

Form E23

(December 2021)



The **ACT**[®]

2021 | 2022

Preview from Notesale.co.uk
Page 1 of 55

In response to your request for Test Information Release materials, this booklet contains the test questions, scoring keys, and conversion tables used in determining your ACT scores. Enclosed with this booklet is a report that lists each of your answers, shows whether your answer was correct, and, if your answer was not correct, gives the correct answer.

In a way, the new jellyfish are clones amidst the
 71
 originating adult.

Scientists are still studying how *T. dohrnii* achieves
 its transformations. At the cellular level, what the jellyfish
 72

does, which is called transdifferentiation, wherein one
 73

type of cell becomes another type. 74 Understanding
 the mechanisms of *T. dohrnii*'s particular kind of

transdifferentiation may yield insights into aging
 75
and disease in all animals, including humans.
 76

71. A. NO CHANGE
 B. with
 C. of
 D. to

72. F. NO CHANGE
 G. all of their
 H. all of it's
 J. their

73. A. NO CHANGE
 B. does to transform,
 C. does is
 D. does,

74. At this point, the writer is considering adding the following true statement:

T. dohrnii's abilities, however, can't save it from lethal encounters with, say, boat propellers or ravenous sea slugs.

Should the writer make this addition here?

- F. Yes, because it adds details about the environmental dangers that *T. dohrnii* may face.
 G. Yes, because it reveals that individual *T. dohrnii* aren't actually immortal.
 H. No, because it suggests that boat propellers and sea slugs are the only true dangers for *T. dohrnii*.
 J. No, because it interrupts the discussion of *T. dohrnii*'s cellular transdifferentiation.

75. Given that all the choices are accurate, which one would best conclude the essay by emphasizing specific benefits of *T. dohrnii* research?

- A. NO CHANGE
 B. is the life's work of Shin Kubota, who studies the only thriving captive population of *T. dohrnii*.
 C. is really important, although there are few experts devoted to the study of this fascinating creature.
 D. will require much diligence, since *T. dohrnii* only produces offspring under very specific conditions.

END OF TEST 1

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

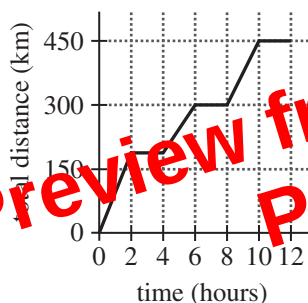


42. Given that the equation $\frac{4x-y}{x+y} = \frac{5}{2}$ is true, what is the value of $\frac{x}{y}$?

F. $\frac{2}{3}$
 G. $\frac{5}{2}$
 H. $\frac{7}{3}$
 J. $\frac{7}{5}$
 K. $\frac{7}{18}$

DO YOUR FIGURING HERE.

43. Juro traveled to 3 locations during a workday. Juro remained at each location a whole number of hours. The graph below shows the relationship between time, in hours, into his workday and total distance, in kilometers, traveled. Which of the following values is closest to Juro's average speed, in kilometers per hour, for the parts of the workday when he was traveling?



A. 45
 B. 57
 C. 60
 D. 75
 E. 94

44. What is the amplitude of the function $y = 3 \sin x$?

F. 1
 G. 3
 H. 6
 J. $\frac{1}{3}$
 K. $\frac{3}{2}$



53. Given that b is rational and $i = \sqrt{-1}$, the product of the expression $(3 + bi)$ and which of the following expressions must be a rational number?

A. i
 B. bi
 C. $3bi$
 D. $3 + bi$
 E. $3 - bi$

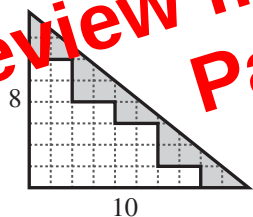
DO YOUR FIGURING HERE.

54. For positive integers x and y where $x < 8$, $\log_x 8 = y$. What is the value of y ?

F. 1
 G. 2
 H. 3
 J. 4
 K. 8

55. The right triangle shown below is 8 squares high and 10 squares long. One of the following values is the ratio of the shaded area to the unshaded area. Which one?

