
S5

YIKES! Science hack:

What is Yikes? Most of the science is about just **finding** the correct area in the passage,

With lots of **DATA** *(graphs and charts)* the thing to do is just **POINT** from question into the DATA area

BUT.... Sometimes that is not enough! That is when you say **YIKES!**

We need to do more. FINGER SCAN for a relevant term in the question and find it in the test above.
Grab the definition or more info from the term and drop back in the question to answer it!

Lakdosnnf klsnvlksl OANO DNANOK sdjk
CJCB SJDBF CSCLSB CVSD CSDSDKNC sc
CKCC CFJKANF FGKLSNF KS RWOW sknr

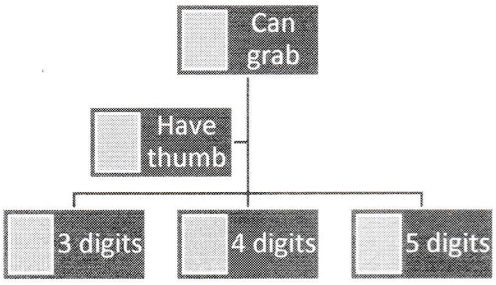


Figure 1

10. In figure 1, digit mammals with a thumb are classified into 2 sub categories in which grab or clutch with which digit firmest?

fJSB FEJBJB DKEEBFBKAAD FSKBF DKFKKS
CKZCVOKN CJSDNN CSKE CSDSKNAS DCF
FSFONFSPPNF FINFW FW HGN E FRIW WN

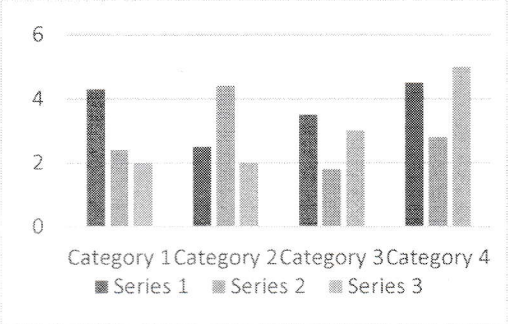


Table 1

4

Passage VI

In a rain cloud, small particles called *cloud condensation nuclei* (CCN) attract nearby water droplets to form a *cloud droplet*. A cloud droplet grows by attracting more water droplets until it becomes a *raindrop*, which then falls from the cloud. Rainfall can be increased by seeding the cloud with additional small particles, such as NaCl particles, to act as CCN.

Over a year, 2 studies of cloud-seeding were done at a subtropical location, using every cumulus cloud that was isolated from other clouds, that had a top at an altitude between 3,350 m and 4,900 m, and that had a liquid water content of at least 0.5 g/m^3.

Study 1

Four types of flares (A–D) were used. Flares of each type, when ignited, released NaCl particles having a specific distribution of particle sizes (see Table 1).

Table 1

Flare Type	Percent of NaCl particles having diameters (μm*): 0.1–0.5	0.6–1.0	1.1–2.0	2.1–5.0
A	64	15	12	9
B	72	12	9	7
C	81	9	6	4
D	90	5	3	2

*μm = 10^{-6} m

A plane carrying all 4 types of flares was sent into the base of each cloud. As the plane entered the base of a cloud, a computer determined whether or not to immediately ignite at least 1 flare, seeding the cloud. The computer also selected which type of flare to ignite, and how many flares to ignite to introduce a concentration of 10, 100, 1,000, or 10,000 particles/cm^3 into the cloud. The average amount of rainfall from the seeded clouds for each type of flare and at each concentration is shown in Figure 1.

