy embryos in the name of science.
(A) adversaries (B) allies (C) forerunners (D) associates
6. Slumdog Millionaire is about a Mumbai teen who grew up in the slums, becomes a contestant on the Indian version of "Who Wants To Be A Millionaire?"
(A) asylum seeker (B) gangster (C) youngster (D) homeless
7. Critical listening is a difficult kind of listening because it requires you to both interpret and evaluate the message.
(A) understand (B) integrate (C) intrigue (D) compose
8. He is worried about a potential quiz tomorrow.
(A) possible (B) actual (C) providential (D) surprising
9. These two girls prefer to have intimate conversation one-on-one
(A) personal (B) secret (C) intelligent (D) discreet
10. His position was contrary to that of the teacher's
(A) puzzling (B) opposite (C) compatible (D) foreseeable

Part II. Question 11-15, please choose the answer that best completes the sentence. Question 16-20, please choose the best answer to fill each of the numbered blanks in the passage.

In many countries, it is considered 11 to appear naked or even half-naked on a public beach. However, some places often have a few 12 beaches that are designated as nudist or "clothing optional" beaches, where uninhibited people can fully 13 themselves to the sun. Other countries, especially those where 14 are hot and attitudes are 15, impose no restrictions at all, so people may sunbathe topless or nude even on the public beaches.

11. (A) inappropriate (B) interesting (C) conservative (D) considerate
12. (A) inclusive (B) executive (C) secluded (D) acceptable
13. (A) demonstrate (B) expose (C) lie down (D) externalize
14. (A) seawater (B) cuisine (C) fashion (D) climates
15. (A) strict (B) sincere (C) liberal (D) general

There are many different forms of potential economic stimulus and they work in different ways. Tax cuts for individuals generally encourage short-term spending. Tax cuts for companies encourage both spending and investment. Expenditures on public works create contracts for firms and provide short- to medium-term 16. Investments in research and development take a longer-term approach 17 the theory 18 in the future (and thus provide jobs) if they have the money to make intelligent investments in their operations

now. Finally, some forms of economic stimulus seek to make investments that will pay off in the long run 19 for everybody. An example is investing in the U.S. energy grid. 20, a one-time outlay could make energy costs for both individuals and businesses less expensive for decades to come.

16. (A) opportunities of employment (B) employment opportunities
(C) employing opportunities (D) employment in opportunities
17. (A) under (B) in (C) of (D) on
18. (A) business is going to be thrive (B) which business is going to be thrive
(C) that business will thrive (D) business thrives
19. (A) with cheaper consumption (B) in making cheaper consumption
(C) by consuming cheaply (D) by making consumption cheaper
20. (A) Theoretic concern (B) Theoretical (C) Being theoretic (D) Theoretically

Part III. Reading Comprehension. In this part, you will read several passages. Each one is followed by one question or a number of questions. Question 21 – 40, you should choose the ONE best answer to each question. 2 points Each.

Question 21-25

The importance of strength in many sports is undeniable. It is so important that many university and professional teams now hire a specialized coach who only attends to the development of strength in athletes. It is interesting to note that no such specialist is hired to attend to the other components of physical fitness. We have yet to see a cardiovascular coach, a coach who attends to developing fitness of the heart and blood vessels, hired by universities or professional teams. This situation raises the question of the relative importance of each of these two components, strength training and cardiovascular training, to the other. Does the strength coach develop the cardiovascular system by prescribing a program to increase muscle fiber?

It is theoretically possible to design a weight-lifting program in which the resistance is so low and the repetitions so numerous that it provides the cardiovascular benefits of a running program. Therefore, if you view weights as a way to overload muscles, you can imagine a continuum of programs that emphasize cardiovascular benefits on the one extreme and strength on the other. The practical truth of the matter is that most coaches are primarily concerned with pure strength. Therefore, the athlete has to work on the end of the weight-overload continuum that promotes little, if any, cardiovascular benefit. In fact, one study has found that a high-intensity strength program reduced mitochondrial density (density of the cellular structures that produce energy in the muscle fiber) per unit of muscle. The athletes increased muscle mass, so they did not eliminate mitochondria presumably, but the fact remains that the oxidative capacity, the ability to use oxygen in the synthesis of energy, was not promoted. Oxidative capacity would usually improve in programs that stress cardiovascular conditioning. Neither increased blood flow nor increased mitochondrial density (both indicators of oxygen extraction) occur with strength training.

