جامعة بيروت العربية
BEIRUT ARAB UNIVERSITY

Student's Name: .....

Student's ID: .....

Entrance Examination

Faculty of Engineering

General Instructions

1- The First Page of the booklet is the answer sheet. Fold this page along the perforations, slowly and carefully tear off the answer sheet.

2- Write your name and your seat number then fill the seat number in the proper place on the answer sheet.

3- Be sure to fill only one answer with a pencil for each question.

1. Look at this series: 7, 10, 8, 11, 9, 12, ... What number should come next?

   A. 7 B. 10 C. 12 D. 13

2. Look at this series: 2, 1, (1/2), (1/4), ... What number should come next?

   A. 1/3 B. 2/3 C. 2/8 D. 1/8

3. Which word does NOT belong with the others?

   A. inch B. ounce C. centimeter D. yard

4. Cup is to coffee as bowl is to

   A. soup B. dish C. spoon D. food

5. Optimist is to cheerful as pessimist is to

   A. gloomy B. mean C. petty D. helpful

6. 2, 4, 8, 16, 32, 64, 128, … What is next?

   A. 256 B. 250 C. 252 D. 254

7. 256 is equal to

   A. 2^7 B. $2(2^7)$ C. 2^9 D. 2^5

8. 129 is equal to

   A. 2^7+2 B. 2^7-1 C. 2^7+1 D. $2(2^7)$

9. Choose the word that is a necessary part of the *harvest*.

   A. autumn B. stockpile C. tractor D. crop

10. Choose the word that is a necessary part of the *book*.

    A. fiction B. pages C. pictures D. learning

11. Choose the word that is a necessary part of the *language*.

    A. tongue B. slang C. writing D. words

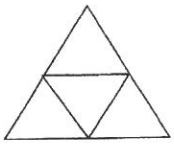
12. Choose the word that is a necessary part of the *school*.

    A. student B. report card C. test D. learning

13. What is the maximum number of squared objects with diagonal length equal to 1 unit you can fit inside a box of dimensions 3 by 2 of same measurement units?

    A. 4 B. 6 C. 8 D. 12

14. The number of equilateral triangles that can be inscribed into a large (parent) equilateral triangle can never be?



A. 8 B. 16 C. 32 D. 64

15. What is the minimum number of horizontal and/or vertical lines that can cover all circles in the following matrix?

○ □ □ ○ □

□ ○ ○ □ ○

□ ○ □ □ □

□ ○ □ ○ □

□ □ □ ○ □

A. 3 B. 4 C. 5 D. 6

16. In how many swaps of adjacent positions you may rearrange the following □ and ○ objects to become alternating?

□○ ○ □ □ □ ○ □ ○ ○

A. 3 B. 4 C. 5 D. 6

17. The day before two days after the day before tomorrow is Saturday. What day is it today?

A. Wednesday B. Thursday C. Friday D. Sunday

18. I am your mother's brother's only brother in law. Who am I?

A. Uncle B. Cousin from father side C. Mother's Sister D. Father

19. If there are three cups of sugar on the table and you take one away, how many did you have?

A. None B. 1 C. 2 D. 3

20. We are two brothers watching at both sides of the road, but we never see each other. Who are we?

A. Twins B. Eyes C. Feet D. Sunglasses

21. Which one of the following shows the numbers $3^{\frac{1}{2}}$, $4^{\frac{1}{3}}$, and $7^{\frac{1}{4}}$ in increasing order?

A. $3^{\frac{1}{2}} < 4^{\frac{1}{3}} < 7^{\frac{1}{4}}$ B. $4^{\frac{1}{3}} < 3^{\frac{1}{2}} < 7^{\frac{1}{4}}$ C. $4^{\frac{1}{3}} < 7^{\frac{1}{4}} < 3^{\frac{1}{2}}$ D. $7^{\frac{1}{4}} < 3^{\frac{1}{2}} < 4^{\frac{1}{3}}$

