1. Find the angle (in degrees) at which the curve $y = \frac{1}{3}\sin 3x$ crosses the x-axis.

(a) 30 (b) ± 45 (c) -60 (d) 37.5 (e) none of these

2. A sample of a substance contains by weight 27.93% Fe, 24.05% S, and 48.01% O. What is the empirical formula of the substance?

(a) $Fe_2S_3O_3$ (b) Fe_2SO_4 (c) FeSO (d) Fe_3SO_3 (e) none of these

3. The absolute pressure in a closed tank is 2.33×10^5 Pa. If a pressure gauge reading psi is used to monitor the pressure in the tank, what reading will the gauge show if the local atmospheric pressure is 29.10 in Hg?

(a) 19.5 (b) 24.5 (c) 29.6 (d) 33.8 (e) none of these

4. The electrolytic manufacture of chlorine gas from sodium chloride solution is carried out by the following reaction:

$$2NaCl + 2H_2O \rightarrow 2NaOH + H_2 + Cl_2$$

How many kilograms of Cl_2 can be produced from 10 m^3 of a brine solution containing 5% by weight sodium chloride? The solution has a specific gravity of 1.07.

(a) 101.5 (b) 162.2 (c) 324.5 (d) 648.9 (e) none of these

5. A spherical snowball is melting (symmetrically) at the rate of 4π cubic centimeters per hour. How fast is the diameter changing when it is 20 centimeters?

(a) 0.1 cm/h (b) 0.01 cm/h (c) 0.02 cm/h (d) 0.04 cm/h (e) none of these

6. What is the minimum value of the function $f(x) = 2x^2 - 7x - 10$ on the interval [-1,3]?

(a) 2.3 (b) 8.6 (c) –8.6 (d) –16.125 (e) none of these

7. How many lb-moles of Na_2SO_4 can be produced by reacting 100 lbs of NaOH with sufficient H_2SO_4?

(a) 0.62 (b) 1.25 (c) 2.50 (d) 5.00 (e) none of these

8. Twenty (20) kg of C_3H_8 are burned with 400 kg of air to produce 44 kg of CO_2 and 12 kg of CO. What is the percent excess air?

(a) 8% (b) 12% (c) 20% (d) 28% (e) none of these

9. An equation for the heat capacity of carbon (solid) is given by Cp = 1.2 + 0.0050 T – 0.0000021 T^2 where T is in ^oF and Cp is in Btu/(lb)(^oF). The calculated value of enthalpy of C(s) at 1000 ^oF is 1510 Btu/lb. What is the reference temperature for the enthalpy value of C(s)?

(a) 0^oF (b) 75^oF (c) 100^oF (d) 215^oF (e) none of these

10. A and B working together can do a job in 10 days. It takes A 5 days longer than B when each works alone. How many days does it take each of them, working alone, to do the job?

(a) 12.2 and 17.2 (b) 14.4 and 19.4 (c) 17.7 and 22.8 (d) 22.8 and 27.8
(e) none of these

11. What is the second derivative of $y = \frac{1}{3+x}$?

(a) $2(3+x)^{-3}$ (b) $(1/(3+x))^{-2}$ (c) $-(3+x)^{-1}$ (d) x^{-2} (e) none of these

12. Calculate the number of moles of AgCl that can be prepared by mixing 2.0 L of 1.2 M $AgNO_3$ with excess NaCl.

(a) 2.4 (b) 3.5 (c) 4.8 (d) 1.2 (e) none of these

13. You have 10 lb of CO_2 in a 20 ft^3 fire extinguisher at 30 ^oC. Assuming the ideal gas law holds, what will be the gauge pressure (psig) on the tank when full? (assume local pressure is 1.0 atm).

(a) 24.6 (b) 51.3 (c) 77.8 (d) 98.4 (e) none of these

14. Five (5) mol of bromine vapor are condensed at a constant pressure of 0.310 bar and a constant temperature of 300 K. Calculate ΔH (kJ) for this process.

The following data are available for bromine:

State	T(K)	P(bar)	v(L/mol)	u(kJ/mol)
Liquid	300	0.310	0.0516	0.000
Vapor	300	0.310	79.94	28.24
Vapor	340	1.330	20.92	29.62

(a) –30.7 (b) –60.8 (c) –82.2 (d) –101.0 (e) none of these

15. A skier passes over the crest of a small hill at a speed of 3.6 m/s. How fast will she be moving when she has dropped to a point 5.6 m lower than the crest of the hill? Neglect friction.

(a) 6.7 (b) 8.1 (c) 9.3 (d) 11.1 (e) none of these

16. Differentiate the following function $y = \sqrt[3]{3x^2}$?

(a) $\frac{6}{\sqrt{3x}}$ (b) $\frac{2}{\sqrt[3]{9x^2}}$ (c) $\frac{2}{\sqrt[3]{9x}}$ (d) $\frac{-2}{\sqrt[2]{3x^3}}$ (e) none of these

17. What volume would be occupied by the oxygen liberated by heating 0.200 g of $KClO_3$ until it completely decomposes to KCl and oxygen? The gas is collected at STP.

(a) 0.0221L (b) 0.0331L (c) 0.0551L (d) 0.0771L (e) none of these

18. The heat capacity Cp of acetic acid in J/(g mol)(K) can be calculated from the equation

$$Cp = 8.41 + 2.4346 \times 10^{-5} T$$

where T is in K. What is the appropriate equation to compute Cp in kJ/(kg mol)(K) when the temperature is given in ^oR instead of K?

(a) $Cp = 8.41 + 1.353 \times 10^{-5} T$
(b) $Cp = 4.67 + 1.353 \times 10^{-5} T$
(c) $Cp = 4.67 + 2.436 \times 10^{-5} T$
(d) $Cp = 15.138 + 1.353 \times 10^{-5} T$
(e) none of these

19. Use the humidity chart attached to answer this question. What will be the absolute humidity of air that is originally at 100 ^oF having 50% relative humidity if it is heated to 200 ^oF?

(a) 10.2 (b) 8.2 (c) 4.2 (d) 2.2 (e) none of these

20. A 60-kg student finds that she can run up a flight of steps in a football stadium in 12 s. The flight of steps has 120 steps, each 20 cm high. If her muscles are 20 percent efficient, how much energy does she use in this exercise?

(a) 16.9 kcal (b) 34.5 kcal (c) 52.2 kcal (d) 74.4 kcal (e) none of these

Question	Correct Answer
1	b
2	e
3	a
4	c
5	c
6	d
7	b
8	d
9	b
10	c
11	a
12	a
13	b
14	e
15	d
16	c
17	c
18	a
19	c
20	a