

I. Vocabulary: Choose the answer that best matches the meaning of each bold word or phrase (20%)

1. Fungal spores, lighter and smaller than all plant seeds, are mainly **dispersed** from their parent by wind.
A. spread widely B. delivered C. made more stable D. collected
2. The **devastating** earthquake and tsunami in Fukushima ruined most of the buildings there and killed thousands of lives.
A. foreboding B. damaging and harmful C. bitter D. intimidating
3. The philosophy of Barack Obama's foreign policy has been **postulated** as "The Obama Doctrine" for the principles it advocates.
A. disputed B. dismissed C. assumed D. scorned
4. Debates have been stirred on whether inmates should become the **integral** part of the social workforce.
A. constituent B. honest C. extrinsic D. outward
5. A mistake that was **inadvertently** made by the clerk has cost him his job.
A. intentionally B. deliberately C. carefully D. accidentally
6. It is **mandatory** that all students, regardless of degree program, take at least five core courses offered by the university.
A. compulsory B. optional C. elective D. voluntarily
7. The Bumrungrad Hospital, one of the leading international hospitals in the world, is known for treating patients with **state-of-the-art** technology.
A. very expensive B. the most advanced C. fashionable D. national treasure
8. Clinicians argue that **rigorous** scientific research is not necessary on alternative medicine, but researchers think otherwise.
A. powerful and forceful B. scrupulously accurate C. lenient D. strenuous
9. Under **optimal** temperature and growth conditions, certain bacteria can have a generation of 15-20 minutes.
A. unfavorable B. adverse C. ideal D. disagreeable
10. The word "Linsanity" is now in most NBA fan's **vernacular** as a result of Jeremy Lin's stunning breakout performance in these past few weeks.
A. collection B. everyday language C. souvenir D. password

II. Sentence Completion: Choose the word that best completes the sentence (10%)

11. Mary is _____ and would never want to be closed in a small room or space.
A. xenophobic B. homophobic C. acrophobic D. claustrophobic
12. Studies show that _____ children are at high risk for a number of conditions, including overweight, high blood pressure and high cholesterol.
A. slim B. anorexic C. obese D. malnourished
13. The ways web-based social media impact our lives are rather different from the ways traditional media do, the most notable being that social media allow communication to become more _____.
A. interactive B. hyperactive C. stagnant D. torpid
14. According to the International Labor Organization, the recent economic decline is likely to increase the unemployment rate for women as well as to make gender _____ in economic policies more visible.
A. equality B. discrepancy C. disparity D. similarity
15. Children with disabilities are discriminated against and treated as burden mainly due to _____ understanding by society and a lack of social supports.
A. sufficient B. ample C. disinterested D. inadequate

III. Written Expression: Identify the underlined word or phrase that must be changed in order for the sentence to be correct (14%)

16. My (A) strong experience, (B) good training, and (C) am a hard worker (D) qualify me for this position.
17. In (A) recent years, some educators argue that it is better for undergraduate students (B) to focus on only one or two subjects than to study a (C) diversified range of different (D) subject.
18. The furniture and refrigerator were (A) delivered (B) promptly to my home, but they were not the style I (C) ordered, and the (D) price was not right either.

19. The saltwater (A) crocodile, the largest of all living (B) reptiles, can travel long (C) distances at sea and is capable of killing any animal that (D) enter its territory.
20. If you are (A) assigned a specific topic for a research paper, you can begin (B) by going to the library to look for (C) informations that (D) is relevant to the topic.
21. According to scientists, if a woman's waist is 70 percent as wide as her (A) hips, she (B) viewed as attractive by most men because the evolution of the brain (C) associates this body figure (D) with fertility.
22. Even though some companies view bribery (A) as illegal, (B) other tolerate it because it is a good way to speed up the (C) completion of a deal and (D) prevent harassment.