Obviously, there is nothing wrong with training athletes to gain strength, but in most strength programs cardiovascular improvements are not made. Therefore, for athletes, who require both strength and cardiovascular conditioning, both components must be trained independently.

21. What is the main point of the passage?
- (A) College and professional teams do not need specialized coaches.
(B) Strength training should be replaced by cardiovascular training.
(C) Cardiovascular training is more difficult than strength training.
(D) Athletes need both strength and cardiovascular training.

22. Under which of the following conditions can a weight-lifting program provide cardiovascular benefits?
- (A) When the weights are very heavy
 - (B) When the weights are lifted very slowly
 - (C) When lifting a heavy weight overtires the muscles
 - (D) When light weights are lifted a large number of times
23. Why does the author mention running?
- (A) To give an example of the benefits of strength training
 - (B) To demonstrate what a typical weight program includes
 - (C) To give an example of an activity that provides cardiovascular conditioning
 - (D) To demonstrate the importance of oxygen extraction
24. Which of the following is an important direct result of cardiovascular training?
- (A) Improved oxidative capacity
 - (B) Increased muscle fiber
 - (C) Decreased mitochondrial density
 - (D) Increased body weight
25. Which of the following policies would the author be most likely to support?
- (A) Sports teams should increase their strength-training programs.
 - (B) All athletes should be able to choose the kinds of training they prefer.
 - (C) Sports teams should provide improved cardiovascular training.
 - (D) All athletes should avoid strength training in order to avoid injury.

Question 26-31

It is in search of adequate food supplies that cetaceans, marine mammals such as whales and dolphins, travel the oceans. They live in a world that is largely hidden from humans. Yet their range is three times as large as ours, since oceans occupy about three-quarters of the Earth's surface. They travel through well-marked ocean zones, **each** with its own characteristic marine life. They glide through the water, periodically rising to the surface to breathe. The sea may be raging but cetaceans are untroubled by the greatest storms; indeed they are more at home in rough than in calm seas.

Indirectly, however, their life is greatly influenced by wind. The eastward rotation of the Earth produces the **prevailing** trade winds, blowing east to west at the equator. These winds drag the surface waters and all they contain in a westerly direction. Warmed by its passage through the tropics, the wind-driven water is deflected against the westward continents, turning southwest in the Southern Hemisphere and northwest in the Northern Hemisphere.

In the Southern Hemisphere, the warm flow of tropical water under the west-going equatorial trade wind produces a genial climate along the eastern shores of Australia, South America, and South Africa. But there is open ocean to the south. Here the current is driven eastward unimpeded by land before the almost incessant westerly gales of this zone. The huge mass of water moves fast, chilled by water from the Antarctic Region, but **laden** with masses of plankton.

This cold, swift current is **split** when it strikes the southwestern extremities of the three southern continents. The northern portion of this water is diverted by the southwest coast of South America to sweep northward toward the equator. Known as the Humboldt Current, this current is rich in plankton on which cetaceans feed. Part of this same cool eastward-flowing current, enriched with water from higher latitudes, is similarly diverted north along the southwest coast of South Africa. This is the Benguela Current, where many cetaceans come to feed.

26. The passage answers which of the following questions?
- (A) What is the main difference between cetaceans and other marine life?

- (B) How far do most cetaceans travel in a year?
(C) How often do cetaceans need to breathe?
(D) What winds and ocean currents affect cetaceans?
27. The word **each** in paragraph 1 refers to a
(A) cetacean (B) surface (C) range (D) zone
28. The word **prevailing** in the passage is closest in meaning to
(A) arctic (B) blowing (C) dominant (D) energetic
29. The word **laden** in paragraph 3 is closest in meaning to
(A) balanced (B) filled (C) touched (D) wrapped
30. The word **split** in paragraph 4 is closest in meaning to
(A) stopped (B) divided (C) opened (D) surrounded
31. What do paragraphs 3 and 4 primarily discuss?
(A) The water currents in the Southern Hemisphere
(B) The trade winds in the Southern Hemisphere
(C) The three continents in the Southern Hemisphere
(D) The large area of open ocean in the Southern Hemisphere.