22. What is the value of $\int_{-\pi}^{\pi} (\sin x - x^3)\, dx$?

A. 0 B. $\sqrt{2}$ C. $\frac{1}{\sqrt{2}}$ D. 2

23. $(1+i)^8 =$

A. 1 B. 16 C. i D. $16\,i$

24. The *area* of a triangle whose side's lengths are 9, 12 and 15 cm is

A. 67.5 cm^2 B. 90 cm^2 C. 54 cm^2 D. 76.5 cm^2

25. The *solution* of $\frac{|2x+1|}{-3} \geq 1$ is

A. $-2 \geq x \geq 1$ B. $1 \leq x \leq 2$ C. $-2 \leq x \leq 1$ D. $2 \geq x \geq 1$

26. Which one of the following statements is true?

A. $a^{\ln b} = b^{\ln a}$, $a > 0, b > 0$ B. $\cos(\sin\theta) = \sin(\cos\theta)$, for all θ C. $e^{\ln x^2} = 2x$ D. $e^{x^2} = (e^x)(e^x)$

27. If $(\sin x + \cos x) = \frac{5}{4}$, then $\sin 2x =$

A. 5/12 B. 9/16 C. 13/6 D. 12/7

28. The slope of tangent of $y = \frac{1+x}{1-x}$ at $x = -1$ is

A. 2/3 B. 3/2 C. 3/4 D. 1/2

29. If $\frac{(n+1)! - n!}{(n+1)! + n!} = \frac{3}{4}$, then

A. $n = 4$ B. $n = 5$ C. $n = 5$ D. $n = 6$

30. In a sequence of positive integers, a_n, the n^{th} term is defined as $a_n = (a_{n-1} - 1)^2$. If 9 is one of the terms of the sequence, then what is the term immediately next to 9?

A. 18 B. 64 C. 210 D. 632

31. Given two parallel lines m and n and another two *intersecting* lines p and q that intersect at point A located between the lines m and n. If line p intersects line m and n at points B and D, respectively. And if line q intersects line m and n at points C and E, respectively. Then the angle $\angle CBA=$

A. $\angle ADE$ B. $\angle BAE$ C. $\angle EAD$ D. $\angle AED$

32. The *solution* of $e^{2x} - e^x + 2 = 0$ is

A. $x = \ln 3$ B. $x = \ln 4$ C. $x = \ln 2$ D. $x = \ln 0.5$

33. The equation of a line through $(3,1)$ and parallel to $y = 2x + 1$, is

A. $y = 2x + 5$ B. $y = 2x - 5$ C. $y = 2x - 3$ D. $y = 2x + 3$

34. The domain of the function $y = \frac{4}{x^2-1}$, is

A. $x \neq \pm 1$ B. $1 < x < -1$ C. $x \neq 1$ D. $x > 1$

35. If $g(x)$ is the inverse function of $f(x) = x^n$, then

A. $g(x) = -\frac{1}{x^n}$ B. $g(x) = \frac{1}{x^n}$ C. $g(x) = x^{-\frac{1}{n}}$ D. $g(x) = x^{\frac{1}{n}}$

36. The solution of $\ln(x^2 - 1) - \ln(x + 1) = 5$, is

A. $x = e^5 - 1$ B. $x = e^5 + 1$ C. $x = e^5 - 2$ D. $x = e^5 + 2$

37. The first derivative of $f(x) = x\sqrt{x} + \frac{2}{x^2} + e^{\ln x}$ at $x = 1$, is equal to

A. $\grave{f}(1) = -\frac{5}{2}$ B. $\grave{f}(1) = \frac{5}{3}$ C. $\grave{f}(1) = -\frac{3}{2}$ D. $\grave{f}(1) = \frac{1}{2}$

38. $\lim_{x\to 0} \frac{x\cos x + \sin x}{x \sin x} =$

A. $\frac{1}{2}$ B. ∞ C. 0 D. $-\frac{1}{2}$

39. Let $f(x)$ be a continuous function on the interval $[a, b]$ and $c \in [a, b]$. The point c is classified as a local maximum point if $f'(c) = 0$ and

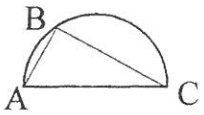
A. $f''(c) = 0$ B. $f''(c) \neq 0$ C. $f''(c) > 0$ D. $f''(c) < 0$

40. If $f(x)$ is a continuous function on the interval $[-a,\ a]$ and $f(x) < 0$, then the area between $f(x)$ and x axis over $[-a,\ a]$, is defined as