IV. Cloze Test: Choose the best answer for each missing word or phrase in the following passages (20%)

On the day of Taiwan's presidential election, hundreds of millions of ethnic Chinese worldwide watched the ballot count on TV and the Internet. Taiwan is the sole ethnic Chinese society (23) a second democratic turnover of power. Ethnic Chinese communities around the world (24) their hopes on this crucial political experiment. By succeeding, we can make unparalleled contributions to the democratic development of all ethnic Chinese communities. This responsibility is (25) to fulfill. The new administration's most urgent task is to lead Taiwan through the daunting challenges from globalization. The world economy (26) profoundly, and newly emerging countries are arising rapidly. We must upgrade Taiwan's international (27) and recover lost opportunities. The uncertainty of the current global economy poses as the main challenge to the revitalization of Taiwan's economy. Yet, we firmly believe that, with right policies and steadfast determination, our goals are (28) our grasp. (Source: President Ma's Inaugural Address in 2008)

23. A. to complete B. has completed C. completed D. to completing
24. A. laid B. is laying C. have laid D. will be laying
25. A. yours B. ours C. theirs D. them
26. A. change B. is changing C. had changed D. changed
27. A. competition B. competitiveness C. competitive D. competitor
28. A. beyond B. under C. next to D. within

The cinema offers a number of possible pleasures. One is scopophilia (a pleasure in looking). There are circumstances in which looking (29) is a source of pleasure, just as, in the reverse formation, there is pleasure in being looked at...[Freud] associated scopophilia with taking other people as objects, (30) them to a controlling and curious gaze... The camera satisfies a primordial wish (31) pleasurable looking, but it also goes further: developing scopophilia (32) its narcissistic aspect. (source: excerpt from "Visual Pleasure and Narrative Cinema" by Luara Mulvey)

29. A. itself B. at it C. forward to D. after
30. A. is subjecting B. subjecting C. subjects D. subjected
31. A. in B. at C. to D. for
32. A. in B. at C. to D. for

V. Reading Comprehension: Choose the best answers to the following questions (36%)

In a recent experiment, scientists asked a group of prescreened people to look at a set of gray patterns and try to visualize color. Eleven members of the group had been identified as highly susceptible to hypnosis while seven of the subjects were not susceptible. Hypnosis is a trance-like state characterized by heightened focus, concentration, and inner absorption, according to the Mayo Clinic. About 10 percent of people worldwide are highly susceptible to hypnosis while 10 percent are not influenced at all. The remaining 80 percent—the majority of the population—are moderately susceptible, said study co-author William McGeown, a neuroscientist at the U.K.'s Hull University. The new study found that all the subjects who were easily hypnotized reported seeing a range of colors even while not under hypnosis, McGeown said. The scientists didn't just take their word for it—MRI scans showed that the parts of the subjects' brains linked to color perception lit up when they saw the imaginary hues. "We can see changes in these color-sensitive regions of their brains, which they have no way of faking," said McGeown, who published the study with colleagues in the December issue of the journal *Consciousness and Cognition*.

The new study also found that being under hypnosis enhanced color hallucination in susceptible subjects. But those who were not susceptible to hypnosis could not hallucinate color with or without hypnosis. Stephen Kosslyn, a psychologist at Stanford

University, said the results reinforce his team's earlier research. In 2000, Kosslyn and colleagues published one of the first studies on hallucinating color. Their experiment asked highly susceptible people under hypnosis to imagine gray squares as being in color. That study, which used PET scans of the subjects' brains, also found that the subjects activated parts of their brains associated with color perception. The new study confirms a similar finding with MRI scans, which are more often favored in today's experiments because they provide better spatial resolution, co-author McGeown said.

Ultimately, the hallucination research may help medical professionals who use hypnosis to treat a range of conditions, from phobias to pain, McGeown noted. That's because, despite its medical use, many people are fearful of the procedure. The new research shows that suggestion can be almost as powerful a tool, which means there may be a less intimidating alternative for people fearful of hypnosis, he said. "Psychological therapies which consist of making suggestions to a patient—even in the absence of hypnosis—may help with their problem substantially."