Question 32-36

Doris Lessing received her Nobel Prize in 2007. Her novel *The Golden Notebook* is considered a feminist classic by some scholars, but notably not by the author herself, who later wrote that its theme of mental breakdowns as a means of healing and freeing one's self from illusions had been overlooked by critics. She also regretted that critics failed to appreciate the exceptional structure of the novel. As she explains in *Walking in the Shade*, Lessing modeled Molly, to an extent, on her good friend Joan Rodker, the daughter of the author and publisher John Rodker.

Lessing does not like the idea of being pigeon-holed as a feminist author. When asked why, she replies:

What the feminists want of me is something they haven't examined because it comes from religion. They want me to bear witness. What they would really like me to say is, 'Ha, sisters, I stand with you side by side in your struggle toward the golden dawn where all those beastly men are no more.' Do they really want people to make oversimplified statements about men and women? In fact, they do. I've come with great regret to this conclusion.

- Doris Lessing, *The New York Times*, 25 July, 1982[8]

32. Doris Lessing is a Nobel Prize winner in
(A) Feminism. (B) Literature. (C) Sociology. (D) Peace.
33. According to Doris, what feminists want from her is
(A) exceptional structure. (B) fighting against men.
(C) creative ideas about men and women. (D) healing power from battles between men and women.
34. Doris Lessing does not particularly like the idea of being **pigeon-holed** as a feminist; pigeon-holed here means
(A) categorized (B) wholesale (C) viewed (D) completed
35. Which of the following statements is **FALSE**?
(A) Critics often neglect the theme of mental breakdowns as a self-freeing power.
(B) She models a heroine on her friend in one of her books.
(C) Her book *The Golden Book* is particularly considered a feminist one by Lessing.
(D) Lessing thinks critics understand her work very well.
36. Generally speaking, Lessing's attitude towards being considered a feminist is
(A) accepting (B) disappointed (C) welcomed (D) patient

Question 37-40

In recent years, many Taiwanese have won awards at international film festivals. However, many theater owners don't consider even prize-winning Taiwanese films to have much commercial potential in their home market. Their viewpoint is generally confirmed by the largely empty seats at showings of locally produced movies. The market share for local films is only about two percent, while more than 95 percent of the market is taken by Hollywood blockbusters. The dominance of American-made films in Taiwan has continued for the past ten years, but the government is proposing some solutions. It is hoped that some legal changes and few promotional projects will help Taiwan's struggling film industry.

One proposal is to give individuals or companies a tax deduction for money spent to produce a film. The idea is that the tax deduction would encourage investments in new films. There are also plans to provide financial support not only for film production, but also for marketing.

37. Which of the following could be a title for this passage?

- (A) The international Movie Industry and Taiwanese Films
- (B) Trends in Taiwanese Moviegoing Habits
- (C) Prize-Winning Taiwanese Films
- (D) A Helping Hand for the Taiwanese Film Industry

38. Which of the following statements is true about Taiwanese films in general?

- (A) They have been commercially successful both locally and abroad.
- (B) Most production of local films has been moved to Hollywood.
- (C) They have won many international awards, but little response from local audiences.
- (D) They have found little success anywhere in the world.

39. What does the passage imply is the main reason that Taiwanese films do not have a large local audience?

- (A) Taiwanese audiences dislike prize-winning films, thinking them "arty."
- (B) American films are superior in quality.
- (C) The Taiwanese film industry is not supported well enough financially.
- (D) Ticket prices for local films are too high.

40. How is the government attempting to help the local film industry?

- (A) By limiting the number of foreign films that local theater owners can show.
- (B) By encourage lower ticket prices for local films.
- (C) By establishing schools for training local filmmaking talent.
- (D) By helping to make creating and promoting local films more affordable.

Part IV. Essay. 20 points.

Do you think that technology alienate people from one another? Why or Why not? Please write a well-structured essay in 150 to 200 words discussing your opinions.

