ENGINEERING ENTRANCE EXAMINATION

QUESTIONS IN MATHEMATICS

NOTE: ANSWER ANY 11 QUESTIONS OUT OF 16 QUESTIONS

1. Evaluate $\lim\limits_{x\to\infty}\dfrac{3x-2}{4x+3}$

2. Find the equation of the straight line passing through (3,1) which is perpendicular to the line passing through (3,-2) and (-6,5)

3. Find the radius of a circle with the equation $x^2 - 2x + y^2 + 6y = -6$

4. If $f(x) = x(x^2 - 5)^{1/2}$, find $f'(x)$

5. If $f(x) = x^2\cos x$, find $f'(x)$

6. If $x^3 - y^3 = 1$, find d^2y/dx^2

7. Find the slope of the tangent line to $y = \dfrac{2}{(x-2)}$ at (0,1)

8. $\displaystyle\int_{\pi/3}^{\pi/6} \dfrac{\cos x}{\sin x}dx$

9. If $dx = 4t^3 \, dt$, if $x = 3$, when $t = 1$, what is the value of x when $t = 2$?

10. If $y = \dfrac{1}{8}(\sin(4x))^2$, then $y' =$

11. $\displaystyle\int_{1}^{\infty} \dfrac{1}{x\sqrt{x}} \, dx$

12. $\displaystyle\int_{2}^{3} \dfrac{x^3 - x^2 + x - 1}{x^2 + 1} \, dx$

13. $\displaystyle\int \dfrac{1}{x} \, dx$

14. $\dfrac{d}{dx}\left(\displaystyle\int_{2}^{x} \ln t \; dt \right) =$

15. $\displaystyle\int_{0}^{2} xe^{x^2} \, dx$
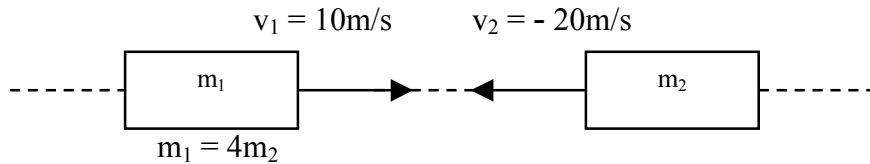
16. If $\displaystyle\int_{-1}^{1} \{x^2 + f(x)\} \, dx = 2$, then $\displaystyle\int_{-1}^{1} f(x) \, dx =$

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QUESTIONS IN PHYSICS

NOTE: ANSWER ANY 11 QUESTIONS OUT OF 16 QUESTIONS
ASSUME $g = 9.8 \text{m/sec}^2$

1. Two masses collide in a perfectly inelastic collision. Given the data in the figure, find the velocity and direction of the resulting combined mass.

$v_1 = 10 \text{m/s}$ $v_2 = -20 \text{m/s}$

$m_1 = 4m_2$

2. A car starting from rest moves with a constant acceleration of 10mi/hr^2 for 1 hour, then decelerates at a constant -5mi/hr^2 until it comes to a stop. How far has it traveled?

3. A ball is thrown downward from the top of a tower. One second after it is thrown, the ball is 224ft from the ground. Three seconds after it is thrown the ball is 76ft from the ground. Determine the average velocity of the ball during this period.

4. From the top of a building 160ft. high, a stone is dropped. Find when the stone will reach the ground, neglecting air resistance.

5. A man pushes a 2400-kg car from the rest to a speed of 4m/s with a constant horizontal force. During this time, the car moves a distance of 40m. Neglecting friction between the car and the road, determine the work done by man.

6. Two masses are connected by a light string passing over a light, frictionless pulley. Such a device is known as an "Atwood machine." Mass m_1 is 2kg and mass m_2 is 5kg. Mass m_2 is initially 2m above the floor when the system is released. What is the speed of m_1 just as m_2 strikes the floor?
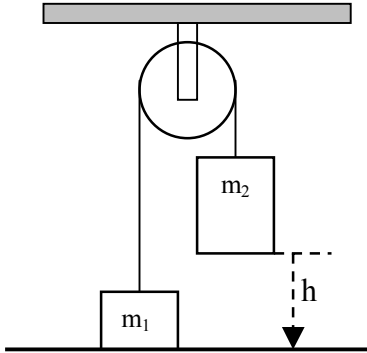
7. At a distance 3m from a pneumatic hammer, the sound level is 120dB and the sound intensity is $1.00W/m^2$. AT 90m from the hammer, what is the sound level in dB.