(Source: "People Can Hallucinate Color at Will" by Christine Dell'Amore in *National Geographic News*, published December 7, 2011)

33. The word "susceptible" in this passage is closest in meaning to
- A. unresistant
 - B. invulnerable
 - C. unexposed
 - D. doubtful
34. Which of the following is NOT one of the characteristics of hypnosis?
- A. The subject is put into a sleeplike state
 - B. Hypnosis is a state of mental concentration
 - C. A hypnotized mind is judging and critiquing.
 - D. None of the above
35. Which of the following statements is NOT true?
- A. Subjects who are susceptible to hypnosis can hallucinate color.
 - B. Subjects who are unsusceptible to hypnosis can visualize color when being under hypnosis.
 - C. Only MRI scans were used in the experiment conducted by William McGeown and his partner.
 - D. The parts of the brain that respond to color perception are activated when the subjects are hallucinating color.
36. According to McGeown, the findings of hallucination research may be of help to people with
- A. irrational fear of a specific object or activity
 - B. migraine
 - C. fever
 - D. A and B only
37. Which of the following statements best summarizes the central idea of this article?
- A. Hypnosis can help people with their problems.
 - B. Some people are fearful of hypnosis
 - C. Only a portion of people are susceptible to hypnosis.
 - D. People can hallucinate color just with the power of suggestion.

"Green" has become a popular English phrase. It means that something is good for the environment. Customers are looking for products that are "natural," "pure," and "made from recycled materials." They feel good about helping the Earth and about buying food and cosmetics that are healthier for their bodies. Anita Roddick sensed this when she founded The Body Shop in 1976. She advertised cosmetics that were "100 percent pure" and boasted that The Body Shop's products were not tested on animals. Also, she said The Body Shop did not take unfair advantage of the workers in poor countries.

For some people, this sounded too good to be true. In 1994, reporter Jon Entine wrote a famous magazine article disputing Roddick's claims. He said that The Body Shop cosmetics were actually only one percent pure. Entine also pointed out that most of the ingredients in The Body Shop's product were, indeed, tested on animals. This prompted Roddick to change the phrase on her cosmetics labels. Instead of "not tested on animals," it became "against animal testing." Later, other critics joined in. The London chapter of Greenpeace accused The Body Shop of exploiting poor workers.

Today many other "green" companies face similar criticism. Are products marketed as "green" really good for environment, or

do producers simply claim that they are so they can make more money? It's a tough question. Thanks to writers such as Entine, however, one thing is certain: They are less likely to trust the manufacturer's word.

(Source: "The Green Myth" in *Reading for the Real World*, Campus Publishing, 2009)

38. According to the passage, the word "green" has become associated with products
- A. that are not greasy and look fresh
 - B. that are friendly to the environment
 - C. that can be easily absorbed by the body
 - D. All of the above
39. Which of the following claims of The Body Shop was NOT disputed by Jon Entine?
- A. The Body Shop cosmetics did not exploit workers in poor countries.
 - B. The Body Shop cosmetics were not tested on animals.
 - C. The Body Shop cosmetics were 100% pure.
 - D. None of the above
40. Which of the following statements best summarizes the main idea of the article?
- A. Customers should never trust the manufacturers because they are dishonest.
 - B. Green advertising claims could be misleading.
 - C. "Green" is a good marketing strategy to sell products.
 - D. False advertising should be punished.
41. Which of the following statement would the writer of this passage probably agree with?
- A. We should stop buying "green" products because none of them is really "green."
 - B. Anita Roddick has abused the trust of her customers.
 - C. Writers such as Jon Entine work to ruin manufactures' reputation.
 - D. All products are bad for environment.

About a year ago I was diagnosed with cancer. I had a scan at 7:30 in the morning, and it clearly showed a tumor on my pancreas. I didn't even know what a pancreas was. The doctors told me this was almost certainly a type of cancer that is incurable, and that I should expect to live no longer than three to six months. My doctor advised me to go home and get my affairs in order, which is doctor's code for prepare to die. It means to try to tell your kids everything you thought you'd have the next 10 years to tell them in just a few months. It means to make sure everything is buttoned up so that it will be as easy as possible for your family. It means to say your goodbyes. I lived with that diagnosis all day. Later that evening I had a biopsy, where they stuck an endoscope down my throat, through my stomach and into my intestines, put a needle into my pancreas and got a few cells from the tumor. I was sedated, but my wife, who was there, told me that when they viewed the cells under a microscope the doctors started crying because it turned out to be a very rare form of pancreatic cancer that is curable with surgery. I had the surgery and I'm fine now.