※ 可用計算機

※ 單位換算 : $1 \text{ bar} = 10^5 \text{ Pa}$, $1 \text{ Pa m}^3 = 1 \text{ J}$, $R = 8.314 \text{ J}/(\text{mol}\cdot\text{K})$

1. Define or explain the following words. (30%)
- | | |
|-------------------------------|-----------------------------------|
| a. elementary reaction | b. third law of thermodynamics |
| c. open system | d. intensive property |
| e. equation of state function | f. Raoult's law |
| g. rate of conversion | h. the law of corresponding state |
| i. Fick's first law | j. effusion |

2. (a) Explain Joule experiment and what we learn from this experiment? (20%)

(b) The joule coefficient is defined by
$$\left(\frac{\partial T}{\partial V}\right)_U = 1/C_V \left[P - T \left(\frac{\partial P}{\partial T}\right)_V \right]$$

Calculate the Joule coefficient for an ideal gas and for a van der Waals gas.

3. For a 2nd-order gas reaction $2A \rightarrow A_2$, if the total pressure of the reaction is P, the initial pressure of A is P_i , and the rate law falls in $R=k_2[A]^2$, please prove: $k_2 = \frac{2(P_i - p)}{P_i(2p - P_i)t}$ (15%)

4. For a reversible reaction,
- $$A \xrightleftharpoons[k_{-1}]{k_1} B$$

If at the beginning, only A is present at the concentration of A_0 , $k_1 = 0.006 \text{ min}^{-1}$, and $k_{-1} = 0.002 \text{ min}^{-1}$, (10%)

- (a) How long does it take to obtain an equal concentration between A and B?
 (b) After 100 min, what are the concentrations of A and B?

5. (a) Please derive the Gibbs-Helmholtz equation $\frac{\partial}{\partial T} \left(\frac{\Delta G}{T} \right)_p = -\frac{\Delta H}{T^2}$ (10%)

(b) Consider the reaction $\text{FeO}(s) + \text{CO}(g) \rightarrow \text{Fe}(s) + \text{CO}_2(g)$ for which K_p is found to have the following values: $K_p(600^\circ\text{C})=0.900$; $K_p(1000^\circ\text{C})=0.396$. Calculate $\Delta G_{\text{reaction}}^\circ$, $\Delta S_{\text{reaction}}^\circ$, and $\Delta H_{\text{reaction}}^\circ$ for this reaction at 600°C . Assume that $\Delta H_{\text{reaction}}^\circ$ is independent of temperature. (10%)

(c) Calculate the molar fraction of $\text{CO}_2(g)$ present in the gas phase at 600°C . (5%)

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第一部份：單選題 (30%)

- How many significant figures are there in the number 0.0006042?
A) 7 B) 3 C) 8 D) 4 E) 0
- A solution contains the ions Ag^+ , Pb^{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_2SO_4 , NaCl , Na_2S B) Na_2SO_4 , Na_2S , NaCl C) Na_2S , NaCl , Na_2SO_4
D) NaCl , Na_2S , Na_2SO_4 E) NaCl , Na_2SO_4 , Na_2S
- All of the following are weak acids *except*
A) HCNO B) HNO_2 C) HF D) HBr E) HCN
- Calculate the molarity of a solution of magnesium chloride with a concentration of 40.9 mg/mL. (MgCl_2 :95.21)
A) 0.859 M B) 0.430 M C) 0.215 M D) 2.33 M E) 0.684 M
- Silver chromate, Ag_2CrO_4 , has a K_{sp} of 9.00×10^{-12} . Calculate the solubility in mol/L of silver chromate.
A) 1.31×10^{-4} M B) 1.65×10^{-4} M C) 2.25×10^{-12} M D) 2.08×10^{-4} M E) 1.50×10^{-6} M
- The two salts AgX and AgY exhibit very similar solubilities in water. It is known that the salt AgX is much more soluble in acid than is AgY . What can be said about the relative strengths of the acids HX and HY ?
A) Nothing. B) HY is stronger than HX . C) HX is stronger than HY .
D) The acids are weak acids and have equal values for K_a . E) Both acids are strong.
- How many electrons are transferred in the following reaction?
$$2\text{ClO}_3^- + 12\text{H}^+ + 10\text{I}^- \rightarrow 5\text{I}_2 + \text{Cl}_2 + 6\text{H}_2\text{O}$$

A) 12 B) 5 C) 2 D) 30 E) 10
- Consider an electrochemical cell with a zinc electrode immersed in 1.0 M Zn^{2+} and a silver electrode immersed in 1.0 M Ag^+ .
$$\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn} \quad E^\circ = -0.764 \text{ V}$$
$$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag} \quad E^\circ = 0.800 \text{ V}$$

