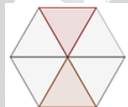# MANILA REVIEW INSTITUTE, INC.

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CHEMICAL ENGINEERING REFRESHER COURSE

MATH AND PHYSICS PART 2

1. There are two consecutive odd integers whose product is 143. Find the sum of the numbers.
   a. 26
   b. 18
   c. 13
   d. 24

2. In a three-digit number, the hundreds digit is twice the units digit. If 396 be subtracted from the number, the order of the digits will be reversed. Find the number if the sum of the digits is 17.
   a. 854
   b. 928
   c. 653
   d. 864

3. Mary is 24 years old. Mary is twice as old as Anna was when Mary was as old as Anna is now. How old is Anna now?
   a. 12
   b. 16
   c. 18
   d. 20

4. In how many minutes after 6 o'clock will the hands of the clock be opposite each other again?
   a. 65.54
   b. 65.45
   c. 64.45
   d. 64.54

5. Lorenz reads the clock differently such that he recognizes the hour hand as the minute hand and the minute hand as the hour hand. How many minutes after 5 o'clock will he read the time correctly?
   a. 26.55
   b. 27.27
   c. 28.92
   d. 28.66

6. In a spherical triangle ABC, B = 80°, a = 49°, and c = 77°. Find the value of angle *A*.
   a. 74.02°
   b. 50.63°
   c. 86.50°
   d. 63.06°

7. A solid has regular hexagonal end panel with side 6 m and 9 m long. What is the capacity of the tank?
   a. 764.56
   b. 841.78
   c. 886.21
   d. 759.23

8. A certain radio wave takes the form of a sine curve and is expressed by the equation y=5sin2x. What is the frequency of this wave?
   a. 3.14
   b. 2.01
   c. 0.32
   d. 1.87

9. A man on the top of a light tower 13.856 m above the ground has spotted 2 boats. One boat has an angle of depression of 45° while the other has an angle of depression equal to 60°. Find the distance between the two boats.
   - a. 8
   - b. 2.93
   - c. 5.86
   - d. 3.45

10. A telephone operator asked 20 of her friends what the memory size of their flask disk are. Two liquids are mixed in a ratio 1:3 by volume and placed in a hemisphere with radius 10 cm. The total depth is 6 cm. After some time, the liquid separated and the smaller amount settles at the bottom. What is the thickness of the lighter liquid?
    - a. 2.82 cm
    - b. 3.18 cm
    - c. 3.28 cm
    - d. 2.72 cm

11. A man on the top of a light tower 13.856 m above the ground has spotted 2 boats. One boat has an angle of depression of 45° while the other has an angle of depression equal to 60°. Find the distance between the two boats.
    - a. 8
    - b. 2.93
    - c. 5.86
    - d. 3.45

12. A square with a side of 2m has circle inscribed in it and it turn this circle has a square inscribed in it. If this square also has a circle inscribed in it, what is the area between the last square and the last circle?
    - a. $0.43cm^2$
    - b. $0.33cm^2$
    - c. $0.53cm^2$
    - d. $0.35cm^2$

13. Determine the area of the square inscribed in a circle with a circumference of 18.84cm.
    - a. $18cm^2$
    - b. $16cm^2$
    - c. $13.5cm^2$
    - d. $19.5cm^2$

14. What is the area of the shaded area in the figure if the area of the entire hexagon is $96cm^2$?

   - a. $32cm^2$
   - b. $46cm^2$
   - c. $28cm^2$
   - d. $35cm^2$

15. If non-parallel sides of an isosceles trapezoid are prolonged, an equilateral triangle with sides of 6cm would be formed. Knowing that the trapezoid is half the height of the triangle, calculate the area of trapezoid.
    - a. $11.70cm^2$
    - b. $13.24cm^2$
    - c. $9.87cm^2$
    - d. $16.17cm^2$

16. Find the area bounded by the lines 5x-6y-30=0, 2y+3x-6=0 and the y-axis.
    - a. 13.71
    - b. 8.57
    - c. 18
    - d. 18.67

17. The vertices of the heptagon are as follows: (1, 4), (3, 2), (2, -2), (1, -5), (-3, -4), (-4, 1), and (-2, 2). Which of the following gives the distance of the centroid from origin?
    - a. 0.286
    - b. 0.331
    - c. 0.389
    - d. 0.404