This was the closest I've been to facing death, and I hope it's the closest I get for a few more decades. Having lived through it, I can now say this to you with a bit more certainty than when death was a useful but purely intellectual concept:

Your time is limited, so don't waste it living someone else's life. Don't be trapped by dogma — which is living with the results of other people's thinking. Don't let the noise of others' opinions drown out your own inner voice. And most important, have the courage to follow your heart and intuition. They somehow already know what you truly want to become. Everything else is secondary.

When I was young, there was an amazing publication called *The Whole Earth Catalog*, which was one of the bibles of my generation. It was created by a fellow named Stewart Brand not far from here in Menlo Park, and he brought it to life with his poetic touch. This was in the late 1960's, before personal computers and desktop publishing, so it was all made with typewriters, scissors, and polaroid cameras. It was sort of like Google in paperback form, 35 years before Google came along: it was idealistic, and overflowing with neat tools and great notions.

Stewart and his team put out several issues of *The Whole Earth Catalog*, and then when it had run its course, they put out a final issue. It was the mid-1970s, and I was your age. On the back cover of their final issue was a photograph of an early morning country road, the kind you might find yourself hitchhiking on if you were so adventurous. Beneath it were the words:

"Stay Hungry. Stay Foolish." It was their farewell message as they signed off. Stay Hungry. Stay Foolish. And I have always wished that for myself. And now, as you graduate to begin anew, I wish that for you.

Stay Hungry. Stay Foolish.

(Source: Stanford commencement address delivered by **Steve Jobs** on June 12, 2005)

42. Which of the following statements is/are true about Steve Jobs?
- A. He did not seem to be familiar with some body organs before his illness.
 - B. He was told that he would be dead in less than a year.
 - C. The tumor he got could be removed with surgery
 - D. All of the above
43. The phrase "buttoned up" is closest in meaning to
- A. kept silence
 - B. finished
 - C. loosened up
 - D. tied down
44. Why did Steve Jobs' doctors react so strongly to the fact that Jobs' cancer was actually curable?
- A. They were upset over the misdiagnosis they had made.
 - B. They were worried that Job would sue them for medical malpractice.
 - C. They were surprised that they could keep their patient alive.
 - D. None of the above
45. In his speech, what advice did Jobs give to Stanford students?
- A. Do not try to live up to others' expectation
 - B. Do not let other people speak louder than you do
 - C. Always put yourself in others' shoes
 - D. It is a waste of time to live with others
46. What did Jobs probably mean by "Stay Hungry. Stay Foolish"?
- A. He meant that it is good to eat less and study less.
 - B. He meant that it is important to always have the curiosity for knowledge.
 - C. He meant that without enough food one can never be smart.
 - D. He meant that it is foolish to stay hungry.

Tonight is a particular honor for me because, let's face it, my presence on this stage is pretty unlikely.

My father was a foreign student, born and raised in a small village in Kenya. He grew up herding goats, went to school in a tin-roof shack. His father, my grandfather, was a cook, a domestic servant to the British. But my grandfather had larger dreams for his son. Through hard work and perseverance my father got a scholarship to study in a magical place, America, that's shown as a beacon of freedom and opportunity to so many who had come before him. While studying here my father met my mother. She was born in a town on the other side of the world, in Kansas.

My parents shared not only an improbable love; they shared an abiding faith in the possibilities of this nation. They would give me an African name, Barack, or "blessed," believing that in a tolerant America, your name is no barrier to success. They imagined me going to the best schools in the land, even though they weren't rich, because in a generous America you don't have to be rich to achieve your potential.

They're both passed away now. And yet I know that, on this night, they look down on me with great pride. And I stand here today grateful for the diversity of my heritage, aware that my parents' dreams live on in my two precious daughters. I stand here knowing that my story is part of the larger American story, that I owe a debt to all of those who came before me, and that in no other country on Earth is my story even possible.