A. $\frac{3}{7}$
 B. $\frac{3}{10}$
 C. $\frac{7}{13}$
 D. $\frac{7}{20}$
 E. $\frac{15}{28}$



56. For all positive integers x , which of the following expressions is equivalent to $x^{\frac{1}{4}} \cdot x^{\frac{1}{6}}$?

F. $\sqrt{x^{24}}$
 G. $\sqrt[5]{x}$
 H. $\sqrt[5]{x^{12}}$
 J. $\sqrt[12]{x^5}$
 K. $\sqrt[24]{x}$

33. The main idea of the fourth paragraph (lines 44–55) is that:
- A. networks of fungi benefit different species of trees at various levels of development.
 - B. young seedlings typically tap into the roots of trees that are the same species as the seedlings.
 - C. established trees genetically alter fungal networks to benefit different species of trees.
 - D. different species of trees can be identified based on their nutritional uptake.
34. The author uses the metaphor of an express stop in a subway system in order to:
- F. explain why parasites are harmful to larger trees.
 - G. contrast two distinct mycelial networks.
 - H. clarify how larger trees function in a mycelial network.
 - J. illustrate how different species of fungi grow to be different sizes.
35. In the passage, the relationship between yeast and the human body is cited as an example of a:
- A. definite commensal relationship.
 - B. possible commensal relationship.
 - C. definite mutualist relationship.
 - D. possible mutualist relationship.
36. The author most likely includes the quote from Linscott (lines 10–12) to:
- F. suggest that mycorrhizal fungi have a commensal relationship with plants.
 - G. contend that mycorrhizal fungi serve the same function as some yeasts in the human body.
 - H. indicate why mycorrhizal fungi have a mutualist relationship with plants.
 - J. explain why mycorrhizal fungi cannot make their own food.
37. As it is used in line 44, the phrase *tap into* most nearly means:
- A. endorse.
 - B. finish.
 - C. lift.
 - D. use.
38. Based on the passage, young seedlings are often dependent on fungal networks because the seedlings are:
- F. struggling to grow in an established tree's shadow.
 - G. trying to defend themselves against parasites.
 - H. in need of a specific nutrient that is unused by established trees.
 - J. susceptible to a wider range of diseases than established trees are.
39. Based on the passage, the author would most likely agree that Indian pipe's level of dependency on mycorrhizal fungi is:
- A. absolute.
 - B. about the same as its dependence on nonphotosynthesizing plants.
 - C. less than its dependence on nonphotosynthesizing plants.
 - D. uncertain.
40. Which of the following statements, if true, would most WEAKEN the claim made by the author in lines 83–86 of the passage?
- F. Over a three-year span, two forests with different tree types increase the amount of mycorrhizal mycelium at the same rate.
 - G. Over a three-year span, two forests with the same amount of mycorrhizal mycelium both lost the majority of their plant biomass.
 - H. During a given year, after the majority of mycorrhizal mycelium dies in a forest, the plants in the forests flourish.
 - J. During a given year, after the majority of mycorrhizal mycelium dies in a forest, the plants in the forests suffer.

END OF TEST 3

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO A PREVIOUS TEST.



SCIENCE TEST

35 Minutes—40 Questions

DIRECTIONS: There are several passages in this test. Each passage is followed by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

You are NOT permitted to use a calculator on this test.

Passage I

The freezing point of an aqueous solution (T_f), in $^{\circ}\text{C}$, can be calculated using the equation

$$T_f = -1.86 \times m \times i$$

where m is the concentration of the solute in moles of solute per kilogram of H_2O (mol/kg H_2O) and i is the average number of particles produced by 1 formula unit of the solute when the formula unit dissolves in H_2O . The *theoretical i value* of a solute is the total number of particles produced when 1 formula unit of the solute dissolves in H_2O . Table 1 gives, for 4 ionic compounds, the chemical formula and the theoretical i value. Table 2 shows how the *observed i value* at 25°C for these compounds changes with solute concentration.

