جــامعة بيروت العربية
BEIRUT ARAB UNIVERSITY

Faculty of Engineering
Admission Exam
2014-2015

Applicants for undergraduate programs in the faculty of engineering at Beirut Arab University are required to sit for an entrance exam designed to measure general academic ability, comprehension of scientific information of basic science (Math , Physics, Chemistry), and thinking skills.

References:

Lebanese High School Program and SAT

Creative Problem Solving: *The Door to Individual Success and Change*, by Thomas W. Dombroski, Publisher: iUniverse, 2000, ISBN-13: 978-1583487235

1. Find the odd one out

   A. 4164   B. 8493   C. 5204   D. 2147

2. How many times will the minute hand cross the hour hand between 6:50 and 10:50am?

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

3. Look at this series: 53, 53, 40, 40, 27, 27, ... What number should come next?

   A. 53   B. 12   C. 27   D. 14

4. Fact 1: All dogs like to run.
   Fact 2: Some dogs like to swim.
   Fact 3: Some dogs look like their masters.

   If the first three statements are facts, which of the following statements must also be a fact?
   I: All dogs who like to swim look like their masters.
   II: Dogs who like to swim also like to run.
   III: Dogs who like to run do not look like their masters.

   A. I only   B. II only   C. II and III only   D. None

5. Fact 1: Jessica has four children
   Fact 2: Two of the children have blue eyes and two of the children have brown eyes.
   Fact 3: Half of the children are girls.

   If the first three statements are facts, which of the following statements must also be a fact?

   I: At least one girl has blue eyes.
   II: Two of the children are boys.
   III: The boys have brown eyes.

   A. II only   B. I only   C. II and III only   D. None

6. Fact 1: All drink mixes are beverages.
   Fact 2: All beverages are drinkable.
   Fact 3: Some beverages are red.

If the first three statements are facts, which of the following statements must also be a fact?

I: Some drink mixes are red.
II: All beverages are drink mixes.
III: All red drink mixes are drinkable.

A. I and II only   B. II only   C. II and III only   D. III only

7. In a certain code language, if the word "TWO" is 428 and "POP" is 585, then how will the term "WOPO" be represented?

A. 5288   B. 2858   C. 2585   D. 5252

8. The day before yesterday was Christmas. On the same day next week will be my birthday. Tomorrow is Friday. So what is the day before my birthday?

A. Tuesday   B. Monday   C. Wednesday   D. Thursday

9. Solve for x, giving real solutions only: $\ln(x^3) + \ln(5) = \ln(1000)$
A. 5.848035   B. 66.66666   C. 1/5   D. 17.0998

10. How many solutions to $\sin x \cos x = 0$ are there on the interval $0 < x < 2\pi$?
A. 5   B. 1   C. 3   D. 7

11. Two identical dice are thrown, one after the other. What is the probability that the second number is greater than the first?
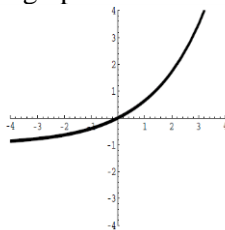A. 5/6   B. 4/11   C. 1/6   D. 15/36

12. Find: $\displaystyle\int_{-\pi/2}^{\pi/2} x \sin(x)\,dx$

A. -2   B. 2   C. 1   D. -1

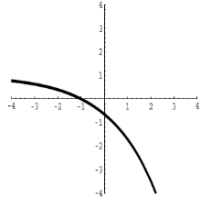13. Which of the following numbers is largest in value? (All angles are given in radians.)

A. $\sin^2(5\pi/2)$ B. $\log_{10}(5\pi/2)$ C. $\log_2(5\pi/4)$ D. $\lim_{h\to 0} \tan(\dfrac{5\pi - h}{2})$

14. The diagram below shows the graph of the function $y = f(x)$. Then $f^{-1}(x)$ is:
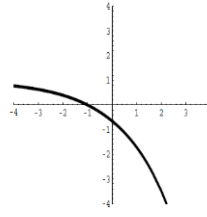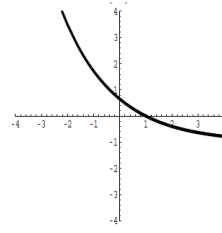
A. None of these

B.   C.   D.

15. For the circle $x^2 + y^2 = 81$ the point (7, 6) is

   A. inside the circle   B. outside the circle   C. on the circle   D. on the center

16. A company has found that it pays as monthly salaries the amount of $\dfrac{x^2}{x-a}$ dollars, if it has x employees, where a is a constant. How many employees should the company have in order that it pays the least amount of salaries?