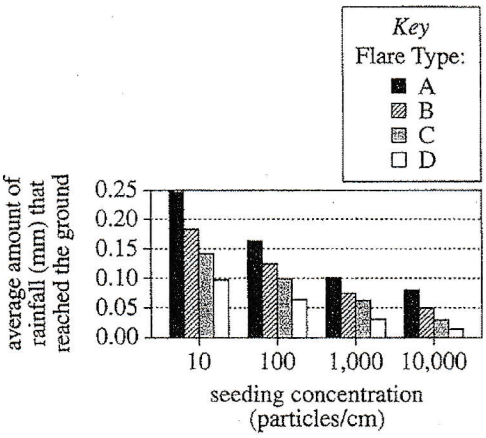


Figure 1

Table 1 and Figure 1 adapted from Y. Segal et al., "Effects of hygroscopic seeding on raindrop formation as seen from simulations using a 2000-bin spectral cloud parcel model." ©2004 by Elsevier B. V.

Study 2

Radar was used to monitor how the mass of raindrops within each cloud changed over the 55 minutes following the time the plane entered the base of the cloud. The averaged results for all the unseeded clouds and for all the seeded clouds are shown in Figure 2.

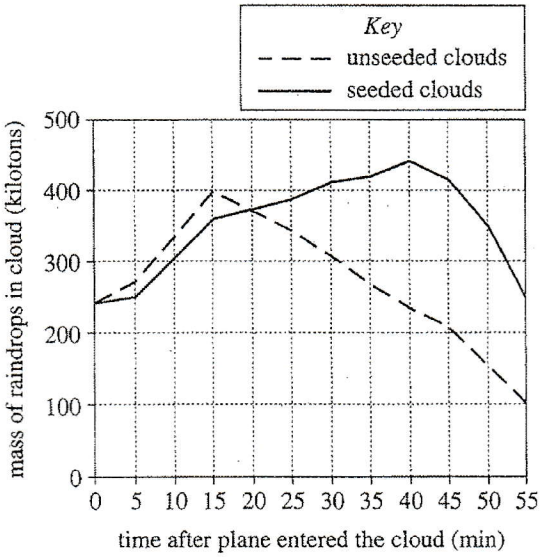


Figure 2

Figure 2 adapted from G. K. Mather et al., "Results of the South African Cloud-Seeding Experiments Using Hygroscopic Flares." ©1997 by American Meteorological Society.

GO ON TO THE NEXT PAGE.

30. According to the results of Study 1, as the seeding concentration increased, the average amount of rainfall that reached the ground:

F. increased for all 4 types of flares.
G. increased for Flare Types A and B, but decreased for Flare Types C and D.
H. decreased for all 4 types of flares.
J. decreased for Flare Types A and B, but increased for Flare Types C and D.

31. Based on the passage, what is the correct order of raindrops, water droplets, and cloud droplets according to their diameters, from smallest to largest?

A. Water droplet, raindrop, cloud droplet
B. Water droplet, cloud droplet, raindrop
C. Raindrop, water droplet, cloud droplet
D. Raindrop, cloud droplet, water droplet

32. According to the results of Study 2, how did the raindrops in the seeded clouds differ from the raindrops in the unseeded clouds with respect to their maximum mass?

F. It took more time for the raindrops in the seeded clouds to reach a maximum mass, and they reached a greater maximum mass.
G. It took less time for the raindrops in the seeded clouds to reach a maximum mass, and they reached a greater maximum mass.
H. It took more time for the raindrops in the seeded clouds to reach a maximum mass, and they reached a lesser maximum mass.
J. It took less time for the raindrops in the seeded clouds to reach a maximum mass, and they reached a lesser maximum mass.

33. The design of Study 1 differed from the design of Study 2 in that in Study 1, the:

A. rainfall from a cloud was measured, whereas in Study 2, the particle-size distribution in types of flares was determined.
B. mass of raindrops in a cloud was determined, whereas in Study 2, the particle-size distribution in types of flares was determined.
C. rainfall from a cloud was measured, whereas in Study 2, the mass of raindrops in a cloud was determined.
D. mass of raindrops in a cloud was determined, whereas in Study 2, rainfall from a cloud was measured.

34. Which of the following statements gives the most likely reason that clouds with tops above an altitude of 4,900 m were *not* included in the studies? Above 4,900 m in such clouds, there would be present:

F. only water vapor.
G. only water droplets.
H. ice crystals but few water droplets.
J. water droplets but few ice crystals.

