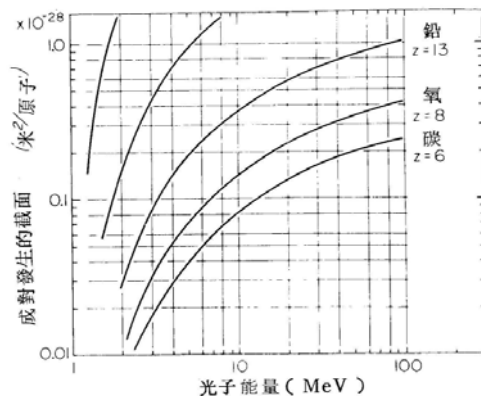


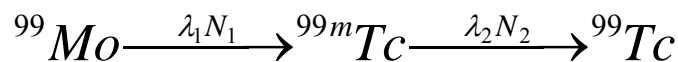
可使用電子計算機

(共 8 題，總分 100 分)

1. 一個射束含有  $10^8$  個光子，每一個光子的能量為 10 MeV，撞擊到每  $m^2$  含有  $10^{30}$  個原子的鉛板上，利用下圖的發生截面，計算下列問題。(a) 求出由成對發生(pair production)過程從射束移走的光子的數目 (5 分)? (b) 計算轉換成動能的能量 (5 分)?

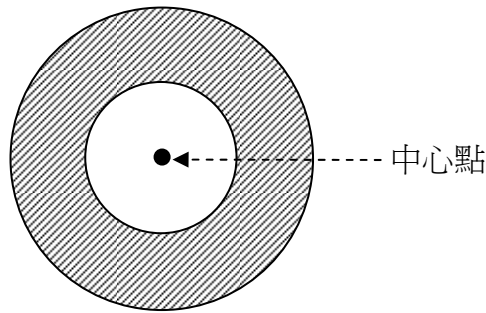


2. 當放射性核種  $^{226}_{88}Ra$  衰變到  $^{222}_{86}Rn$  時，5.5% 的頻率發射一個 4.6 MeV 的  $\alpha$  粒子。已知這種衰變中釋放的總能量  $Q = 4.88$  MeV。試問在衰變中， $^{222}_{86}Rn$  的彈跳能量(recoil energy)為多少 (5 分)?
3. 在核子醫學裡，廣泛地利用  $^{99}Mo$  同位素產生器來供應  $^{99m}Tc$  的同位素。假設現在有極純的放射性母核種  $^{99}Mo$ ，其衰變後的子核種為  $^{99m}Tc$ ，而會再衰變成子核種  $^{99}Tc$ ，如下圖所示。令母核種  $^{99}Mo$  的原子數目隨時間的變化為  $N_1 = (N_1)_0 \exp(-\lambda_1 t)$ ，其中  $(N_1)_0$  為母核種在時間  $t=0$  時的原子數目，且子核種  $^{99m}Tc$  的數目為  $N_2$ ， $\lambda_1$  及  $\lambda_2$  分別是母核種  $^{99}Mo$  及子核種  $^{99m}Tc$  的衰變常數。



- (a) 試推導出  $^{99m}Tc$  的量 ( $N_2$ ) 隨時間變化的方程式 (10 分)?
- (b) 已知  $^{99}Mo$  與  $^{99m}Tc$  的半衰期分別為 66.7 與 6 小時。試畫出母核  $^{99}Mo$  與子核  $^{99m}Tc$  活性隨時間變化的關係圖，使用對數(log)作圖 (5 分)?
- (c) 核醫部在星期二早上 9:00 接到一部活性為 100 mCi 的  $^{99}Mo$  產生器，於星期四早上 9:00 把所有的  $^{99m}Tc$  全部擠出，且在中午前  $^{99m}Tc$  都使用完了。當天下午核醫部來了一位新病人需要使用  $^{99m}Tc$ ，試問在下午 2:00 的時候約可以擠出多少活性的  $^{99m}Tc$  (10 分)?