A) 0.036 V B) -0.036 V C) 1.564 V D) -1.564 V E) none of these
- The value of the equilibrium constant, K , is dependent on
I. The temperature of the system. II. The temperature of the system.
III. The concentration of the reactants. IV. The concentration of the products.
A) III, IV B) II, III C) I, II D) It is dependent on three of the above choices.
E) It is not dependent on any of the above choices.
- Which of the following will not produce a buffered solution?
A) 100 mL of 0.1 M Na_2CO_3 and 50 mL of 0.1 M HCl
B) 100 mL of 0.1 M NaHCO_3 and 25 mL of 0.2 M HCl
C) 100 mL of 0.1 M Na_2CO_3 and 75 mL of 0.2 M HCl
D) 50 mL of 0.2 M Na_2CO_3 and 5 mL of 1.0 M HCl
E) 100 mL of 0.1 M Na_2CO_3 and 50 mL of 0.1 M NaOH

第二部分：問答及申論題 (70%)

1. What is a transducer in an analytical instrument? (4%)
2. Define “low-pass filter” and “high-pass filter”. (6%)
3. Please answer the following questions corresponding to NMR.
 - A) How can spin-spin splitting lines be differentiated from chemical shift lines? (5%)
 - B) A nucleus has a spin quantum number of $5/2$. How many magnetic energy states does this nucleus have? What is the magnetic quantum number of each? (10%)
4. Please answer the following questions corresponding to potentiometry.
 - A) Differentiate between an electrode of the *first kind* and an electrode of the *second kind*. (5%)
 - B) What is the source of the *asymmetry potential* in a membrane electrode? (5%)
 - C) What is the source of the boundary potential in a membrane electrode? (5%)
5. Please answer the following questions corresponding to voltammetry.
 - A) Why is a high supporting electrolyte concentration used in most electroanalytical procedures? (5%)
 - B) What is the purpose of the electrodeposition step in stripping analysis? (5%)
 - C) Define half-wave potential ($E_{1/2}$). (5%)
6. Please answer the following questions corresponding to chromatography.
 - A) What is meant by temperature programming in GC? (5%)
 - B) What is the order in which the following compounds would be eluted from an HPLC column containing a reversed-phase packing? (5%)
acetone, dichloroethane, acetamide
 - C) Define size-exclusion chromatography. (5%)

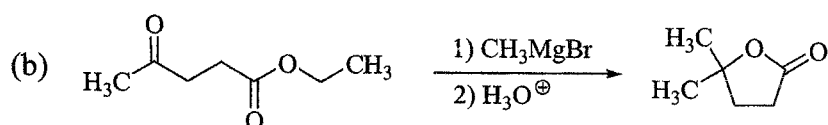
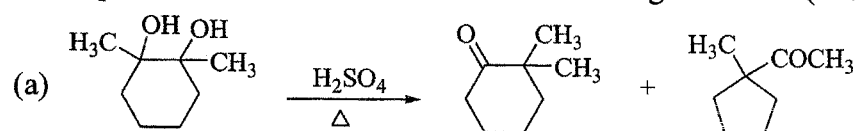
解釋名詞: 20% (每題 2%)

1. Glucagon
2. Thermogenin
3. Antibody
4. Glutathione
5. Transposon
6. β -Oxidation
7. Zymogen
8. Telomeres
9. Glycoprotein
10. RIA

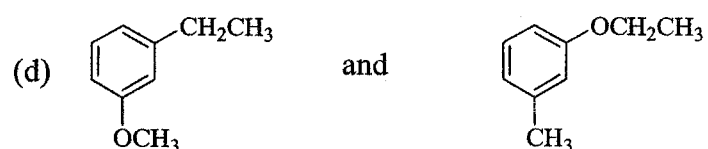
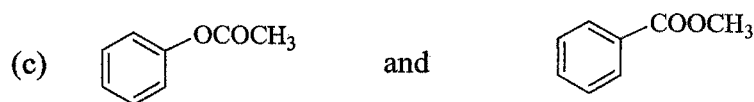
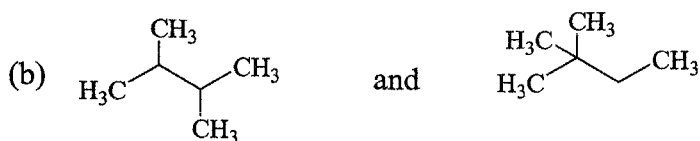
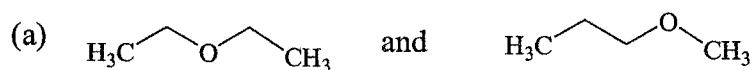
問答題: 80% (每題 10%)

