

* داوطلب گرامی، عدم درج مشخصات و امضا در مندرجات جدول ذیل، به منزله عدم حضور شما در جلسه آزمون است.

اینجانب با شماره داوطلبی با آگاهی کامل، یکسان بودن شماره صندلی خود را با شماره داوطلبی مندرج در بالای کارت ورود به جلسه، بالای پاسخنامه و دفترچه سؤالات، نوع و کد کنترل درج شده بر روی دفترچه سؤالات و پائین پاسخنامه را تأیید می‌نمایم.

امضا:

زبان عمومی و تخصصی (انگلیسی):

PART A: Vocabulary

Directions: Choose the word or phrase (1), (2), (3), or (4) that best completes each sentence. Then mark the answer on your answer sheet.

- 1- It's an ----- to their friends as to why the couple broke up because they seem perfect for each other.
1) interference 2) inference 3) alteration 4) ☒ enigma
- 2- Mr. Baker has decided to move to a big city because of a ----- of employment opportunities in his small hometown.
1) demonstration 2) foundation 3) trace 4) ☒ dearth
- 3- Do you know of an alternate route we could take to ----- having to drive through the city?
☒ circumvent 2) delight in 3) partake of 4) suggest
- 4- My political science professor presents her lectures in a relaxed manner using ----- rather than elaborate language.
1) loquacious 2) ☒ colloquial 3) literary 4) inflated
- 5- My uncle, a farmer, is an ----- pessimist when he discusses the weather. For example, if the sun is shining, he's sure a drought is beginning; if it's raining, he's sure his crops will be washed away.
1) initial 2) instant 3) ☒ immutable 4) interactive
- 6- The pharmaceutical company had to ----- its advertising claim regarding the healing power of its new arthritis medicine because research studies clearly indicate the medicine isn't effective.
☒ repudiate 2) enhance 3) distribute 4) replicate
- 7- I would like to compliment Jaden for the course of action he recommended because I think it will ----- our problem once and for all.
1) sequence 2) speculate 3) signify 4) ☒ settle
- 8- An ----- is often expressed as a simile, as in "The football game was like a battle between gladiators."
1) endeavor 2) invasion 3) ☒ analogy 4) arena

- 9- There are many good reasons for not smoking, but those having to do with health are the most -----.
- 1) passionate ☒ cogent 3) paradoxical 4) accidental
- 10- ----- therapy is a psychological approach designed to help individuals change harmful thought patterns to more constructive ones.
- 1) Inherent 2) Thoughtful ☒ Cognitive 4) Epidemiological

PART B: Cloze Test

Directions: Read the following passage and decide which choice (1), (2), (3), or (4) best fits each space. Then mark the correct choice on your answer sheet.

The earliest human artifacts showing evidence of workmanship with an artistic purpose (11) ----- the subject of some debate. It is clear that such workmanship existed some 40,000 years ago in the Upper Paleolithic era, (12) ----- it is quite possible that it began earlier. In September 2018, scientists (13) ----- the discovery of (14) ----- by *Homo sapiens*, which is estimated to be 73,000 years old, much earlier than the 43,000-year-old artifacts (15) ----- to be the earliest known modern human drawings found previously.

- 11- ☒ are 2) is 3) has been 4) was
- 12- 1) as 2) when 3) since ☒ although
- 13- 1) who reported ☒ reported 3) having reported 4) to report
- 14- 1) known drawing the earliest 2) the earliest drawing was known
- ☒ the earliest known drawing 4) known as the earliest drawing
- 15- 1) that understand ☒ understood
- 3) were understood 4) they are understood

PART C: Reading Comprehension

Directions: Read the following three passages and answer the questions by choosing the best choice (1), (2), (3), or (4). Then mark the correct choice on your answer sheet.

PASSAGE 1:

When first introduced, linear motors were seen as a major technological breakthrough. However, disappointingly few practical applications have been found for this new development. An earlier innovation, the Wankel engine, was radically different from conventional engines, having a rotary piston and no valves. Wankel engines were adopted by the Mazda car company. However, Wankel engines are now rarely used because of problems with fuel consumption and maintenance. The Wankel story illustrates the risks involved in developing any new product – success can mean a market lead over competitors but failure means that expensive development costs must be written off with no result. Sadly, technological superiority does not guarantee

success. Betamax video tapes, technically better than their rivals gave way to VHS because of better marketing.

- 16- The main message of this passage is -----.
- 1) marketing is more important than technology
 - 2) technological superiority does not guarantee success
 - 3) Wankel engines were better than conventional engines
 - 4) linear motors were a major technological breakthrough
- 17- The word "lead" in line 8 means -----.
- 1) direction
 - 2) usefulness
 - 3) first place
 - 4) a soft and heavy metal
- 18- According to the text, -----.
- 1) Betamax video tapes were a marketing success
 - 2) linear motors were invented before the Wankel engine
 - 3) failure means another product has technological superiority
 - 4) the Wankel engine was essentially different from conventional engines
- 19- All of the following, based on information given in the passage, are true EXCEPT -----.
- 1) Wankel engines have maintenance problems
 - 2) linear motors have few practical applications
 - 3) Wankel engines are used in a few Mazda car company products
 - 4) Wankel engines use more fuel than engines with a rotary piston and valves
- 20- Which of the following products was a success in the market?
- 1) VHS
 - 2) Linear motors
 - 3) Wankel engine
 - 4) Betamax video tapes

PASSAGE 2:

Sonar (originally an acronym for Sound Navigation And Ranging) is a technique that uses sound propagation (usually underwater, as in submarine navigation) to navigate, communicate with or detect objects on or under the surface of the water, such as other vessels. Two types of technology share the name "sonar": passive sonar is essentially listening for the sound made by vessels; active sonar is emitting pulses of sounds and listening for echoes. Sonar may be used as a means of acoustic location and of measurement of the echo characteristics of "targets" in the water. Acoustic location in air was used before the introduction of radar. Sonar may also be used in air for robot navigation, and SODAR (an upward looking in-air sonar) is used for atmospheric investigations. The term sonar is also used for the equipment used to generate and receive the sound. The acoustic frequencies used in sonar systems vary from very low (infrasonic) to extremely high (ultrasonic). The study of underwater sound is known as underwater acoustics or hydroacoustics.