4. 計算 200 kVp 的 X 光機滲漏輻射與散射輻射之次防護屏蔽時，求得滲漏輻射需 4 HVL(half-value layer)，已知鉛對 X 光機之 HVL 為 0.4 mm，屏蔽散射輻射需 2.0 mm，試問次防護屏蔽應為多少 HVL (5 分)？
5. 電腦斷層(CT)、單光子電腦斷層(SPECT)以及正子斷層造影(PET)，都使用類似的影像重建方法，包含傅利葉分析以及疊代法。
- (a) 請描述 Filtered Back Projection 以及 Iterative Line Correction 的影像重建原理 (10 分)？
- (b) 假設我們在一個圓球形物體獲得一張 PET 的橫切影像【如下圖：內圓為骨骼組織，密度為  $1650 \text{ kg/m}^3$ ，半徑為 10cm，衰減係數  $(\mu/\rho)$  為  $0.096 \text{ cm}^2/\text{g}$ ；外圓為肌肉組織，密度為  $1040 \text{ kg/m}^3$ ，半徑為 20cm， $(\mu/\rho)$  為  $0.092 \text{ cm}^2/\text{g}$ 】，在 PET 影像上我們偵測到中心點的強度為最外圍的 5 倍，試問經過衰減修正後，理論上中心點強度應修正為最外圍的多少倍 (10 分)？



6. 在臨床使用的超音波儀器中，今天我們使用一個頻率為 5.0 MHz 的平行式 transducer，假設今天想要檢查深度在 1.5 cm 內的組織的病變。
- (a) 試問 transducer 的大小至少多大才能在 1.5 cm 內維持射束的一致性 (beam coherent) (5 分)？
- (b) 續上題，在那樣大小的 transducer 下，深度 3.0 cm 處，測量到的射束寬度會變多大 (10 分)？
7. 現今的醫院中，愈來愈多醫院使用較強磁場的磁振掃描儀 (MRI)。假設現在醫院汰換了一台舊的 MRI，並且即將採購一台較高磁場的 MRI，若主磁場從原本的 1.5T 增加 3.0T 的磁場強度。
- (a) 試問組織的 T1、T2 及 Proton Density 物理特性會有怎麼樣的改變，請說明為什麼 (5 分)？
- (b) 除了上述常見的物理特性外，Echo-Planar Imaging (EPI)、Susceptibility-Weighted Image (SWI)、Time-of-flight MR Angiography (TOF MRA) 的影像上是否有無差異，若有差異請分別說明為什麼 (5 分)？
8. 若我們要在 3T MRI 中掃描 2D Spin Echo T2 權重影像，假設儀器參數設定如下：TR=6000 ms, TE=100 ms, slice thickness=2 mm, Field-of-view =  $10 \times 10 \text{ cm}^2$ , Matrix size =  $256 \times 256$ , Transmission Bandwidth = 5 kHz 及 Receiver Bandwidth = 100 kHz。
- (a) 請問這台 3T MRI 所搭配的梯度磁場至少要多大，才能掃描出所要的影像 (5 分)？
- (b) 已知脂肪與水在 3T 下的頻率相差 3.5 ppm，請計算在影像上會看到脂肪與水的訊號偏移了多少像素 (pixel) (5 分)？

**I. SENTENCE COMPLETION:** You are to choose the word or phrase that best completes the sentence. 20%

1. Joe is really creative fashion designer. He can always be relied on to \_\_\_\_ new ideas.  
(A) put up with (B) come up with (C) face up with (D) draw to
2. Everyone admired Dr. Victor Chang, the brilliant heart transplant surgeon. He was respected \_\_\_\_\_the world.  
(A) outside (B) over (C) throughout (D) through
3. At the end of the century, the Y2Kcomputer virus could have caused \_\_\_\_ in information systems worldwide.  
(A) problem (B) chaos (C) stoppage (D) fright
4. Have you ever \_\_\_\_ about a career in the electronics industry? I think you would be very successful.  
(A) thought (B) spoken (C) discussed (D) considered
5. I love springtime, when the mountains are covered in wild flowers. It's the most \_\_\_\_ time of the year.  
(A) awful (B) delightful (C) painful (D) fruitful
6. We've having a college reunion next week. \_\_\_\_ you like to join us?  
(A) Will (B) Can (C) Could (D) Would
7. Sometimes I get sick of studying, but I know it will be \_\_\_\_ it in the end.  
(A) good (B) useful (C) worth (D) worthwhile
8. It's very \_\_\_\_ when someone uses a cell phone during a movie because it disturbs other people.  
(A) annoyed (B) interesting (C) annoying (D) frustrated
9. \_\_\_\_ my grandfather is 85 years old, he still walks miles everyday.  
(A) Even (B) Despite (C) Although (D) However
10. That's the last time I'll go to that restaurant. The food made me \_\_\_\_ and I had to see a doctor.  
(A) angry (B) sad (C) unhappy (D) sick