    A. a   B. 2a   C. 2   D. 5

17. If $a \sin(x) + b \cos(x) = c \sin(x+d)$, then c equals:

   A. $\sqrt{a^2 - b^2}$ B. $a^2 + b^2$ C. $a+b$ D. $\sqrt{a^2 + b^2}$

18. The area between a function $y = f(x)$ and the x axis on the interval $a < x < b$ is

A. $f(b) - f(a)$ B. $(b-a)\int f(x)dx$ C. $\int_a^b f(x)dx$ D. $\int_b^a f(x)dx$

19. If u is function of the y and y u is function of x, then

A. $\dfrac{du}{dx} = \dfrac{du}{dy} + \dfrac{du}{dx}$ B. $\dfrac{du}{dx} = \dfrac{du}{dy} / \dfrac{du}{dx}$ C. $\dfrac{du}{dx} = \dfrac{du}{dy} \cdot \dfrac{du}{dx}$ D. $\dfrac{du}{dx} = \dfrac{du}{dy} \cdot \dfrac{dy}{dx}$

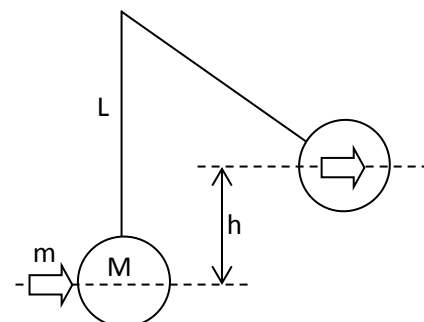20. Given $f(x) = x(x+1)$ and $g(x) = 2x + 7$, which of the following is $f(g(x))$?

A. $4x^2 + 30x + 48$ B. $4x^2 + 32x + 56$ C. $4x^2 + 30x + 56$ D. $x^2 + 32x + 48$

21. Ballistic pendulum, of mass M=2kg and length L=1m, is a device which measures the speed of bullet m=20g. If the bullet sticks with the block immediately after impact, find the initial velocity of the bullet v. Given that the combined system raises a height $h=20cm$.

A. 501.5 m/s   B. 2 m/s   C. 50 m/s   D. None of A,B,C

22. In a Young's double slit demonstration using monochocrmatic blue light, it is found that the fringes are too close together for convinient observation. The fringe separation could be increased by

A. decreasing the distance between slits and screen.

B. increasing the distance between slits and screen.

C. replacing the light with monochromatic red light

D. replacing the light with monochromatic violet light

23. 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 500Hz

24. A capacitor and a resistor are connected in series across the terminals of a battery. 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 increased

25. How many grams of deuterium ^{2}H (atomic mass = 2.0141 u) must be fused to helium ^{4}He (atomic mass 4.0026 u) in one second to produce 3000 MJ of energy? [1 u $= 1.66 \times 10^{-27}$ kg=931.5Mev/c^2]

A. 0.005g   B. 0.05g   C. 0.0001g   D. 0.1g

26. 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

27. A mass on a spring vibrates in simple harmonic motion at a frequency of 4 Hz and amplitude of 4 cm. If a timer is started when its displacement is a maximum (hence $x = 4$ cm when $t = 0$), what is the speed of the mass when $t = 3$ s?

A. 0   B. 0.0065 m/s   C. -0.0065 m/s   D. 0.04 m/s

28. The half-life of radon-222 is 2.8 days. How many days would it take for the activity due to radon in a tightly closed building to decrease to 2.8 % of its original value?

A. 1.0 day   B. 8.9 days   C. 12 days   D. 14 days

29. How much energy is needed to ionize a hydrogen atom in its first excited state?

A. 13.6 eV   B. 10.2 eV   C. 3.4 eV   D. 0 eV

30. Suppose you illuminate a metal surface using a light whose frequency is four times the cutoff frequency f_0 for that material. What is the maximum kinetic energy of the ejected electrons?