Active sonar creates a pulse of sound, often called a "ping", and then listens for reflections (echo) of the pulse. This pulse of sound is generally created electronically. Occasionally, the acoustic pulse may be created by other means, e.g. (1) chemically using explosives, or (2) airguns or (3) plasma sound sources. To measure the distance to an object, the time from transmission of a pulse to reception is measured and converted into a range by knowing the speed of sound.

- 21- According to the text, sonar is -----.
- 1) passive
 - 2) introduced after radar
 - 3) usually used under water
 - 4) used to generate and receive sound
- 22- What is the main difference between the passive sonar and the active sonar?
- 1) Unlike active sonar, passive sonar is only used under water.
 - 2) Passive sonar is essentially listening for the sound made by vessels; active sonar is emitting pulses of sounds and listening for echoes.
 - 3) Passive sonar is used for finding targets in the water, but active sonar is used for atmospheric navigation.
 - 4) Passive sonar uses very low frequencies, but active sonar uses extremely high frequencies.
- 23- A ping, according to the passage, is -----.
- 1) pulse of sound generated by an active sonar
 - 2) the reflections of the sound
 - 3) an echo of the signal
 - 4) an electronic pulse
- 24- How is the acoustic pulse generally generated in active sonar?
- 1) electronically
 - 2) by using airguns
 - 3) chemically using explosives
 - 4) by using plasma sound sources
- 25- To measure how far away an object is from us, we need to know -----.
- 1) the time of the ping
 - 2) the speed of the vessel
 - 3) the measurement unit and conversion skills
 - 4) the time from transmission of a pulse to reception and the speed of sound

PASSAGE 3:

Researchers have discovered that perovskites crystals exhibit strong carrier multiplication properties. The news may revolutionize the solar cells industry. New work from the University of Amsterdam (UA) and Osaka University (OU) has just revealed a crucial discovery related to perovskites crystals that may just be the key to efficiently turning light into electricity. The research has found that the crystals have strong carrier multiplication properties, a previously unknown fact.

Perovskites, discovered in 1839 by German mineralogist Gustav Rose and named after Russian mineralogist Count Lev Alekseevich Perovski, are minerals with the same type of crystal structure as calcium titanium oxide (CaTiO_3). This structure is known as the perovskite structure.

The materials have applications in perovskites solar cells known to be preferable to traditional silicon ones because they can be manufactured with much simpler and cheaper techniques. In addition, the solar cell efficiencies of devices using perovskites have significantly increased in the past few years (3.8% in 2009 to 22.7% in late 2017 in single-junction architectures).

With the potential of offering very high efficiency combined with low production costs, these perovskites cells are considered the fastest advancing solar technology to date. Their desirable electronic properties have also seen them be useful in the construction of LEDs, TV-screens and even lasers.

Despite being studied extensively in the last year by physicists, researchers had yet to discover this impressive carrier multiplication ability. Now, the revelation is bound to see the Shockley-Queisser limit revisited.

This limit, also known as the detailed balance limit, refers to the maximum theoretical efficiency of a solar cell (i.e. its ability to turn light into electrical power). In ordinary solar cells, it lies at most a little below 30%. However, in materials that display the carrier multiplication effect that limit has already been beat, with efficiencies of up to 44% reached. The question now becomes, what could perovskites achieve?

- 26- The word "crucial" in the first paragraph, line 4 means -----.
- 1) important 2) strong 3) rare 4) difficult
- 27- Who has discovered that perovskites crystals exhibit strong carrier multiplication properties?
- 1) Shockley-Queisser 2) Alekseevich Perovski
3) Researchers from the UA and OU 4) Gustav Rose
- 28- All of the following are true about the efficiency of solar cells EXCEPT -----.
- 1) the efficiency of ordinary solar cells is limited by Shockley-Queisser limit
2) no material could have a greater efficiency than the Shockley-Queisser limit
3) the efficiency of ordinary solar cells is smaller than 30%
4) the carrier multiplication effect increases the efficiency of solar cells made of perovskites
- 29- Which item is not a reason for perovskites solar cells being preferred to traditional silicon ones?
- 1) They are more efficient.
2) They are simpler to produce.
3) They are cheaper to produce.
4) They are useful in the construction of LEDs, TV-screens and even lasers.
- 30- According to the text, what has been unknown until recently?
- 1) The detailed balance limit
2) The Shockley-Queisser limit
3) The crystal structure of calcium titanium oxide (CaTiO_3)
4) Perovskites crystals exhibiting strong carrier multiplication properties

ریاضیات (معادلات دیفرانسیل، ریاضیات مهندسی، آمار و احتمال):

۳۱- فرض کنید معادله دیفرانسیل $M(x,y)dx + N(x,y)dy = 0$ دارای عامل انتگرال ساز به صورت $\mu(z)$ با شرط

$z = x^2 + xy$ باشد. $\frac{d \ln \mu}{dz}$ کدام است؟

$$\frac{M_y - N_x}{(2x + y)M - xN} \quad (2)$$

$$\frac{M_y - N_x}{(2x + y)N - xM} \quad (1)$$

$$\frac{M_y - N_x}{(2x + y)M + xN} \quad (4)$$

$$\frac{M_y - N_x}{(2x + y)N + xM} \quad (3)$$