18. Find the distance between the lines 4x-y+2=0 and 4x-y+9=0.
    - a. 1.6
    - b. 1.7
    - c. 1.8
    - d. 1.9

19. Given the points A(3,2), B(-2,5), C(4,7) and D(-4,-5). Find the equation of the line joining the midpoints of segments AB and CD.
    - a. 5x+y+1=0
    - b. 5x-y-1=0
    - c. 5x-y+1=0
    - d. 5x-y+1=0

20. What is the radius of the circle passing through (-3, 1), (0, 4) and (3, -6)?
    a. 5.24
    b. 4.80
    c. 4.96
    d. 5.33

21. Which x-interval for the graph of the function shows downward concavity?
$$y = e^{-x^2/2}$$
    a. $(-\infty, 1]$
    b. $[-1, 1]$
    c. $[1, \infty)$
    d. $(-\infty, \infty)$

22. The demand function for a product is modeled by
$$p = 56e^{-0.000012x}$$
    Where p is the dollar price per unit and x is the number of units. What price will yield the maximum revenue?
    a. $18.85
    b. $16.87
    c. $13.55
    $20.60

23. Determine the radius of curvature at (4, 4) of the curve $y^2 - 4x = 0$.
    a. 23.4
    b. 22.4
    c. 25.4
    d. 24.4

24. A baseball diamond is a square whose sides are 90 ft long. If a batter hits a ball and runs to the first base at the rate of 20 ft/s. How fast is his distance from the second base changing at the instant when he has run 50 ft?
    a. 2.18 ft/s
    b. 8.21 ft/s
    c. 8.12 ft/s
    d. 12.8 ft/s

25. Water is flowing at constant rate of 125.664 cm³/s in a hemispherical bowl with radius 20 cm. If the height of water is increasing at 0.196 cm/s, what is the height of the water at this instant?
    a. 4 cm
    b. 5 cm
    c. 6 cm
    d. 7 cm

26. Find the centroid of the plane bounded by $y = x^3, x = 2$ and x-axis.
    a. (1.6, 2.29)
    b. (1.6, 2.05)
    c. (1.7, 2.05)
    d. (1.7, 2.29)

27. Calculate the moment of inertia about x-axis of the first quadrant portion of the curve:
$$y = 4 - x^2$$
    a. 4.27
    b. 19.50
    c. 18.67
    d. 15.23

28. Calculate the volume of solid generated by rotating the region bounded by $y = \sqrt{x}, y = 3$ and y-axis about the y-axis.
    a. 243.21
    b. 152.68
    c. 187.54
    d. 191.98

29. Calculate the volume of solid generated by rotating the region bounded by $x = y^2 - 6y + 10$ and $x = 5$ about y-axis.
    a. 227.87
    b. 331.21
    c. 354.18
    d. 283.63

30. Find the work done by pumping out molasses from a conical tank filled to 2 ft from the top of the tank. The tank has a maximum radius of 3 ft and a height of 10 ft. Molasses weighs 100 lb/ft³.
    a. 1.930 x 10⁴ ft-lb
    b. 1.830 x 10⁴ ft-lb
    c. 1.853 x 10⁴ ft-lb
    d. 1.803 x 10⁴ ft-lb

31. If the index of refraction of water is 1.33, how deep would a river seem to an observer of the actual depth of the river is 6m? Answer in m.
    a. 4.51
    b. 2.11
    c. 4.56
    d. 6.65

32. If photons obey Planck's energy rule, at what frequency will they have an energy of 4 eV? Answer in THz.
    a. 967
    c. 2414
    b. 1256
    d. 678

33. A cable of length 0.6m and a mass of 10g is under a tensile load of 250N. Find the frequency at the 3rd overtone. Answer in Hz.
    a. 408
    c. 363
    b. 201
    d. 225

34. What is the speed of sound in air when the temperature is 60°C? Answer in m/s.
    a. 332
    c. 352
    b. 342
    d. 369

35. A 70 kg ball is travelling eastward at a rate of 8m/s while a 60kg ball is travelling westward at a rate of 12m/s. If they stick together after impact, calculate their velocity in m/s.
    a. 1.23 eastward
    c. 9.85 eastward
    b. 1.23 westward
    d. 9.85 westward

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