A. hf_0 B. $2hf_0$ C. $3hf_0$ D. $4hf_0$

31. Two resistors of 2 ohms and 4 ohms are connected in parallel with a battery (10 volts) the current flowing through the (4 ohms) resistor is

A. 10/6 A   B. 6/10 A   C. 5/2 A   D. 2/5 A

32. A radio-station broadcasts at 30 m wavelength. The frequency of electromagnetic waves transmitted from this station could be

A. 10 MHz   B. 10 kHz   C. 3×10^{10} Hz   D. 3×10^8 Hz

33. Two copper wires, the first has length (L) and a cross-section area (A) while the second has length (L/2) and a cross-section area (3A). The ratio between the resistivity of the first wire and that for the second wire equals

A. 2   B. 1   C. 6   D. 3

34. The linear momentum of a body is $P = a + (bt^2/2)$. The force acting on the body is

A. $a + (bt/2)$ B. $a + bt$ C. $bt/2$ D. bt

35. A block of Niobium, a metal with density 8570 kg/m^3 , has sides of length 3 cm, 4 cm and 5 cm. What is the maximum pressure that can be exerted by this block when it is stood upright on one of its faces?

A. 4.3 kPa   B. 430 Pa   C. 2.6 kPa   D. 510 kPa

36. What is the density of ammonia gas at 2 atm pressure and a temperature of 25°C?

(R=0.0821 atm. L/mol.K) (H=1, N=14)

A. 0.720 g/L   B. 0.980 g/L   C. 1.39 g/L   D. 16.6 g/L

37. A catalyst can act in a chemical reaction to:

(I) increase the equilibrium constant.

(II) lower the activation energy.

(III) decrease ∆E for the reaction.

(IV) provide a new path for the reaction.

A. only I & II   B. only II & III   C. only III & IV   D. only II & IV

38. Which of the following statement is **TRUE** regarding chemical equilibrium?

1. chemical equilibrium only apply to solutions

2. chemical equilibrium only apply to gases

3. increasing the temperature in an exothermic reaction shifts the equilibrium
   towards the side of the reactants

4. at equilibrium, the rate of reaction from reactants to products and the reverse is zero

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

39. In the following chemical equation of the ionization of $H_3PO_{4(aq)}$ in water, what best describes $H_2PO_4^-{}_{(aq)}$?

$$H_3PO_{4(aq)} + H_2O_{(l)} \leftrightarrows H_2PO_4^-{}_{(aq)} + H_3O^+{}_{(aq)}$$
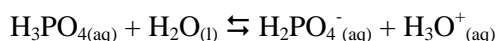
A. acid   B. base   C. conjugate acid   D. conjugate base

40. Given: $A + 3B \rightarrow 2C + D$

This reaction is first order with respect to reactant A and second order with respect to reactant B. If the concentration of A is doubled and the concentration of B is halved, the rate of the reaction would _____ by a factor of _____.

A. increase, 2   B. decrease, 2   C. decrease, 4   D. not change

41. What is the pH of the solution formed when 0.060 moles NaOH is added to 1.00 L of 0.050 M HCl?

A. 12.78   B. 2.00   C. 7.00   D. 12.00

42. In the reaction, $2H_2O_2 \rightarrow 2H_2O + O_2$

1. Oxygen is oxidized only   2. Oxygen is neither oxidized nor reduced
3. Oxygen is reduced only   4.Oxygen is both oxidized and reduced
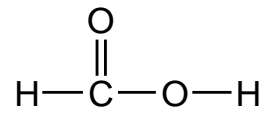
A. 12.78   B. 2.00   C. 7.00   D. 4

43. Which of these represents the proper IUPAC name for the following structure:
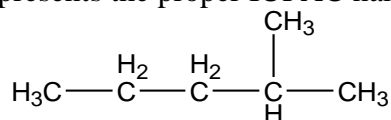
A. Ispropyl propane   B. 4-Methylpentane   C. 3-Methyl pentane   D. 2-Methylpentane

44. What is the name of the following compound:

$$H-\overset{\overset{\displaystyle O}{\|}}{C}-O-H$$

    A. Formic acid   B. Methanol   C. Formaldehyde   D. Methyl ether

45. Under what type of drugs is Aspirin included?

A. Antibiotic   B. Tranquilizer   C. Analgesic   D. Anesthetic