ENGINEERING ENTRANCE EXAMINATION

QUESTIONS IN MATHEMATICS

NOTE: ANSWER ANY 11 QUESTIONS OUT OF 16 QUESTIONS

1. Evaluate $\int_1^e (x \ln x)dx$

2. Find an equation of the line passing through (3,-2) and perpendicular to the line $3y - x = 13$.

3. Find $\lim_{h\to 0}\frac{(2+h)^2 - 4}{h}$

4. A particle moves on the x-axis so that at any time $t \geq 0$ its velocity is given by $v(t) = -(\sin t)(e^{\cos t})$ and its position is given by x(t). If $x(0) = 2e$, then $x(\pi) =$

5. If $f(x) = x(x^2 + 4)^{\frac{1}{2}}$, find $f'(x)$

6. Evaluate $\int_{\pi/3}^{\pi/6} \frac{\sin x}{\cos x}dx$

7. If $dx = 3t^2\, dt$; if $x = 3$, when $t = 2$, what is the value of x when $t = 1$:

8. $\int_0^1 x^2 e^{x^3}\,dx =$

9. If f(x) = 3sin3x, then $f'(x)$ =

10. Evaluate $\int x^2 e^{-x^3}\,dx$

11. $\int \frac{x\,dx}{1+x}$

12. Consider a function of x equals to the determinant:

$$f(x) = \begin{vmatrix} x^4 & x^2 \\ x^3 & x^{-1} \end{vmatrix}$$, then $f'(x)$ =

13. If $f(x) = x(3x-5)^{1/2}$ then $f'(x)$ =

14. Evaluate $\int \sec^2 x e^{\tan x}\,dx =$

15. Evaluate $\int_{-1}^{2} (4x - 6x^2)\,dx =$

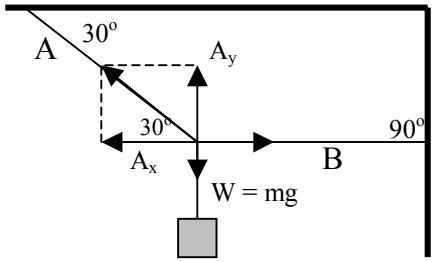
16. Evaluate $\int_{-0}^{1} [x^2 + (x^2+1)^4 x]\,dx =$

ENGINEERING ENTRANCE EXAMINATION

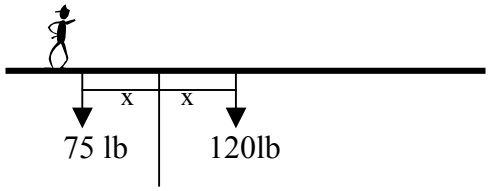
QUESTIONS IN PHYSICS

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

1. The suspended mass is 40kg, Find the tensions in cords A and B.



2. A uniform 10 foot beam weighing 120 pounds lies on the roof of a garage, with four feet of the beam extending out beyond the edge of the roof. A 75-pound boy walks carefully out along the beam. What is the maximum distance the boy can walk out beyond the edge of the roof without causing the beam to tip?

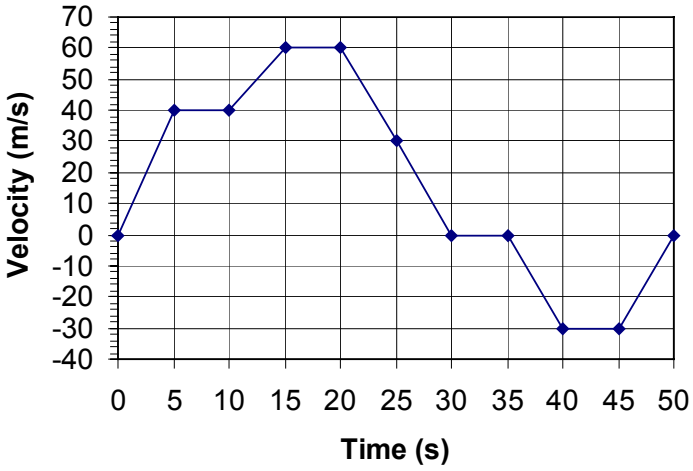


3. A solid gold cylinder is to be designed for a jewelry display. The mass of the gold cylinder must be exactly 400 grams (gm). If the density of gold is $19.3 gm/cm^3$, and the height of the cylinder is to be 2 cm, what must be the radius of the cylinder

4. The potential energy of a 800-gram body moving in three-space is a function of its position as given by the equation $U = 4x^3y^2z + 3yz^2$ in MKS units. When the body is at the point (1,-2,3)m, what is the magnitude of its acceleration?