Table 1		
Name	Chemical formula	Theoretical i value
Sodium chloride	NaCl	2
Potassium chloride	KCl	2
Magnesium chloride	MgCl_2	3
Ammonium sulfate	$(\text{NH}_4)_2\text{SO}_4$	3

Table 2				
Concentration of aqueous solution (mol/kg H_2O)	Observed i value at 25°C for:			
	NaCl	KCl	MgCl_2	$(\text{NH}_4)_2\text{SO}_4$
0.1	1.87	1.85	2.78	2.30
0.2	1.85	1.83	2.63	2.19
0.3	1.84	1.81	2.68	2.12
0.4	1.84	1.80	2.76	2.07
0.5	1.84	1.80	2.84	2.03
0.6	1.85	1.80	2.92	2.00
0.7	1.85	1.79	3.01	1.97
0.8	1.86	1.79	3.11	1.96
0.9	1.86	1.79	3.21	1.94
1.0	1.87	1.80	3.32	1.92
2.0	1.97	1.83	4.57	1.87

Table 2 adapted from B. A. Kunkel, "Comments on 'A Generalized Equation for the Solution Effect in Droplet Growth.'" ©1969 by American Meteorological Society.



13. How many times in Experiment 2 was a bottle placed into the box when the box was maintained at 10°C ?
- 7
 - 14
 - 29
 - 58
14. Suppose that in Experiment 2 the bottle containing water stored at 50°C had been reused 35 times. At that reuse number, the approximate concentration of Sb^{3+} in the water would have been:
- less than 270 ng/L.
 - between 270 ng/L and 300 ng/L.
 - between 300 ng/L and 330 ng/L.
 - greater than 330 ng/L.
15. Assume that the maximum acceptable concentration of Sb^{3+} in drinking water is 6,000 ng/L. This concentration of Sb^{3+} is how many times as great as the concentration of Sb^{3+} in water stored at 50°C in a bottle that was reused 21 times in Experiment 2 ?
- 2
 - 3
 - 20
 - 30
16. Which set of experimental conditions resulted in an Sb^{3+} concentration of 140 ng/L in water stored in a bottle that had been reused 14 times?
- 10°C, UV light
 - 10°C, visible light
 - 30°C, UV light
 - 30°C, visible light
17. The substance composing the bottles tested in the experiments is best classified as which of the following?
- Alloy
 - Polymer
 - Element
 - Salt
18. Suppose that in Experiment 1 a temperature of 20°C had been tested. At a reuse number of 21, the Sb^{3+} concentration would most likely have been between:
- 125 ng/L and 175 ng/L.
 - 175 ng/L and 225 ng/L.
 - 225 ng/L and 275 ng/L.
 - 275 ng/L and 325 ng/L.
19. Did Experiment 1 and Experiment 2, respectively, take more than 1 day or less than 1 day to complete?
- | | Experiment 1 | Experiment 2 |
|----|--------------|--------------|
| A. | more | more |
| B. | more | less |
| C. | less | more |
| D. | less | less |

Preview from Notesale.co.uk
Page 44 of 55

**Passage IV***Introduction*

During the *early Earth period* (the first 2 billion years after Earth formed), the Sun produced only about 70% of the light and heat that it does today. Consequently, if early Earth's atmosphere had been identical to Earth's atmosphere today, the average surface temperature would have been well below the freezing point of water. However, geologic evidence indicates that a large amount of liquid water was present on the surface. Two hypotheses were proposed to explain how 3 heat-absorbing greenhouse gases—carbon dioxide (CO_2), ammonia (NH_3), and methane (CH_4)—in early Earth's atmosphere contributed to the presence of liquid water on the surface.

Hypothesis 1

During the early Earth period, volcanic eruptions released both CO_2 and NH_3 into the atmosphere. In addition, microbes produced CH_4 by metabolizing hydrogen (H_2) gas. Compared with atmospheric greenhouse gas concentrations at present day, those on early Earth were considerably greater: the CO_2 concentration was about 100 times as great, the NH_3 concentration was about 20 times as great, and the CH_4 concentration was about 1,000 times as great. These higher-than-present atmospheric concentrations of CO_2 , NH_3 , and CH_4 absorbed enough heat to maintain an average surface temperature that allowed for liquid water.

Hypothesis 2

The only source of atmospheric CO_2 , NH_3 , and CH_4 on early Earth was volcanic eruptions. Compared with atmospheric CO_2 and NH_3 concentrations at present day, those on early Earth were somewhat greater: the CO_2 concentration was about 40 times as great and the NH_3 concentration was about 10 times as great. The CH_4 concentration was about the same as its present value. At those concentrations, the 3 gases by themselves would not have absorbed enough heat to raise the average surface temperature above freezing. However, atmospheric concentrations of both nitrogen (N_2) and H_2 were approximately twice what they are today. These higher-than-present concentrations of N_2 and H_2 greatly enhanced the heat-absorbing effects of the 3 greenhouse gases, maintaining an average surface temperature that allowed for liquid water.