**II. CLOZE TEST:** This passage contains several missing words or phrases. You are to choose the best answer for each missing word or phrase in the passage. 10%

The small Greek island of Eleni is not popular with tourists because it is isolated and difficult to get to. There are only two ferry services a week from Athens and the trip (11) eleven hours. Nevertheless, it was the ideal (12) for me to take the quiet vacation that I had dreamed about for so long. On the first evening, I sat on a sandy beach admiring the beauty of the sea and (13) the



trapezoid and is played by striking the strings with small wooden hammers called mallets. On the hammered dulcimer, there are sets of two, three, or four strings, called courses, which are struck at one time to sound each note. There are from twelve to twenty-two courses on a standard hammered dulcimer. The hammered dulcimer is usually categorized as belonging to the zither family of string instruments, although some musicologists challenge this classification.

The Appalachian dulcimer's immediate ancestors include the German scheitholt, the French epinette, and perhaps the Swedish hummel. It is classified as a member of the lute family of instruments. Appalachian dulcimers are painstakingly crafted by artisans, mainly in the mountain areas of West Virginia, Kentucky, Tennessee, and Virginia. They have three strings—the melody, middle, and bass string. Sometimes a second melody string is added. This instrument is played by plucking the strings with the fingers or with quills. They are shaped like teardrops or hourglasses. Heart-shaped holes in the sounding boards are traditional. Most performers play the instrument while seated with the instruments in their laps, but others wear them around their necks like guitars or place them on tables in front of them. Before the 1960's, the Appalachian dulcimer had a limited appeal. It was usually associated with dance music and with "hillbilly" music. However, the instrument was popularized by musicians such as Jean Richie and Richard Farina during the folk music revival of the 1960's and is today featured in many types of music.

21. The author says that the word dulcimer
  - (A) means "wooden box" (B) was not used until the 1960's
  - (C) means "sweet song" in Persian (D) comes from two languages
22. What is the greatest number of notes that could be played on a standard hammered dulcimer?
  - (A) Three (B) Four (C) Twelve (D) Twenty-two
23. According to the passage, experts do NOT all agree that the
  - (A) Appalachian dulcimer is a member of the lute family
  - (B) hammered dulcimer should be classified as a string instrument
  - (C) hammered dulcimer is a member of the zither family
  - (D) Appalachian dulcimer had a limited appeal before 1960
24. Which of these instruments could NOT be considered an ancestor of the Appalachian dulcimer?
  - (A) The zither (B) The epinette (C) The santir (D) The scheitholt
25. According to the passage, how many strings does the Appalachian dulcimer have?
  - (A) One or two (B) Three or four (C) Four or five (D) Six or more
26. According to the passage, most musicians play the Appalachian dulcimer
  - (A) while sitting down (B) with the instrument around their necks
  - (C) while standing next to tables (D) with wooden hammers
27. According to the passage, Jean Richie and Richard Farina are known for
  - (A) playing dance music and "hillbilly" music
  - (B) designing and building Appalachian dulcimers
  - (C) helping to bring more attention to dulcimers
  - (D) beginning the folk music revival of the 1960's

Pigeons have been taught to recognize human facial expressions, upsetting long-held beliefs that only humans have evolved the sophisticated nervous systems needed to perform such a feat. In recent experiments at the University of Iowa, eight trained pigeons were shown photographs of people displaying emotions of happiness, anger, surprise, and disgust. The birds learned to distinguish between these expressions. Not only that, but they were able to correctly identify the same expressions on photographs of unfamiliar faces. Their achievement does not suggest, of course, that the pigeons had any idea what the human expressions meant.

Some psychologists had theorized that, because facial expression is vital to human communication, humans have developed special nervous systems capable of recognizing subtle differences between expressions. Now the pigeons have cast doubt on that idea.

In fact, the ability to recognize facial expressions of emotion is not necessarily innate even in human babies, but may have to be learned in much the same way that pigeons learn. In experiments conducted several years ago at the University of Iowa, it was found that pigeons organize images of things into many of the same logical categories that humans do.

None of these results would come as any surprise to Charles Darwin, who long ago wrote about the continuity of mental development from animals to humans.