35. Which of the following statements about the particle-size distribution in the 4 types of flares is supported by Table 1 ?

A. For all 4 types of flares, the majority of particles belonged to the largest size category.
B. For all 4 types of flares, the majority of particles belonged to the smallest size category.
C. For Flare Types A and B, the majority of particles belonged to the largest size category, whereas for Flare Types C and D, the majority of particles belonged to the smallest size category.
D. For Flare Types A and B, the majority of particles belonged to the smallest size category, whereas for Flare Types C and D, the majority of particles belonged to the largest size category.

4

SCIENCE TEST

35 Minutes—40 Questions

DIRECTIONS: There are seven 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

Two species of aquatic plants, Species A and Species B, are often found in the same freshwater lakes. Both species can grow in water up to 2 m deep. However, typically, Species A is found closer to the lake's edge in shallower water whereas Species B grows farther out in deeper water. Both species spread by means of underground stems called *rhizomes* and by means of seeds. A scientist conducted 2 studies to examine the effect of water depth on the growth of Species A and Species B plants from seeds.

Study 1

In early June, seeds from Species A and Species B were germinated. In mid-June, 24 seedlings of each species, all having shoot lengths of 3 cm to 5 cm, were transferred to identical pots (1 seedling per pot). The pots were suspended beneath the water in large outdoor tanks that were located in full sun. Eight seedlings of each species were submerged to each of 3 water depths—0.2 m, 0.4 m, and 0.8 m. In late September, the average shoot length for surviving Species A seedlings and Species B seedlings at each of the 3 water depths was determined. The results are shown in Figure 1.

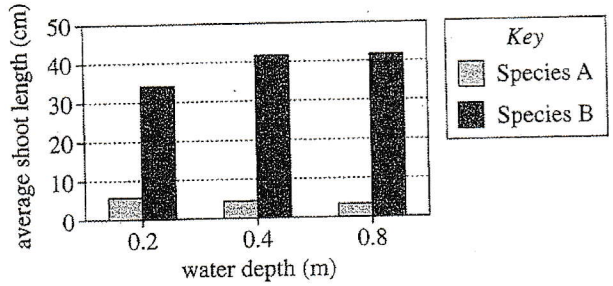


Figure 1

Study 2

Immediately after Study 1, the surviving seedlings of Species A and B were removed from the tanks, dried, and then weighed. The average dry mass of the surviving Species A seedlings from each water depth was 2.3 mg. The average dry mass of the surviving Species B seedlings from each water depth is shown in Figure 2.

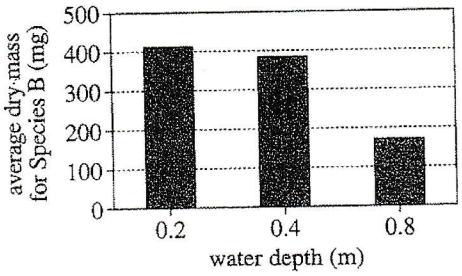


Figure 2

For each water depth, the shoot length and dry mass of each surviving Species B seedling were plotted. The best-fit curve for each set of data points is shown in Figure 3.

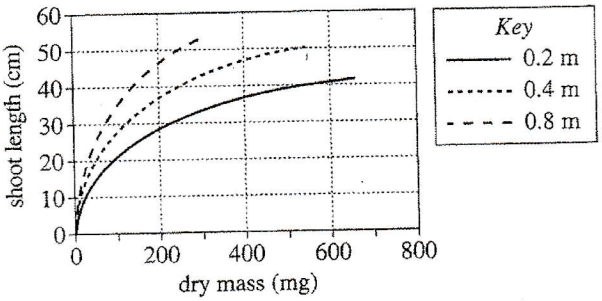


Figure 3

Figures adapted from Stefan E. B. Weisner et al., "Influence of Submergence on Growth of Seedlings of *Scirpus lacustris* and *Phragmites australis*." ©1993 by Blackwell Publishing.