A. $\int_{-a}^{a} f(x)\,dx$ B. $\int_{a}^{-a} f(x)\,dx$ C. $\frac{f(a)-f(b)}{2}$ D. $2\int_{0}^{a} f(x)\,dx$

41. If A, B and C are three points on the circumference of the semi-circle with radius r, as shown. Then the maximum value of the area of triangle ABC is:

A. $r\sqrt{r}$ B. $r\sqrt{2r}$ C. r^2 D. $2r^2$



42. Which one of the following functions intersects x-axis only at one point?

A. $x^2 + y^2 = 2$ B. $y = \ln x$ C. $y = x^2 - x$ D. $y = \sin x$

43. The solution of the differential equation $y' - 2xy = 2x$ is

A. $y = Ce^{2x} + 1$ B. $y = Ce^{2x} - 1$ C. $y = Ce^{x^2} + 1$ D. $y = Ce^{x^2} - 1$

44. The integral $\int \frac{ax^n}{\sqrt{3-x^3}}\,dx = \sqrt{3-x^3} + c$, if

A. $a = -3, n = 3$ B. $a = \frac{2}{3}, n = 3$ C. $a = \frac{2}{3}, n = 2$ D. $a = -\frac{3}{2}, n = 2$

45. Two identical dice are thrown, what is the probability that the sum of the appearing numbers is at least 10?

A. 1/12 B. 1/9 C. 1/6 D. 7/36

46. How many packages of 4 different books can be made from 8 Mathematics books and 6 Physics books, if the number of Mathematics books must be always greater than the number of Physics books?

A. 406 B. 320 C. 120 D. 247

47. The two vectors $\vec{a} =< a_1, a_2, a_3 >$ and $\vec{b} =< b_1, b_2, b_3 >$ are perpendicular, if

A. $\vec{a} \times \vec{b} = \vec{0}$ B. $\vec{a} \cdot \vec{b} = 0$ C. $\vec{a}/\vec{b} = -1$ D. $\vec{a}\,\vec{b} = 0$

48. The simple form of $\left(y = \sqrt{(x+2) + 2\sqrt{x+1}} + \sqrt{(x+2) - 2\sqrt{x+1}},\ x \geq 0\right)$, is

A. $\sqrt{x+1}$ B. $2\sqrt{x+1}$ C. $\sqrt{x-1}$ D. $x + 3$

49. The solution (x, y) of the simultaneous equations $\begin{matrix} x - y = 2 \\ x^2 + 3y - y^2 = 11 \end{matrix}$, is

A. (4,2) B. (5,3) C. (3,1) D. $(1, -1)$

50. The area of the parallelogram with two adjacent sides formed by the vectors $\vec{a}$ and $\vec{b}$ is given by $A = \|\vec{a} \times \vec{b}\|$. If $\vec{a} = \langle 1, 2, 3 \rangle$ and $\vec{a} = \langle 4, 5, 6 \rangle$, then

A. $A = \sqrt{54}$ B. $A = \sqrt{57}$ C. $A = \sqrt{58}$ D. $A = \sqrt{63}$

51. The distance between point $A(3,-2,1)$ and the plane of equation $4x + 3y + 4 = 0$ is
A. 4.5 B. 2.5 C. 3.5 D. 2

52. $\lim_{x\to 0} \frac{\sqrt{x+2}-\sqrt{2}}{x}$
A. $1/2$ B. $1/2\sqrt{2}$ C. ∞ D. $\sqrt{2}$

53. The product of two complex numbers $(a + b\,i)$ and $(c + d\,i)$ is an imaginary number if
A. $a = -c$ B. $ac = bd$ C. $ad = -bc$ D. $ad = bc$

54. If $z_1 = 8 + 3i$ and $z_2 = 9 - 2i$, then the real part of $\frac{z_1}{z_2}$ is
A. $\frac{42}{85}$ B. $\frac{45}{85}$ C. $\frac{66}{85}$ D. $\frac{65}{85}$

55. Two years ago a man was six times as old as his daughter. In 18 years he will be twice as old as his daughter, then their present ages are
A. 32 *and* 7 B. 26 *and* 6 C. 38 *and* 8 D. 20 *and* 5

56. $\int_1^{\infty}(x^{-2} + e^{-x})\,dx =$
A. $e^1 - 1 = 0$ B. $1 + e^1$ C. $1 + e^{-1}$ D. $1 - e^{-1}$