28. From the information in paragraph 1, it can be inferred that pigeons
- (A) show more emotions than people thought they could
  - (B) can understand the human emotions of happiness, anger, surprise, and disgust
  - (C) can identify only the expressions of people that they are familiar with
  - (D) have more sophisticated nervous systems than was once thought
29. The author probably believes that the psychologists mentioned in paragraph 2
- (A) will need to revise their theory
  - (B) no longer believe that expressions are important in human communication
  - (C) have conducted their own experiments with pigeons
  - (D) no longer think that the pigeons have cast doubt on their theories
30. In paragraph 3, the author suggests that, at birth, human babies
- (A) have nervous systems capable of recognizing subtle expressions
  - (B) can learn from pigeons
  - (C) are not able to recognize familiar faces
  - (D) may not be able to identify basic emotions through facial expressions
31. What can be inferred about the experiments that were conducted several years ago at the University of Iowa?
- (A) They were completely contradicted by more recent experiments.
  - (B) They supported the idea that pigeons and humans share certain mental abilities.
  - (C) They were conducted by scientists on human babies.
  - (D) They proved that animals other than pigeons could recognize human expressions.

32. If Charles Darwin could have seen the results of this experiment, his most probable reaction would have been one of \_\_\_\_\_ .

(A) rejection (B) surprise (C) agreement (D) amusement

The 1960's saw a rising dissatisfaction with the modernist movement in architecture, especially in North America, where its failings were exposed in two influential books, Jane Jacobs's *The Death and Life of Great American Cities* in 1961 and Robert Venturi's *Complexity and Contradiction in Architecture* in 1966. Jacobs highlighted the destruction of the richness and variety of America that occurred as a result of the urban renewal programs sponsored by the federal government. She went on to say that these historic buildings were being replaced by massive, impersonal buildings. Venturi implied that modernist structures were without meaning because they lacked the complexity and intimacy of historical buildings. Both writers called for a new style of architecture.

By the early 1980's, post-modernism had become the dominant style, particularly for public buildings in the United States. Post-modernism evolved from modernism and yet it is a contradiction of that style. In fact, post-modernists have little in common with one another in terms of style or theory. They are united mainly in their opposition to the modernist style. One quality that is common to many post-modernist buildings is characterized by what architect Peter Jencks calls "double coding," a mixture of two styles: modern mixed with tradition, contemporary with historical, functional with decorative, and familiar with newly invented. These characteristics can be seen in Robert Venturi's bold designs for the Brant-Johnson House (1975) in Vail, Colorado, which mixes contemporary and Italian Renaissance style. Similar characteristics are clear in the work of Venturi's disciple Michael Graves's Portland Building (1982) in Portland, Oregon, and his Humana Tower (1986) in Louisville, Kentucky, have the bulk of skyscrapers but incorporate historical souvenirs such as colonnades, belvederes, keystones, and decorative sculpture. Likewise, Robert Stern's Observatory Hill Dining Hall (1984) at the University of Virginia in Charlottesville, Virginia, combines the red brick and white wood of Thomas Jefferson's original plan for university building with modern building forms and walls with large windows. Chinese-American architect I. M. Pei's design for an addition to the Louvre Museum in Paris (1989) included a glass pyramid, referring to the Egyptian art in the Louvre and the fact that French emperor Napoleon Bonaparte played a major role in making Egypt a subject of study in the early 1800's.

Another major tendency in post-modern architecture is the emphasis on decoration, which modernism eliminated. This can be seen in the works of Phillip Johnson, who was once a champion of modernism but became an out-spoken advocate of post-modernism. He wrapped the AT&T building (1984), which is now the SONY Building, in New York City, in pinkish granite and topped it with a tower that looks like an enormous piece of Chippendale furniture. Some architects turned entire building into sculptures. Frank Gehry's monumental Guggenheim Museum in Bilbao, Spain (1997), resembles an enormous abstract sculpture made of glass and titanium steel.

## Glossary

**Chippendale:** an ornate style of furniture first developed in Britain in the eighteenth century

33. Which of these statements best expresses the opinion of Jane Jacobs and Robert Venturi as given in paragraph 1 ?
- (A) Post-modern buildings are massive and impersonal.
  - (B) Modernist architecture is rich and varied
  - (C) The federal government should increase its urban renewal efforts.
  - (D) Modernism should be replaced by some other style of architecture.
34. The primary purpose of the second paragraph is to
- (A) explain “double coding” and give examples of various combinations of styles
  - (B) describe several features of skyscrapers
  - (C) discuss how Pei’s pyramid refers to Napoleon Bonaparte and his study of Egyptian culture
  - (D) show how post-modernism evolved from modernism
35. The author probably uses the word *souvenirs* in paragraph 2 because
- (A) tourists often visit the Portland Building and the Humana Building and buy souvenirs
  - (B) the Portland Building and the Humana Building now exist only in people’s memories
  - (C) some features of the Portland Building and the Humana Building remind people of the past
  - (D) the Portland Building and the Humana Building house important museums
36. The author presents details about the AT&T (now the SONY) building in New York City to show that it
- (A) resembles an abstract sculpture
  - (B) influenced post-modern furniture design
  - (C) was built when Johnson was modernist architect
  - (D) has ornamental architectural features