20. A supporter of Hypothesis 1 and a supporter of Hypothesis 2 would be likely to agree that, during the early Earth period, magma from beneath Earth's crust contained:

- F. carbon compounds but not nitrogen compounds.
- G. nitrogen compounds but not carbon compounds.
- H. both carbon compounds and nitrogen compounds.
- J. neither carbon compounds nor nitrogen compounds.

21. Suppose that the current atmospheric CO_2 concentration on Earth is approximately 395 parts per million (ppm). Based on Hypothesis 2, the atmospheric CO_2 concentration on early Earth was most likely closest to which of the following values?

- A. 395 ppm
- B. 15,800 ppm
- C. 39,500 ppm
- D. 197,500 ppm

22. Which of the hypotheses, if either, indicated that 2 additional gases were necessary for CO_2 , NH_3 , and CH_4 to absorb enough heat for liquid water to exist on early Earth's surface?

- F. Hypothesis 1 only
- G. Hypothesis 2 only
- H. Both Hypothesis 1 and Hypothesis 2
- J. Neither Hypothesis 1 nor Hypothesis 2

23. In regard to the source of CH_4 in early Earth's atmosphere, which of the following statements describes a difference between Hypothesis 1 and Hypothesis 2? According to Hypothesis 1, CH_4 was:

- A. released from volcanic eruptions, whereas according to Hypothesis 2, CH_4 was produced by microbial metabolism.
- B. released from volcanic eruptions, whereas according to Hypothesis 2, CH_4 was produced by chemical reactions between CO_2 and H_2O .
- C. produced by microbial metabolism, whereas according to Hypothesis 2, CH_4 was released from volcanic eruptions.
- D. produced by microbial metabolism, whereas according to Hypothesis 2, CH_4 was produced by chemical reactions between CO_2 and H_2O .

Scoring Keys for Form E23

Use the scoring key for each test to score your answer document for the multiple-choice tests. Mark a "1" in the blank for each question you answered correctly. Add up the numbers in each reporting category and enter the total number correct for each reporting category in the blanks provided. Also enter the total number correct for each test in the blanks provided. The total number correct for each test is the sum of the number correct in each reporting category.

Test 1: English—Scoring Key

Key	Reporting Category*		
	POW	KLA	CSE
1. D			___
2. J			___
3. C		___	
4. F			___
5. A	___		
6. F		___	
7. C			___
8. J			___
9. C	___		
10. F			___
11. B			___
12. F	___		
13. B			___
14. H			___
15. B	___		
16. J	___		
17. C			___
18. J	___		
19. B			___
20. H	___		
21. A		___	
22. H	___		
23. A			___
24. H			___
25. D			___
26. F		___	
27. B	___		
28. J		___	
29. D	___		
30. G	___		
31. A			___
32. G	___		
33. C			___
34. J		___	
35. D			___
36. J			___
37. C			___
38. F	___		

Key	Reporting Category*		
	POW	KLA	CSE
39. D			___
40. G			___
41. B	___		
42. F			___
43. C			___
44. G			___
45. B			___
46. J			___
47. C	___		
48. F			___
49. A			___
50. J			___
51. A			___
52. G		___	
53. B			___
54. G			___
55. C		___	
56. H			___
57. D			___
58. H			___
59. B	___		
60. J	___		
61. D		___	
62. F			___
63. B			___
64. G	___		
65. D	___		
66. H			___
67. B			___
68. J		___	
69. C			___
70. G	___		
71. C			___
72. F			___
73. C			___
74. J	___		
75. A	___		

*Reporting Categories

POW = Production of Writing

KLA = Knowledge of Language

CSE = Conventions of Standard English

Preview from Notesale.co.uk
Page 51 of 55

Number Correct (Raw Score) for:	
Production of Writing (POW)	___ (24)
Knowledge of Language (KLA)	___ (11)
Conventions of Standard English (CSE)	___ (40)
Total Number Correct for English Test (POW + KLA + CSE)	___ (75)