8. A 500-gram block, resting on a level floor is pressed against a horizontal spring, compressing it 8cm. The force constant of the spring is 300N/m. If the coefficient of kinetic friction between block and floor is 0.300, how far will the block slide before coming to rest?

9. A 500-kg crate is pulled across a warehouse floor by means of a horizontal cable connected to an engine. The coefficient of kinetic friction between the crate and the floor is 0.450. How much power must the engine deliver in order to move the crate at a constant speed of 4m/s?

10. An 800-gram body attached to a spring having a force constant of 40N/m, oscillates with simple harmonic motion with a maximum displacement of 8cm from its equilibrium position. Calculate the maximum speed of oscillating body.

11. A wheel of 80cm in diameter starts from rest and rotates with a constant angular acceleration to 5400rpm in 6 seconds. What is the angular acceleration of the wheel?

12. The suspended weight W is 100N. Find the tension in cords A and B.

70° 37°

A   B

W
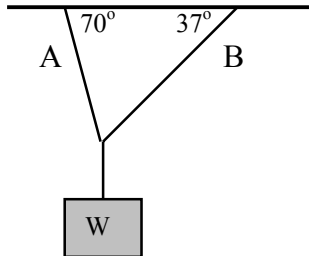
13. A cannonball is fired at an angle of 53° over level terrain and lands 1200 m away. What is the muzzle velocity of the cannonball?

14. Given vectors: A =5i – 7j +9k and B = 3i +6j +4k. Find a unit vector perpendicular to both vectors.

15. A uniform 60-gm meterstick has loads suspended from it as follows: 40gm at the 20-cm mark; 50gm at the 40-cm mark; and X gm at the 90-cm mark. If the fulcrum must be placed beneath the meterstick at the 70-cm mark for complete equilibrium, what is the magnitude of the mass X?

|10 |20 |30 |40 |50 |60 |70 |80 |90

40gm

50gm

60gm

F   X = ?
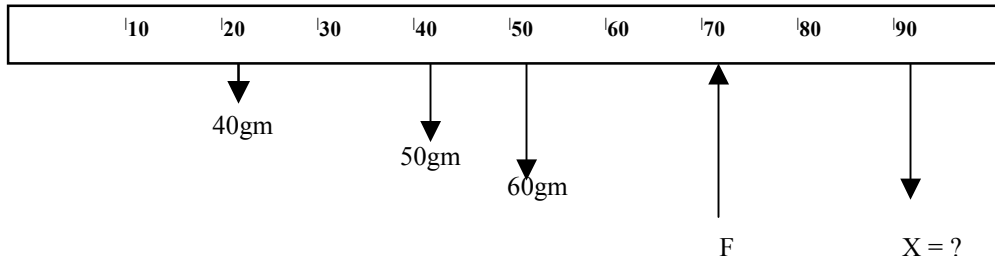
16. A heat engine operates in a Carnot cycle between the temperatures 60° C and 400°C. During each cycle, it absorbs 6 x 10^3 calories of heat from the high-temperature reservoir. If the duration of each cycle is one second, How much heat is expelled during each cycle?

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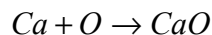
QUESTIONS IN CHEMISTRY

NOTE: ANSWER ANY 3 OUT OF 5 QUESTIONS

1. A volumetric analysis of a gaseous mixture is as follows:

$$\begin{array}{ll} CO_2 & 12\% \\ O_2 & 4\% \\ N_2 & 82\% \\ CO & 2\% \end{array}$$

What is the percentage of CO_2 on a mass basis?

2. If 2.25g of pure calcium metal are converted to a 3.13g of pure CaO, what is the atomic weight of calcium? The atomic weight of oxygen is 16g/mole.

$$Ca + O \rightarrow CaO$$

3. How many moles of C_3H_8 are there in 150 grams of C_3H_8?

4. Calculate the percentage by weight of oxygen in potassium sulphate.

5. What volume is occupied by 26.8g of mercury? Density $= 13.6$g/ml.