Tonight, we gather to affirm the greatness of our nation not because of the height of our skyscrapers, or the power of our military, or the size of our economy; our pride is based on a very simple premise, summed up in a declaration made over two hundred years ago: "We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain inalienable rights, that among these are life, liberty and the pursuit of happiness."

That is the true genius of America, a faith in simple dreams, an insistence on small miracles; that we can tuck in our children at night and know that they are fed and clothed and safe from harm; that we can say what we think, write what we think, without hearing a sudden knock on the door; that we can have an idea and start our own business without paying a bribe; that we can participate in the political process without fear of retribution; and that our votes will be counted -- or at least, most of the time.

And fellow Americans, Democrats, Republicans, independents, I say to you, tonight, we have more work to do..... more work to do, for the workers I met in Galesburg, Illinois, who are losing their union jobs at the Maytag plant that's moving to Mexico, and now they're having to compete with their own children for jobs that pay 7 bucks an hour; more to do for the father I met who was losing his job and choking back the tears wondering how he would pay \$4,500 a month for the drugs his son needs without the health benefits that he counted on; more to do for the young woman in East St. Louis, and thousands more like her who have the grades, have the drive, have the will, but don't have the money to go to college.

People don't expect -- people don't expect government to solve all their problems. But they sense, deep in their bones, that with just a slight change in priorities, we can make sure that every child in America has a decent shot at life and that the doors of opportunity remain open to all.

(Source: Excerpt from **Barack Obama's** Democratic Convention Speech delivered on July 27, 2004)

47. Which of the following is/are mentioned in Obama's speech?
- A. Interracial heritage
 - B. Education
 - C. Opportunity
 - D. All of the above
48. Obama's parents thought their son's African name would not hinder his success because
- A. they believed he could go to the best school.
 - B. America is a racially tolerant country
 - C. Obama is blessed by his name
 - D. one of his parents was born in America
49. Which of the following statements would Obama probably have faith in?
- A. All men are created equal
 - B. One does not have to be rich to achieve one's dream in America
 - C. There is no poverty in America
 - D. A and B only
 - E. B and C only
50. What are some of the social causes that Obama would most probably support according to the passage?
- A. Encouraging interracial marriage
 - B. Offering financial aids to low income students
 - C. Lowering the unemployment rate
 - D. A and B only
 - E. B and C only

一、請解釋下列名詞：

- (一)原子的螢光能譜(fluorescent spectra)(5 分)
- (二)個人等效劑量(personal dose equivalent)(5 分)
- (三)增建因數(buildup factor) (5 分)
- (四)布拉格-戈雷空腔理論(Bragg-Gray cavity theory) (10 分)

二、將一 0.6 c.c. Farmer 游離腔置入水中，以平衡厚度的等效組織為腔壁(cavity wall)，利用 LINAC 輸出的 6 MV x 光射束的照射 1 分鐘，電容為 125 pF，受照射後跨過游離腔的電壓差為 530 V，則水的吸收劑量率(Gy/min)為何？[截止能量(cutoff energy) Δ 為 10keV 的水對空氣的平均限制阻擋本領比為 $(\bar{L}/\rho)_{air}^{water}=1.127]$ ($\rho_{air}=1.293\times 10^{-3} \text{ g/cm}^3$) (10 分)

三、使用 ^{60}Co 的照射，照野 $10\times 10 \text{ cm}^2$ ，深度 $d=4 \text{ cm}$ 時，SSD 從 80cm 減少為 70 cm，其 Mayneord F-因數為何？(10 分)

四、LINAC 輸出動能為 12 MeV 的電子，請問：

- (一) 12 MeV 的電子在真空中的速度為光速的幾倍？(5 分)
- (二) 12 MeV 的電子之質量為電子靜止質量的幾倍？(5 分)

五、假設某人單次攝入 37 kBq 的 ^{131}I ，在其後 50 年期間甲狀腺接受了 4.5 mGy 的 β 劑量和 0.5 mGy 的 γ 劑量。甲狀腺的組織加權因數 W_T 為 0.05。