57. Two triangles are drawn such as one of their edges is common with length (L) and the free vertices lie on a line perpendicular to the common edge on the same side. If (H) is the distance between the two vertices, then the area between the two triangles is
A. $\frac{H+L}{2}$ B. $\frac{\sqrt{HL}}{2}$ C. $\frac{HL}{2}$ D. $\frac{\sqrt{H+L}}{2}$

58. Two identical dice are thrown, what is the probability that the sum of the appearing numbers is at most 5?
A. 1/12 B. 2/9 C. 5/18 D. 11/36

59. A square and a circle are equal in perimeters, then the ratio of the area of the square to the area of the circle is:
A. $2/\pi$ B. $4/\pi$ C. $\pi/4$ D. $\pi/2$

60. The value of C that makes the mean and the mode of the following force readings (8, 10, 11, C, 8, 9, 10, 11, 9, 12, 12) equal, is
A. 9 B. 10 C. 8 D. 11

61. Light refracts when traveling from air into glass because light

A. travels at the same speed in air and in glass.
B. frequency is greater in air than in glass.
C. frequency is greater in glass than in air.
D. travels slower in glass than in air.

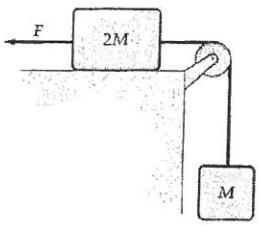
62. Interference is a property of

A. light waves.
B. sound waves.
C. water waves.
D. all of these.

63. When light reflects from a surface, there is a change in its

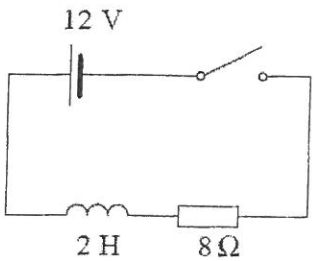
A. frequency.
B. wavelength.
C. speed.
D. none of these.

64. If F = 40 N and M = 1.5 kg, what is the tension in the string connecting M and 2M ? Assume that all surfaces are frictionless.



A. 13 N
B. 23 N
C. 36 N
D. 15 N

65. When the switch in the circuit is closed in the figure,
(1) the current will rise initially at the rate of di/dt=6 A/s,
(2) the final value of the current is 1.5 A,
(3) the final energy stored in the inductor is 2.25 J

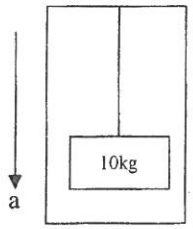


A. (1), (2) and (3)
B. and (2) only
C. and (3) only
D. only

66. How much work is done in moving a book with a mass of 2 kg from the floor to the top of a table that is 1 m above the floor?

A. zero
B. 20 N
C. 2 J
D. 20J

67. This figure shows an elevator with a mass of 10kg suspended from a rope within it. The elevator is accelerating downwards at a rate of 2 m/s^2. What is the tension of the rope that is holding the block up? ($g=10m/s^2$)



A. 80N
B. 30N
C. 105.6N
D. 20N

68. A variable magnetic field of magnitude B=3.14.t (T) is subjected to a circular coil and perpendicular to it. Find the induced current in the coil if its resistance R=0.1ohm and its radius is 10cm.

A. 1A
B. 0.1A
C. 0.22A
D. 10A

69. How much energy is required to ionize hydrogen when it is in the ground state?

A. 103ev
B. 10.2ev
C. 3.18ev
D. 13.6ev

70. The energy level of the hydrogen atom is given by $E=-13.6\ ev/n^2$. Find the energy of a photon in ev that can make a transition of the hydrogen atom from the 1st excited state to the 3rd excited state

A. 10.2ev
B. 5.4ev
C. 1.8ev
D. -13.6ev

71. In a diffraction experiment a source of monochromatic radiation of wavelength $\lambda = 0.5\mu m$ in air illuminates a horizontal slit F of width a=0.4mm. A screen of observation is placed at a distance D =5m from F. Calculate the linear width L of central fringe in mm.

A. 12.5
B. 22.5
C. 13
D. 0.0125

72. The mechanical energy of any moving object is conserved if the:

A. speed is constant
B. height is constant
C. frictional forces are negligible
D. all previous answers are correct

73. In an R,L circuit with voltage source $v=100\sin\omega t$ (v) and current $I_{max}= 2A$ the phase difference between the voltage and the current is 45^0. Find the resistor of the circuit.