5. A 4-kg block (A) sliding to the right at 8m/s makes a head-on collision with 6-kg block B, sliding in the opposite direction at 3m/s. If the coefficient of restitution in the collision is 0.86. What is the velocity of each block immediately after impact?

6. The velocity time-graph of an object moving along the x axis is shown. Determine the total distance traveled during the time interval from t = 10s to t = 40s.



6. A 300-gram soccer ball is kicked with an initial speed of 40m/s and lands 160m away on level ground. At what angle did the soccer ball leave the ground?

7. The potential energy of a 500-gram body moving in three-space is a function of its position as given by the equation $U = 4x^3y^2z + 3yz^2$ in MKS units. When the body is at the point (1,-2,3)m, what is the magnitude of its acceleration?

8. A 4-kg block (A) sliding to the right at 5 m/s makes a head-on collision with 6-kg block B, sliding in the opposite direction at 3m/s. If the coefficient of restitution in the collision is 0.86. What is the velocity of each block immediately after impact?

9. A boy sees a brick lying on a parking lot and gives the brick a kick, sending it sliding a distance of 6m before coming to rest. If the coefficient of kinetic friction between brick and asphalt is 0.400, what is the initial speed of the brick?

10. Water flows through a horizontal pipe where, at one point, the pressure is 3.0×10^4 Pa, the diameter is 6 cm, and the speed is 5m/s. At a constriction in the pipe, the diameter is 2 cm. What is the pressure difference between the two points?

11. An ambulance travels down a highway at a speed of 33.5m/s (75mi/hr). Its siren emits sound at a frequency of 400 Hz. What is the frequency heard by a passenger in a car traveling at 24.6 m/s (=55mi/h) in the opposite direction as the car approaches the ambulance

12. Four moles of oxygen are initially at a temperature of $27^{o}C$ and occupy a volume of 10 liters. The oxygen is first expanded isobarically until its volume has doubled, and then expanded adiabatically until the temperature returns to its original value. How much heat is added to the system?

13. A 600-kg crate is pulled at a constant speed of 2m/s across a level warehouse floor by an engine. The coefficient of kinetic friction between the crate and the floor is 0.460. How much power must the engine supply?

14. A 700-gram mass is attached to a spring and executes simple harmonic motion with a period of 0.25 second. If the total energy of the system is 4J, find the force constant of the spring?

15. Jacky, wearing roller-skates, is standing beside his mailbox when his friend Davey skates by at a constant speed of 4m/s. Two seconds later, Jacky skates after his friend and accelerates uniformly at $3m/s^2$. How long does it take Jacky to catch Davey?

16. At a distance 6m 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.

ENGINEERING ENTRANCE EXAMINATION

QUESTIONS IN CHEMISTRY

NOTE: ANSWER ANY 3 OUT OF 5 QUESTIONS

1. A sample of CO occupies a volume of 350 ml and exerts a pressure of 1020 torr at 25^{o}C. If the volume expands to 500 ml with no temperature change, what pressure will the gas exert?

2. How many moles of C_3H_8 are there in 100 grams of C_3H_8?

3. Which of the following chemical equations is incorrect?

   a) $S + Fe \rightarrow FeS$

   b) $ZnSO_4 + Na_2S \rightarrow ZnS + Na_2SO_4$

   c) $H_2SO_4 + ZnS \rightarrow ZnSO_4 + H_2S$

   d) $Al_2S_3 + 6H_2O \rightarrow 2\,Al(OH)_3 + 3H_2S$

   e) $ZnS + O_2 \rightarrow SO_2 + ZnO$

4. What is the oxidation state of nitrogen in NO_3?