In April 1874, an art exhibit opened in Paris featuring famous and priceless works of art. However, at the time, no one knew that these paintings would one day be considered masterpieces. The paintings and the painters were **virtually** unknown at the time and would remain that way for several years. (Paragraph 1)

In the nineteenth century, French art was dominated by the Academy of Fine Arts. Every year the academy held an art show called *Le Salon*. In 1863, the Academy rejected one of the paintings of Edouard Manet. Manet and a group of other independent artists organized their own show, which they called *Salon des Refuses* (Salon of the Rejected), which opened on April 15, 1874. A newspaper critic named Louis Leroy visited the gallery and was not pleased with what he saw. One painting of boats in a harbor at dawn by Claude Monet particularly enraged him. It was called *Impression: Sunset*. Leroy wrote that this piece and in fact most of the pieces in the show, looked like “impressions”—a term for a preliminary, unfinished sketch made before a painting is done. Leroy’s newspaper review was jokingly called “The Exhibition of the Impressionists.” Within a few years of Leroy’s review, the term *Impressionists* had clearly stuck, not as a term of **derision** but as a badge of honor, and a new movement was born. (Para 2)

The Impressionist movement included the French painters Edouard Manet, Claude Monet, Pierre-Auguste Renoir, Edgar Degas, Paul Cezanne, and the American painter Mary Cassatt. The



techniques and standards employed within the Impressionist movement varied widely, and though the artists shared a core of values, the real glue which bound the movement together was its spirit of rebellion and independence. (Para 3)

This spirit is clear when you compare Impressionist paintings with traditional French paintings of the time. Traditional painters tended to paint rather serious scenes from history and mythology. Many Impressionist paintings feature pleasant scenes of urban life, celebrating the leisure time that the Industrial Revolution had won for the middle class, as shown in Renoir's luminous painting *Luncheon of the Boating Party*. In that famous painting, the sun filters through the orange-striped awning, bathing everything and everyone at the party in its warm light. Renoir once said that paintings should be "...likable, joyous, and pretty." He said, "There are enough unpleasant things in this world. We don't have to paint them as well." It is this joy of life that makes Renoir's paintings so distinctive. (Para 4)

The Impressionists delighted in painting landscapes (except for Edgar Degas, who preferred painting indoor scenes, and Mary Cassatt, who mainly painted portraits of mothers and children). Traditional painters, too, painted landscapes, but their landscapes tended to be somber and dark. The Impressionists' landscapes sparkle with light. Impressionists insisted that their works be "true to nature." When they painted landscapes, they carried their paints and canvases outdoors in order to capture the ever-changing light. Traditional painter generally made preliminary sketches outside but worked on the paintings themselves in their studios. (Para 5)

"Classic" Impressionist paintings are often easy to spot because of the techniques used by the painters. One of the first "rules" of the Impressionist, that the colors should be dropped pure on the canvas instead of getting mixed on the palette, was respected by only a few of them and for only a couple of years, but most Impressionists mixed their paints as little as possible. They believed that it was better to allow the eye to mix the colors as it viewed them on the canvas. The traditional technique at the time was to make sketches or outlines of the subject before painting them. Generally, Impressionists painted directly onto the canvas without sketches. Impressionists tended to paint with short, thick strokes of paints shaped like commas. While traditional painters paid attention to details, Impressionists valued overall effect. Traditional painters always tried to hide their brush strokes, but Impressionists left brush strokes on the canvas for the world to see. Unlike traditional painters, Impressionists applied one layer of paint on top of the last one without waiting for the paint to dry. These techniques created paintings that seemed strange and unfinished to the general public when they were first painted, but are much loved in our time. (Para 6)

37. What point does the author make about the art show that opened on April 15, 1874, at the Salon des Refuses in Paris ?