- (一)試計算對甲狀腺的約定等價劑量。(5 分)
- (二)若甲狀腺是唯一受曝露的器官，試計算其約定有效劑量。(5 分)
- (三)求這種攝入途徑的年攝入限度(annual limit on intake, ALI)。(5 分)

六、放射治療室中 ^{60}Co 點射源的活度為 3000 Ci，距主屏蔽的距離為 2.5 公尺，屏蔽外為醫事放射師之占用位置，佔用因數 $T=1$ ，使用因數 $U=1$ 。假設屏蔽為混凝土(半值層 $\text{HVL}=6.2 \text{ cm}$ ，增建因數 $B=10$)，求屏蔽的厚度。 $(^{60}\text{Co}$ 的 $\Gamma=3.7\times 10^{-4} \text{ mSv m}^2/\text{MBq h}$) (10 分)

七、核醫常用的放射性藥物為 $^{99m}_{43}\text{Tc}$ ，請問：

(一)母核 $^{99}_{42}\text{Mo}(t_{1/2}=66.02 \text{ h})$ 經過多久可使子核 $^{99m}_{43}\text{Tc}(t_{1/2}=6.02 \text{ h})$ 活度為最大值？(5 分)

(二)臨床上，經過子核 $^{99m}_{43}\text{Tc}$ 的 4 個半化期後，子核 $^{99m}_{43}\text{Tc}$ 活度被擠出(milked)約為母核 $^{99}_{42}\text{Mo}$ 活度的多少？(5 分)

八、圖示解釋碰撞克馬 K^{col} 與吸收劑量 D 兩者的關係。(10 分)

※注意：本試題可以使用電子計算器。

選擇題 (80% 單選，每題 2 分)

- 將身體分割成左右兩半的平面稱為：
(A) 中冠狀面 (Median Coronal Plane) (B) 中矢狀面 (Median Sagittal Plane)
(C) 軸向面 (Axial Plane) (D) 分割面 (Section Plane)
- 下列何者通常不屬於急性腹症 (acute abdomen) 的 X 光攝影基本方法？
(A) AP supine abdomen (B) Erect lateral abdomen
(C) PA chest (D) AP erect abdomen
- 下列何者不屬於上肢攝影的適當條件？
(A) 短照射時間 (B) 小焦斑 (C) 高速增感屏 (D) 低至中的 kVp 值
- 第二頸椎骨通常又叫做：
(A) Atlas (B) Axis (C) Lamina (D) Pedicle
- 下列組織在電腦斷層攝影的影像中的灰階值 (CT number) 何者是負數？
(A) 肌肉 (B) 灰質 (C) 腦脊髓液 (D) 脂肪
- CT 值 (number) 是以何物質為基準計算而來？
(A) 水 (B) 空氣 (C) 密質骨 (D) 軟組織
- CT 影像的一個 pixel 裡，若包括了兩種直線衰減係數相差很大的物質，將造成下列何種假影？
(A) 環狀假影 (ring artifact) (B) 移動假影 (motion artifact)
(C) 部分體積假影 (partial volume artifact) (D) 條紋假影 (streak artifact)
- 電腦斷層攝影技術中，視窗寬度 (window width) 若開啟越大時：
(A) 影像反差越大 (B) 影像反差越小 (C) 影像越不清楚 (D) 輻射量越低
- 在 spin echo 波序中的 180° 波有下列何種作用？
(A) 增加 T1 遲緩 (B) 增加 T2 遲緩 (C) 增加組織對比度 (D) 移除 T2* 效應
- MRI 檢查時的梯度磁場，其主要之目的為：
(A) 產生自旋效應 (B) 空間編碼 (C) 產生旋進效應 (D) 產生共振效應
- 化學位移假影 (chemical shift artifact) 造成的原因是由於：
(A) 組織中酸鹼性的變化 (B) 血液中血鐵濃度的改變
(C) 組織中水與脂肪自旋頻率的不同 (D) B_0 磁場校正不均勻
- 注射磁振造影顯影劑後會有下列何種現象發生？
(A) 組織內的擴散常數 (diffusion coefficient) 增加 (B) 組織的縱向回復時間縮短
(C) 化學位移的頻率變化加大 (D) 正常組織之間的對比度增加
- 乳房攝影 (mammography) X-光機常用之濾器 (filter) 材料為何？
(A) 鉬 (molybdenum, Mo) (B) 釷 (gadolinium, Gd)
(C) 鋇 (barium, Ba) (D) 鈹 (beryllium, Be)
- 超音波的探頭主要是基於下列何種原理而產生波動？
(A) 光電原理 (B) 靜電原理 (C) 壓電原理 (D) 電池原理
- 做超音波檢查時選擇較高頻率的探頭可以達成下列何種結果？
(A) 增加穿透的深度 (B) 增加影像解析度
(C) 減少顯像的頻率 (frame rate) (D) 增加音束的波長
- 網路路由器 (router) 的功能為何？
(A) 連結二或多種相似或相異網路，如 WAN、MAN 或 LAN
(B) 不同通訊協定轉換
(C) 橋接相似網路但不同的媒介結構
(D) 減少影像大小
- Mo-99/Tc-99m 孳生器 (generator) 中之 Mo-99 其物理半衰期有多長？
(A) 47 小時 (B) 66 小時 (C) 80 小時 (D) 93 小時