- 一、請說明脂溶性維生素有那些及其重要的生理功能?
- 二、請說明 NADPH 及 Ribose 由那個代謝路徑產生, 其重要功為何?
- 三、試說明電子傳遞鏈 (Electron-transfer chain) 及其產能位置。
- 四、請說明飢餓 Glucose 降低時, 碳水化合物在肝臟中的主要代謝途徑?
- 五、何謂酵素 (Enzyme)? 並說明競爭性抑制作用 (Competitive inhibition) 有那些特性?
- 六、請說明 Southern blotting、Northern blotting 和 Western blotting。
- 七、DNA replication 時有那些特點。
- 八、某檢體中含蛋白質、糖類、脂肪及核酸, 可用那些方法將其分離純化?

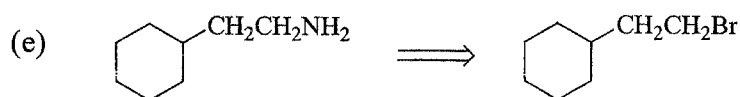
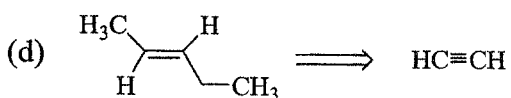
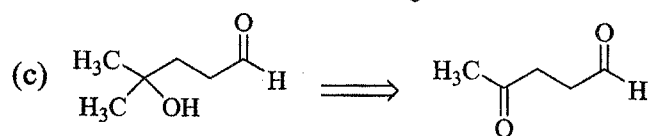
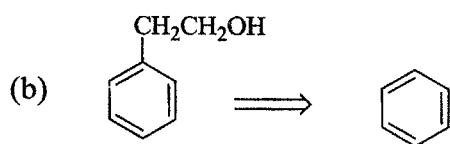
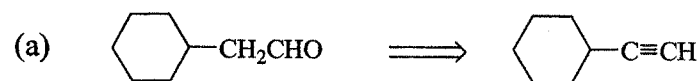
1. Propose a mechanism for the each of following reactions. (10%)



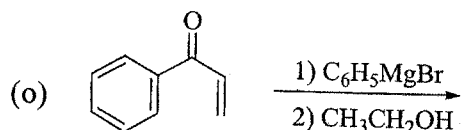
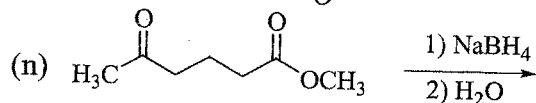
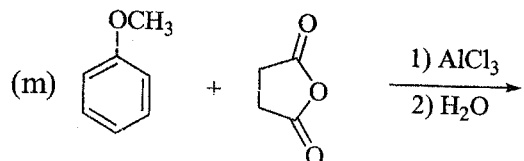
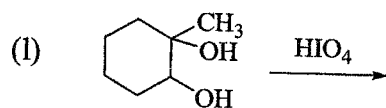
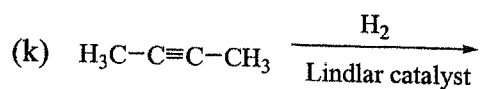
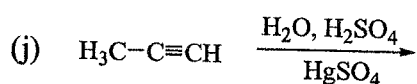
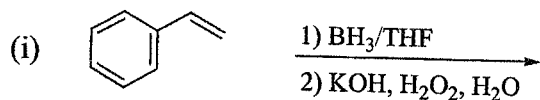
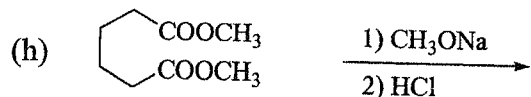
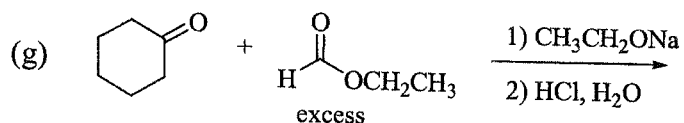
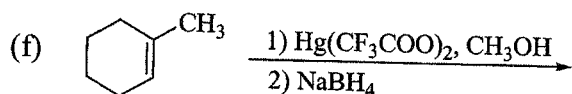
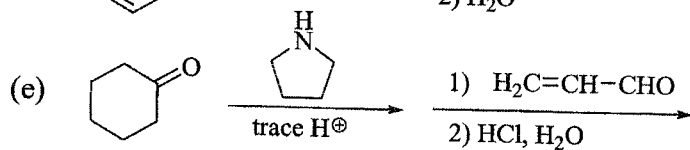
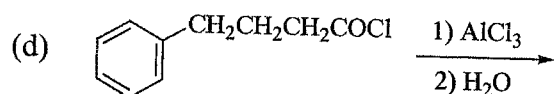
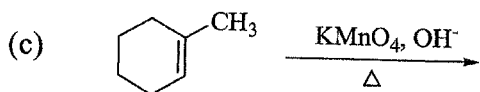
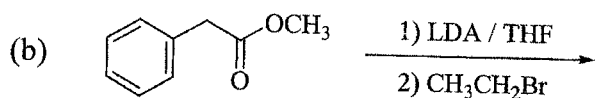
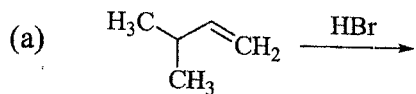
2. How could ^1NMR distinguish between the compounds in each of the following pairs. (20%)