- (A) It was more popular with visitors and critics than the official show called "Le Salon."
- (B) It made the painters and paintings shown there instantly successful.
- (C) Its organizers refused to allow Edouard Manet to display his paintings there.
- (D) It featured famous paintings and painters before they became well known.

38. The word virtually in the passage is closest in meaning to the word \_\_\_\_\_.

- (A) almost (B) infinitely (C) seemingly (D) forever
39. According to the author, Louis Leroy used the term “Impressionists” because \_\_\_\_\_ .  
(A) he understood that these artists did not carefully study their subjects, but only got a quick impression of what they painted  
(B) he thought that Monet’s painting, and all of the paintings at the show, looked like unfinished drawings  
(C) he believed that giving these artists a group name would help them become famous  
(D) he thought that the painting *Impression: Sunset* was the best painting at the show
40. The word **derision** in the passage is closest in meaning to  
(A) ridicule (B) sincerity (C) respect (D) sorrow
41. Renoir’s painting *Luncheon of the Boating Party* is given in paragraph 4 as an example of  
(A) an industrial scene (B) a study of some urban buildings  
(C) a picture of people enjoying their leisure time (D) a traditional French painting
42. According to the information in paragraph 5, what did the painters Edgar Degas and Mary Cassatt have in common?  
(A) They both painted portraits of children and mothers.  
(B) Neither of them was originally from France.  
(C) Neither of them was primarily interested in landscapes.  
(D) They both preferred painting unpleasant scenes.
43. According to paragraph 5, when traditional painters worked on landscape paintings, they  
(A) studied the ever-changing light (B) did not make any preliminary sketches  
(C) never left their studios (D) sketched outdoors but painted indoors
44. It can be inferred from the information in paragraph 6 that in the author’s view, the first “rule” of Impressionism \_\_\_\_\_ .  
(A) was not really a rule at all (B) was the most important rule of all  
(C) led Impressionists to mix their colors (D) lasted longer than other rules
45. The phrase **the last one** in the passage refers to  
(A) an artist (B) a painting (C) a brush stroke (D) a layer of paint

Genetic Engineering is a radical and rapidly developing technology that touches our lives through its application in medicine, forensics, industry and agriculture. Through this science humans are fast becoming the architects of life but there are those who warn against the unknown dangers of playing God while others see its benefits in our fight against disease and the production of **abundant** food supplies.

In the past 50 years, plant and animal production has increased dramatically. Today, the human population is the largest it has ever been and fortunately we produce more food per capita than ever before. Despite the fact that we have enough food for every single human being to have an adequate diet, some 1 billion people still suffer from malnutrition and hunger. A lot of the increase in food

production is **attributed to** efficient farming methods and environmental factors such as irrigation, pest and weed control but the largest contributing factor is modern plant and animal breeding.

Genetically engineered plants and animals have already entered the market and are on our supermarket shelves. Their appearance however has sparked much debate. Scientists have improved plants by changing their genetic makeup through *hybridization* since the 19<sup>th</sup> century, and farmers have used *crossbreeding* of plants and animals for thousands of years. For example, racehorses are bred to be faster and stronger and roses are bred to produce a wide range of colors. Cattle are bred according to whether they are for beef or dairy herds. Most of today's dairy cattle are very different from the cattle that were originally domesticated. Over the years, dairy herd breeding has focused on increasing milk production and quality. Milk production per cow has doubled in the last 25 years.

So what are GM food and what are the concerns for the consumer? The main difference between GM foods and traditional breeding methods is the direct modification or manipulation of certain genes. Traditional methods involve mixing thousands of genes whereas genetic modification allows just one individual gene, or a small number of genes, to be inserted into a plant, or animal.

The resulting organisms are “genetically modified,” “genetically engineered,” or “transgenic”. The foods that reach the supermarket are known as “GM” foods, *Genetically Modified foods*. The technique allows us to produce plants, animals and microorganisms, such as bacteria, with specific qualities more accurately and efficiently than through traditional methods.

The benefits of GM foods are enormous. Genetic modification can be used to give crops immunity to plant viruses or to improve the nutritional value of a plant. In animals intended for food, genetic modification could potentially increase how fast and how big they grow. *Starvation* on any part of the planet could be a thing of the past as we could the yield, varieties and size of foods and produce strains that are resistant to pests, Extremes in temperature and are tolerant to herbicides.