1. Based on Figure 3, for a water depth of 0.8 m, the shoot length and dry mass of how many Species B seedlings were plotted?

   A. 5
   B. 8
   C. 24
   D. Cannot be determined from the given information

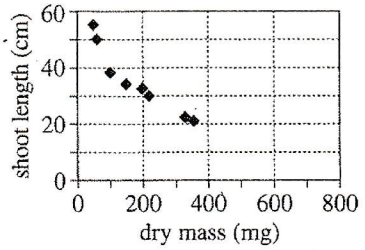
2. Suppose that a fourth group of pots containing Species B seedlings had been suspended at a water depth of 0.3 m. The average shoot length of these seedlings in late September would most likely have been:

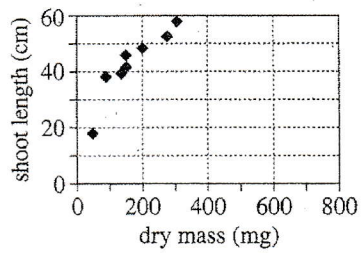
   F. less than 34 cm.
   G. between 34 cm and 42 cm.
   H. between 42 cm and 50 cm.
   J. greater than 50 cm.

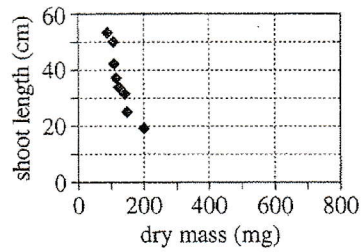
3. At the conclusion of Study 2, a seedling of Species B was found to have a dry mass of 400 mg and a shoot length of 33 cm. Based on Figure 3, this seedling most likely had been submerged at which of the following water depths?

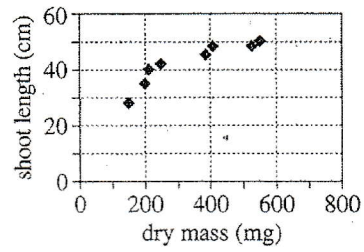
   A. 0.2 m
   B. 0.4 m
   C. 0.8 m
   D. 1.0 m

4. Which of the following sets of data points most likely yielded the best-fit curve for surviving Species B seedlings grown at a depth of 0.4 m ?

   F.
   

   G.
   

   H.
   

   J.
   

5. According to the results of Studies 1 and 2, for a given water depth, how did surviving seedlings of Species A compare to surviving seedlings of Species B ? On average, seedlings of Species A had:

   A. longer shoot lengths and greater dry mass.
   B. longer shoot lengths but lesser dry mass.
   C. shorter shoot lengths and lesser dry mass.
   D. shorter shoot lengths but greater dry mass.

6. Of the 8 Species A seedlings grown at a water depth of 0.2 m, 6 survived. The *total* dry mass of these surviving seedlings can be calculated using which of the following expressions?

   F. 2.3 mg × 6
   G. 2.3 mg ÷ 6
   H. 2.3 mg × 8
   J. 2.3 mg ÷ 8

Passage VII

An *RCL circuit* contains an alternating current (AC) power supply, a resistor having a resistance R, a capacitor having a capacitance C, and an inductor having an inductance L (see Figure 1).

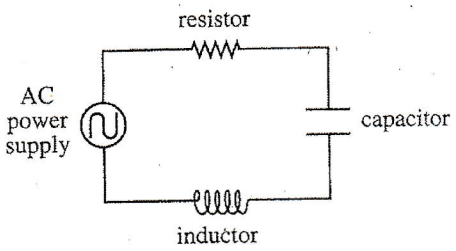


Figure 1

The capacitor and inductor each possess *impedance*, a type of electrical resistance. The *angular frequency* of the current, ω, is a measure of the number of times each second that the current reverses direction.

Figure 2 shows, for specific values of C, L, and average voltage, V, how the average current, I, varies with ω and with R.