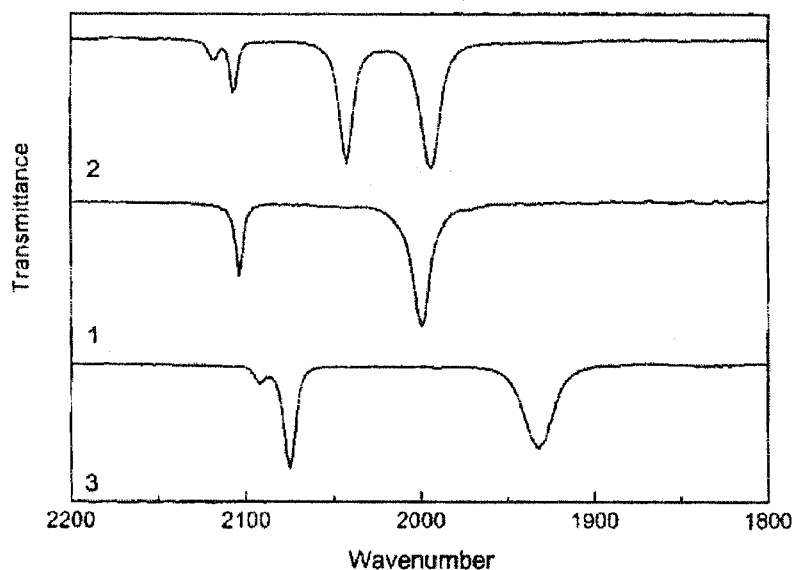
3. Show how the following compounds could be prepared from the given starting materials. You can use any necessary organic or inorganic reagents. (25%)