Opponents of GM foods however consider their production to be the world's biggest uncontrolled biological experiment, a disaster waiting to happen. The biggest concerns are the effects that an uncontrolled genetically modified species could potentially have on human and animal health, agriculture, and on the environment as a whole. Genetically modified species have the potential to become biological pollutants that are far worse than chemical pollutants as they would be virtually impossible to control since they are alive, migrate and could **mutate** producing even more dangerous offspring. This could lead to irreversible damage to the ecology of the planet.

Recent studies have shown that transgenic species could potentially hold bigger surprises than scientists anticipate. Genetically altering plants to resist viruses can cause the virus to mutate into new forms that could potentially be spread. The effect on crops could be disastrous. The toxins released by the genetically mutated virus could also have untold damaging effects on human, animal and plant life. Toxins can produce severe allergic reactions leading to death. (Para 8)

Another example could be the release of larger species into the environment. For example, what if scientists release squid, octopus and salmon that are 3 times their natural size. The new species would eat far more food, leaving less for other species possibly leading to the extinction of several

species that would ultimately damage the delicate ecology of our seas and therefore the planet as whole.

At the moment there is no proof of serious harm to humans, animals and plants but potential for a massive biological disaster that could wreak and irreversible damage is not such a fairy tale. On the other hand the possibility of forever freeing the world of starvation could outweigh ant possible dangers that may or may not be unleashed.

46. What is main difference between GM and traditionally bred foods?
- (A) Scientists can choose the outcome of GM foods such as size and color.
  - (B) The consumer is far more concerned about GM foods.
  - (C) Traditional methods rely on the direct manipulation of only certain genes.
  - (D) The difference lies in the methods and the number of genes that are affected.
47. Why has the appearance of GM foods in the supermarket sparked much debate?
- (A) Some people are worried about man taking over God's role of creator.
  - (B) Some people think GM foods should be sent to feed third world countries.
  - (C) Some people are concerned about the effects on our health and environment.
  - (D) Scientists do not know enough about the harmful effects of certain bacteria
48. In paragraph 6, why does the author state that starvation could be a thing of the past?
- (A) Because all varieties of genetically modified plant or animal will be able to survive in any environment.
  - (B) Scientists will be able to raise genetically modified animals on genetically modified animal feed which will dramatically increase their size.
  - (C) There would be no need to use expensive herbicides since all genetically modified crops will be pest resistant.
  - (D) Scientists will be able to control the size, variety and immunity of crops and animals.
49. In paragraph 7, what is the main opposition to the production of GM foods?
- (A) Chemical pollutants are more dangerous than biological pollutants.
  - (B) GM foods are not properly tested.
  - (C) Opponents to GM foods say that their production is an agricultural disaster waiting to happen.
  - (D) The potential of producing harmful offspring could not be controlled.
50. In paragraph 8, why does the author say that scientists might be surprised?
- (A) Toxins are carried through the air by wind dispersal.
  - (B) There is a potential that any new virus strains could be carried to other areas adversely affecting crops, human and animal life.
  - (C) They are often surprised by transgenic species.
  - (D) Toxins can potentially kill all life forms.

1. X 光是如何產生的?請畫出 X 光的能譜，並說明 kVp, mA, filter, 陽極靶材料對於 X 光的質(quality)和量(quantity)有何影響? (5%)
2. X 光攝影中散射(scatter)是如何產生的?那些因素會影響散射的多寡?什麼方法可以減少散射? (5%)
3. 試述影像增強管(image intensifier)的主要結構及每一組成元件的功能。(5%)
4. 試述 CR(computed radiography)的成像原理。(5%)
5. 試述乳房攝影執行壓迫的優缺點。(5%)
6. 試述電腦斷層掃描中 CT number 及 pitch 的定義。(5%)
7. 試述磁共振造影中使用 Gd-DTPA 顯影劑的原因及注意事項。(5%)
8. 試述都卜勒超音波(Doppler Ultrasound)的成像原理及應用。(5%)
9. 試述單光子斷層掃描(SPECT)及正子斷層掃描(PET)的硬體結構及成像原理。(10%)
10. 試述放射免疫分析(RIA)的原理、方法及應用。(10%)
11. 試述核醫藥物在甲狀腺的應用。(10%)
12. 試比較放射治療中使用光子治療和電子治療的差異。(10%)
13. 試述鼻咽癌(NPC)病人接受放射治療的流程及注意事項。(10%)
14. 試述放射治療使用分次治療的原因。(10%)