A. 40.43 ohms
B. 35.35 ohms
C. 400 ohms
D. 28.5 ohms

74. A transformer has 100 turns on its primary and 1000 on its secondary. If a 50 Hz, 100. V output is seen at the secondary, then the

A. frequency at the primary is 5 Hz
B. voltage across the primary is 10 V
C. current on the secondary is 10 times the current in the primary.
D. frequency at the primary is 500 Hz

75. Monochromatic light falls on two very narrow slits 0.048 mm apart. Successive fringes on a screen 5 m away are 6.5 cm apart near the center of the pattern. What is the wavelength of the light?

A. 620 nm
B. 580 nm
C. 540 nm
D. 500 nm

76. The phenomenon of interference occurs for

A. Sound wave
B. Light wave
C. Sound and light waves
D. None of the above

77. A capacitor has a capacitance of 1 F (farad). Which of the following deductions must be correct?
(1) It stores 1 coulomb of charge at a potential difference of 1 volt.
(2) It gains 1 joule of electrical energy when it has 1 coulomb of charge.
(3) It will be fully charged in 1 second by a constant current of 1 ampere.

A. (1) only
B. (3) only
C. (1) and (2) only
D. None of the above

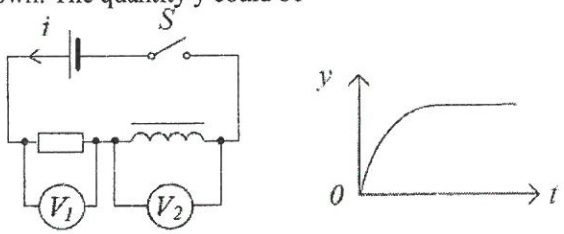
78. The activity of a sample of radioactive isotopes decreases to 1/3 of its initial value in 12 s. How much more time would be required for the activity to decrease to 1/9 of its initial value?

A. 4 s
B. 8 s
C. 1.2 s
D. 12 s

79. Which of the following statements is/are true for beta particles originating from nuclear disintegrations?
(1) Beta particles travel at the speed of light.
(2) Emitted beta particles from a nuclide have a continuous energy distribution.
(3) Beta decay is accompanied by the emission of neutrinos.

A. (1), (2) and (3)
B. (1) and (2) only
C. (2) only
D. (2) and (3) only

80. When the switch S in the above circuit is closed, the variation of quantity y with time t is plotted as shown. The quantity y could be



(1) the current i in the circuit.
(2) the voltage V1 across the resistor.
(3) the voltage V2 across the inductor.

A. (1) only
B. (3) only
C. (1) and (2) only
D. None of the above

81. Consider the following table and pick the true statement:

Work function of zinc	$6{,}88 \times 10^{-19}$ J
Frequency of ultraviolet light	$7{,}89 \times 10^{14}$ Hz
Frequency of red light	$4{,}29 \times 10^{14}$ Hz

A. red light fails to emit photoelectrons from the surface of the zinc plate
B. ultraviolet light fails to emit photoelectrons from the surface of the zinc plate
C. both are fail to emit photoelectrons from the surface of the zinc plate
D. both have tendency to emit photoelectrons from the surface of the zinc plate

82. A 0.1 kg ball is dropped freely toward the ground from an altitude of 1.8m. Just after impact with the ground the speed is reduced to 3 times less than the value of the speed just before impact. Then the variation of momentum in kg.m/s is around:

A. 0.08
B. 0.4
C. 0.04
D. 0.8

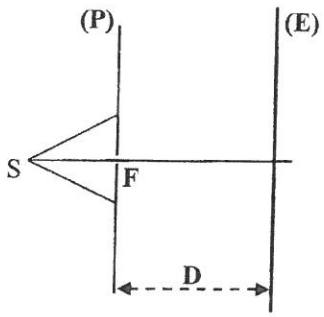
83. A particle moves back and forth along the x axis from $x = -x_m$ to $x = +x_m$, in simple harmonic motion with period T. At time $t = 0$ it is at $x = -x_m$. When $t = 0.75T$:

A. it is at $x = 0$ and is traveling toward $x = +x_m$
B. it is at $x = 0$ and is traveling toward $x = -x_m$
C. it is between $x = 0$ and $x = +x_m$ and is traveling toward $x = -x_m$
D. none of the above