4. Give the structure of major product for the following reactions. (45%)



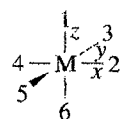
- Calculate L and S for the nitrogen atom. (6%)
- Calculate the spin-only magnetic moment for the following atoms and ion. (8%)
Fe, Fe^{2+} , Cr, Cr^{3+} , Cu, Cu^{2+}
- Using the angular overlap model, determine the relative energies of d orbitals in a metal complex of formula ML_4 having tetrahedral geometry. Assume that the ligands are capable of σ interaction only. How does this result for Δ_t compare with the value for Δ_o ? (12%)
- Please define the Fischer carbene and Schrock carbene? (10%)
- Give the valence electron count for the following species. Which one obeys the 18-e rule? (18%)
 - $[\text{CpCo}(\text{NO})]_2$
 - $\text{Cp}^*\text{Re}(\eta^2\text{-EtC}\equiv\text{CEt})\text{Cl}_2$
 - $\text{Cp}_2\text{Co}_2(\mu\text{-NO})_2$
 - $[\text{CpTi}(\text{CO})_4]^-$
 - $\text{Cr}(\text{CH}_2\text{CMe}_3)_2[\text{Pr}_2\text{PCH}_2\text{CH}_2\text{PPr}_2]$
 - $\text{Cp}^*(\text{CO})\text{Ir}(\mu\text{-CO})_2\text{Re}(\text{CO})\text{Cp}$
- Draw at least two possible structures of $\text{Os}_3(\text{CO})_9(\text{PPh}_3)_3$. (3%)
 - The IR spectrum of this compound in CH_2Cl_2 has CO stretches at 1962 and 1917 cm^{-1} . How does this knowledge help to narrow the possible structure? (5%)
- Explain how the facts that $(\eta^6\text{-C}_6\text{H}_5\text{CO}_2\text{H})\text{Cr}(\text{CO})_3$ is a stronger acid than benzoic acid and that $(\eta^6\text{-C}_6\text{H}_5\text{CO}_2\text{H})\text{Cr}(\text{CO})_3$ is a weaker base than aniline show that the $\text{Cr}(\text{CO})_3$ group withdraws electrons from the aromatic rings. (8%)
- Please distinguish the difference between the transition metal dihydride complex and dihydrogen complex? (5%)
- The infrared spectra of *trans*- and *cis*- $[\text{Fe}(\text{CO})_2(\text{CN})_4]^{2-}$ (1 and 2, respectively) and of $[\text{Fe}(\text{CO})(\text{CN})_5]^{3-}$ (3) are shown in the figure below.



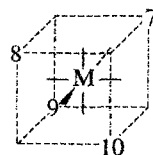
- Which stretching bands occur at lower energy, those for the CO ligand or those for the CN- ligand? Explain. (8%)
 - How many C-O and C-N stretching bands would you predict for each of these complexes on the basis of their symmetry? Compare your predictions with the observed spectra. (8%)
- Explain the following term: (9%)
 - agostic interaction
 - Nephelauxetic effect
 - HSAB theory (hard and soft acids and bases theory)

Reference:

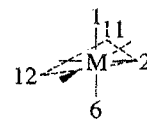
TABLE A
Angular Overlap Parameters: Sigma Interactions



Octahedral positions



Tetrahedral positions



Trigonal-bipyramidal positions

Sigma Interactions (all in units of e_{σ})
Metal d Orbital

CN	Shape	Positions	Ligand Position	z^2	$x^2 - y^2$	xy	xz	yz
2	Linear	1, 6	1	1	0	0	0	0
3	Trigonal	2, 11, 12	2	$\frac{1}{4}$	$\frac{3}{4}$	0	0	0
3	T shape	1, 3, 5	3	$\frac{1}{4}$	$\frac{3}{4}$	0	0	0
4	Tetrahedral	7, 8, 9, 10	4	$\frac{1}{4}$	$\frac{3}{4}$	0	0	0
4	Square planar	2, 3, 4, 5	5	$\frac{1}{4}$	$\frac{3}{4}$	0	0	0
5	Trigonal bipyramidal	1, 2, 6, 11, 12	6	1	0	0	0	0
5	Square pyramidal	1, 2, 3, 4, 5	7	0	0	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
6	Octahedral	1, 2, 3, 4, 5, 6	8	0	0	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
			9	0	0	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
			10	0	0	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
			11	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{9}{16}$	0	0
12	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{9}{16}$	0	0			

TABLE B
Representations and Orbital Symmetry for Square-Planar Complexes

D_{4h}	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$	
A_{1g}	1	1	1	1	1	1	1	1	1	1	R_z
A_{2g}	1	1	1	-1	-1	1	i	1	-1	-1	
B_{1g}	1	-1	1	1	1	1	-1	1	1	-1	
B_{2g}	1	-1	1	-1	-1	1	-1	1	-1	1	(R_x, R_y)
E_g	2	0	-2	0	0	2	0	-2	0	0	
A_{1u}	1	1	1	1	1	-1	-1	-1	-1	-1	z
A_{2u}	1	1	1	-1	-1	-1	-1	-1	1	1	
B_{1u}	1	-1	1	1	1	-1	1	-1	-1	1	(xz, yz)
B_{2u}	1	1	1	-1	-1	-1	1	-1	1	-1	
E_u	2	0	-2	0	0	-2	0	2	0	0	
											(x, y)