18. 下列關於疊代式影像重組的敘述中，何者錯誤？
 (A) 在低影像對比下即可得到不錯的結果 (B) MLEM、OSEM 都是疊代式影像重組法
 (C) 可以同時作衰減校正 (D) 運算速度較反投影影像重組為快
19. SPECT 攝影時，若所設定的投射影像 (projection) 數目太少，則：
 (A) 出現條狀假影 (streak artifact) (B) 出現環狀假影 (ring artifact)
 (C) 影像無法重組 (D) 影像密度偏低
20. 下列有關 FDG 與葡萄糖 (glucose) 的敘述，何者錯誤？
 (A) 皆可以被葡萄糖轉運體 (glucose transporter) 運送進入細胞
 (B) 皆可以在細胞中被磷酸化代謝為 glucose-6-phosphate
 (C) 皆可以被進一步代謝為二氧化碳及水
 (D) 皆可以被葡萄糖轉運體 (glucose transporter) 運送出細胞
21. ^{99m}Tc -MAA 在何處被代謝？
 (A) 腎臟 (B) 脾臟 (C) 小腸 (D) 肝臟
22. Tl-201 (鉍-201) 可被心肌攝取，主要是經由下列何種機轉？
 (A) 鈉-碘共同轉運體 (sodium iodide symporter)
 (B) 鈉鉀幫浦 (Na^+/K^+ pump)
 (C) 擴散作用
 (D) 阻塞作用
23. RIA 的方法是利用何種原理？
 (A) 氧化還原技術 (B) 酸鹼中和技術 (C) 薄膜過濾技術 (D) 同位素稀釋技術
24. 貝克 (Bq) 是什麼單位？
 (A) expoure (B) dose equivalent (C) absorbed dose (D) activity
25. 競爭性放射免疫分析標準曲線中，所測得活性與待測物濃度的關係為何？
 (A) 正比 (B) 反比 (C) 常數 (D) 正、反比皆有
26. 在設定加馬攝影機取像條件時，若將能窗 (energy window) 調整較窄，將會造成下列何種狀況？
 (A) 散射現象 (scatter) 減少，計數率 (count rate) 減少
 (B) 散射現象 (scatter) 增加，計數率 (count rate) 增加
 (C) 散射現象 (scatter) 增加，計數率 (count rate) 減少
 (D) 散射現象 (scatter) 減少，計數率 (count rate) 增加
27. 下列何種核醫造影可用來偵測發炎病灶？
 (A) ^{67}Ga -citrate 造影 (B) ^{99m}Tc 標記紅血球造影
 (C) ^{111}In 標記體抑素造影 (D) ^{18}F 標記酪胺酸造影
28. PET/CT 中，CT 扮演的角色為何？
 (A) 劑量評估 (B) 病灶之功能性診斷 (C) 良惡性判斷 (D) 衰減校正及病灶之定位
29. 當使用 SSD 技術的光子射束時，其照野大小定義在何處？
 (A) 皮膚表面 (B) 射束穿出病人處 (C) 鉛擋塊托盤處 (D) 最大劑量深度處
30. 下列何者不是 IMRT 技術的應用？
 (A) Gamma knife (B) Tomotherapy (C) dynamic MLC technique (D) step-and-shoot technique
31. 若病人體厚 20 cm，治療機的 SAD=100 cm，AP 照野的 SSD 為 93 cm，則 PA 照野的 SSD 為多少 cm？
 (A) 97 (B) 93 (C) 87 (D) 83
32. 下列何種射束較適用於執行全身放射治療 (TBI)？
 (A) 6 MV 光子 (B) 70 MeV 質子 (C) 6 MeV 電子 (D) 10 MeV 中子
33. 下列何者並非組織填充物 (bolus) 的目的？
 (A) 填補照射部位凹凸的表面組織 (B) 增加表皮劑量
 (C) 吸收加速器機頭所產生額外散射電子 (D) 降低照野中部分區域的電子穿透深度
34. 細胞週期 (cell cycle) 的那個時間點會表現出最強的放射線抗性？
 (A) G1 檢查點 (checkpoint) (B) S
 (C) G2 檢查點 (D) M