84. As a 10 kilogram mass on the end of a spring oscillates with ($\frac{1}{\pi}$ Hz) passes through its equilibrium position with kinetic energy of the 20J. The amplitude Xm of oscillation is then

A. 1m
B. 2m
C. 0.01m
D. 0.45m

85. A source of monochromatic radiation of wavelength $\lambda = 0.5$ μm in air illuminates under normal incidence a horizontal slit F of width a=0.4mm cut in an opaque screen (P). A screen of observation (E) is placed parallel to (P) at a distance D =5m. Calculate the linear width L of central fringe in mm.



A. 12.5
B. 22.5
C. 13
D. 0.0125

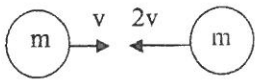
86. The magnetic flux (Φ=NBScosα) through a coil of wire containing two loops changes from - 0.3 Wb to + 0.38 Wb in 0.42 seconds. What is the magnitude of the emf induced in the coil?

A. 3.24 volt
B. 0.19 volt
C. 3.2 volt
D. 1.62 volt

87. A hydrogen atom, in its ground state, receives a visible light of frequency 6.16×10^{14}Hz. (plank's constant=6.62×10^{-34}SI and 1ev=1.6×10^{-19}J) then, if possible, the atom jumps to a level

A. 2
B. 3
C. 0
D. Impossible

88. Two identical objects move toward one another along the same line as shown in the diagram which one of the following statements is correct?



A. the magnitude of the total momentum before the impact is mv
B. the magnitude of the total momentum before the impact is 3mv
C. the magnitude of the total momentum after the impact is 2mv
D. the magnitude of the total momentum after the impact is 0

89. Two freely moving objects collide and stick together. If they are still moving after the collision, which one of the following is correct?

	Total Kinetic Energy	Total Momentum
A.	Decreases	Remains unchanged
B.	Remains unchanged	Decreases
C.	Decreases	Decreases
D.	Increases	Increases

90. A capacitor and a resistor are connected in series across the terminals of a batty. If the resistance is increased, then

A. The final charge on the capacitor is increased.
B. The final charge on the capacitor is decreased.
C. The final charge on the capacitor is the same, but the capacitor charges more quickly.
D. Charging time is decreased

91. The mass of P_4O_{10} that will be obtained from the reaction of 1.33 g of P_4 and 5.07 g of oxygen is (Atomic mass: O = 16, P = 31)

A. 2.05 g
B. 3.05 g
C. 4.05 g
D. 5.05 g

92. The value of K_c for the following reaction at 900 °C is 0.28:

$$CS_2(g) + 4\ H_2(g) \leftrightarrows CH_4(g) + 2\ H_2S(g)$$

What is the value of K_p at this temperature? (R=0.082 L atm /K mol)

A. 3.0×10^{-5}
B. 2.1×10^{-4}
C. 6.7×10^{-3}
D. 1.4×10^{-2}

93. The maximum number of isomers for an alkene with molecular formula C_4H_8 is

A. 5
B. 4
C. 2
D. 3

94. What is the molarity of a salt solution prepared by dissolving three moles of salt in 500 milliliters of water?

A. 1
B. 2
C. 4
D. 6

95. The oxidation number of chlorine in $KClO_4$ is:

A. -1
B. +3
C. +7
D. +1

96. The rate of a chemical reaction can be affected by:

A. Temperature
B. concentration of products
C. concentration of reactants
D. all of the above

97. What is the pH of an aqueous solution of 0.1 mole/L HCl?

A. 7
B. 13
C. 1
D. 3

98. An aldehyde can be oxidized to form:

A. a ketone
B. an acid
C. an alcohol
D. an ester

99. Endothermic refers to a process that

A. does work
B. gives off heat
C. loses mass
D. absorbs heat

100. Based on the information given below, what is ΔH° for the following reaction?

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

$C(s) + 2H_2(g) \rightarrow CH_4(g) \quad \Delta H^\circ = x$
$C(s) + O_2(g) \rightarrow CO_2(g) \quad \Delta H^\circ = y$
$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l) \quad \Delta H^\circ = z$

A. $x + y + z$
B. $x + y - z$
C. $z + y - 2x$
D. $2z + y - x$