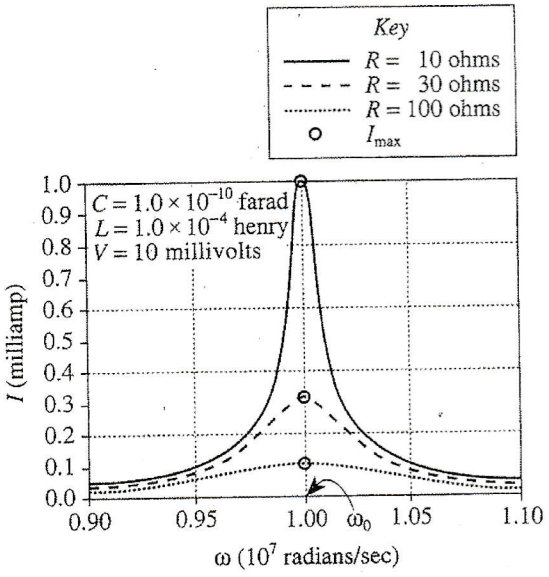


Figure 2

Figure 2 adapted from David Halliday and Robert Resnick, *Physics, Part 2*, 3rd ed. ©1978 by John Wiley and Sons, Inc.

For a given R, the peak average current, I_{max}, occurs at the *resonant angular frequency*, ω_0.

Figure 3 shows how ω_0 varies with L and C.

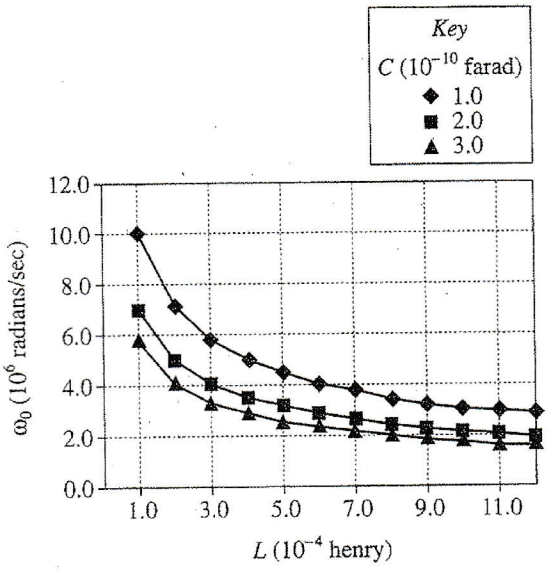


Figure 3

36. What is the resonant angular frequency of the RCL circuit for the conditions given in Figure 2 ?

F. 0.90×10^7 radians/sec
G. 0.95×10^7 radians/sec
H. 1.00×10^7 radians/sec
J. 1.05×10^7 radians/sec

37. According to Figure 3, for $C = 1.0 \times 10^{-10}$ farad, as L increases, ω_0:

A. increases only.
B. decreases only.
C. varies, but with no general trend.
D. remains the same.

38. For the conditions specified in Figure 2 and $R = 30$ ohms, the resistor will generate the greatest amount of heat when ω is closest to which of the following values?

F. 0.90×10^7 radians/sec
G. 0.95×10^7 radians/sec
H. 1.00×10^7 radians/sec
J. 1.05×10^7 radians/sec

39. According to Figure 2, does ω_0 vary with R ?

A. Yes; as R increases, ω_0 decreases.
B. Yes; as R increases, ω_0 remains the same.
C. No; as R increases, ω_0 increases.
D. No; as R increases, ω_0 remains the same.

40. For a given L, what is the correct ranking of the values of C in Figure 3, from the C associated with the lowest ω_0 to the C associated with the highest ω_0 ?

F. 1.0×10^{-10} farad, 2.0×10^{-10} farad, 3.0×10^{-10} farad
G. 1.0×10^{-10} farad, 3.0×10^{-10} farad, 2.0×10^{-10} farad
H. 2.0×10^{-10} farad, 3.0×10^{-10} farad, 1.0×10^{-10} farad
J. 3.0×10^{-10} farad, 2.0×10^{-10} farad, 1.0×10^{-10} farad

END OF TEST 4

STOP! DO NOT RETURN TO ANY OTHER TEST.