35. 設計治療計畫時，Gross tumor volume (GTV)，Planning target volume (PTV)，Irradiated volume (IV) 之大小順序應為何？
 (A) $GTV > PTV > IV$ (B) $PTV > GTV > IV$ (C) $PTV > IV > GTV$ (D) $IV > PTV > GTV$
36. 下列何者不是電子射束治療的特徵？
 (A) 只能治療深度少於 5 cm 表淺腫瘤 (B) 深層組織劑量少
 (C) 能量均勻分布治療體積 (D) 具顯著的劑量增建區
37. TVL (tenth value layer) 與 HVL (half value layer) 兩者間的關係為何？
 (A) $3.2 \text{ HVL} = 1 \text{ TVL}$ (B) $1 \text{ HVL} = 3.2 \text{ TVL}$ (C) $1 \text{ HVL} = 10 \text{ TVL}$ (D) $10 \text{ HVL} = 1 \text{ TVL}$
38. 照野驗證片的主要目的是：
 (A) 定位 (B) 驗證治療位置與大小 (C) 治療機射束品質測試 (D) 避免醫療糾紛
39. 若使用直線加速器來治療，能量為 10 MV，則最大劑量 (Dmax) 約位於：
 (A) 皮膚表面 (B) 皮下 0.5 公分 (C) 皮下 2.5 公分 (D) 皮下 5.0 公分
40. 旋轉中心點在病患中點的 SAD 設定下，兩相對平行照野其中一照野比重為另一照野的兩倍，則最大劑量發生在何處？
 (A) 比重較高照野的入射處 (B) 比重較低照野的入射處
 (C) 旋轉中心點 (SAD) (D) 劑量分布不受照野比重影響

問答題 (20%)

1. 使用螺旋式 CT (spiral/helical CT) 檢查時，若 pitch 值為 1.5，掃描時間為 32 秒，X-光管每 0.8 秒轉一圈，切片厚度為 6 mm，求身體長軸照射長度為多少公分？(5%)
2. 請簡述醫學影像儲存與傳輸系統 (PACS) 的架構與運作方式 (5%)
3. 若一張核子醫學影像，其矩陣大小為 256×256 pixels，每個 pixel 使用 2 bytes 的資料量，則儲存一張沒壓縮的影像，最少需要多少的儲存空間？(1 kB = 1024 bytes) (5%)
4. 兩相鄰照野治療深度位於 5 cm 處的腫瘤，治療條件為 $SSD=100$ cm，照野寬度分別為 20 cm 及 28 cm，為了避免腫瘤劑量過多的重疊，請計算兩相鄰照野邊緣在皮膚表面上的間隙應該為多少？(5%)