

ENGINEERING ENTRANCE EXAMINATION

QUESTIONS IN MATHEMATICS

NOTE: ANSWER ANY 11 QUESTIONS OUT OF 16 QUESTIONS

1. What is  $\lim_{t \rightarrow 0} \frac{\sqrt{x+t} - \sqrt{x}}{t}$

2. Find the equation of the line through (6,8) which is parallel to the line with the equation:  $6x - 2y = 11$

3. Given  $dx = 3t^2 dt$ ; if  $x = 2$  when  $t = 2$ , what is the value of  $x$ , when  $t = 1$ ?

4. If  $f(x) = \pi^{\frac{3}{7}}$ , then  $f'(x)$  equals to

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

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

7. Evaluate  $\int_0^{\infty} \frac{1}{\sqrt{e^x}} dx$

8. Evaluate  $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x^2 - 3x + 2}$

9. Find the equation of the line through (3,-3) which is parallel to the line through (-1,2) and (3,-1)

10. If  $f(x) = e^{-2x}$ , find  $f''(x)$

11. If  $f(x) = (x^2 - 2)^{\frac{1}{2}}$ , find  $f'(x)$

12. If  $f(x) = x^2 \sin x$ , then  $f'(x) =$

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

14. The slope of the line tangent to the curve  $2x^3 - x^2y^2 + 4y^3 = 20$  at the point (3,1) is:

15. If  $s(t) = t^3 - 2t^2 - 4t + 10$  represents the height  $s$  of an object during time  $t$ , then the acceleration  $s''(t)$ , becomes zero when  $t$  equals?

16. Find  $\int \frac{x + 4}{\sqrt{x + 2}} dx$

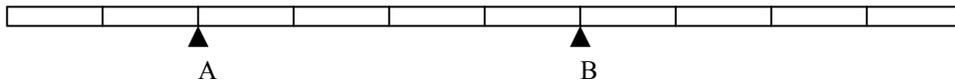
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QUESTIONS IN PHYSICS

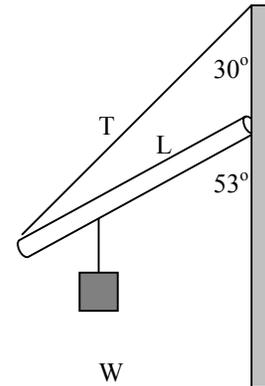
NOTE: ANSWER ANY 11 QUESTIONS OUT OF 16 QUESTIONS

ASSUME  $g = 9.8\text{m/sec}^2$

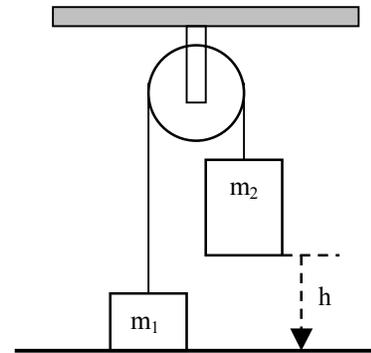
1. A 600-kg crate is pulled at a constant speed of 4m/s across a level warehouse floor by an engine. The coefficient of kinetic friction between the crate and the floor is 0.460. How much power must the engine supply?
2. A 500-gram mass is attached to a spring and executes simple harmonic motion with a period of 0.25 second. If the total energy of the system is 4J, find the force constant of the spring?
3. 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  $2\text{m/s}^2$ . How long does it take Jacky to catch Davey?
4. A lawn roller, in the form of a solid cylinder 60cm in diameter and weighing 490 N, is rolled along the ground and given just enough initial speed so that when it reaches a ramp leading up into the bed of a truck it will just reach the top of the ramp. If the ramp is 3m long and inclined  $30^\circ$  to the horizontal, what must be the initial speed of the roller at the base of the ramp?
5. A vertical steel wire 8 m in length and 2mm in diameter has a 5-kg mass attached to its lower end. Young's modulus for steel is  $20 \times 10^{10} \text{ N/m}^2$ . Determine the strain.
6. A uniform, 100-gram meter stick is supported by supports A and B, located at the 20-cm mark and the 60-cm mark, respectively. A 200-gram mass is placed on the meter stick at the 30-cm mark. How far from the 100-cm end of the meter stick can a 250-gram mass be placed on the stick without causing the stick to tip?



7. The uniform boom of length  $L$  weighs  $800\text{ N}$  and is hinged at one end. A weight,  $W$ , of  $1400\text{ N}$  is suspended one-fourth of its length from the free end. Determine the tension  $T$  in the guy wire.

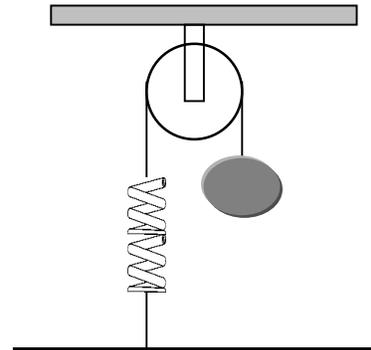


8. A solid sphere of mass  $20\text{ kg}$  and radius  $10\text{ cm}$  rolls from rest down a  $53^\circ$  incline  $12\text{ m}$  in length. As the sphere reaches the bottom of the incline. What is its angular velocity about its center?
9. The Atwood machine shown in the figure has a cord draped over a  $2\text{-kg}$  pulley in the form of a solid disk of radius  $5\text{ cm}$ . Fastened to one end of the cord is  $3\text{-kg}$  mass,  $m_1$ , initially resting on the floor, and at the other end of the cord is a  $5\text{-kg}$  mass,  $m_2$ , initially  $2\text{ m}$  above the floor. When the system is released. What is the acceleration of the  $5\text{-kg}$  mass?



10. Two masses slide over a smooth surface in the  $x$ - $y$  plane. A  $2\text{-kg}$  mass sliding at  $8\text{ m/s}$  in the direction  $\theta = 0^\circ$  collides with a  $3\text{-kg}$  mass sliding at  $4\text{ m/s}$  in the direction  $\theta = 90^\circ$ . If the two masses become coupled upon impact, what is the direction of their velocity after impact.
11. A  $3\text{-kg}$  medicine ball is thrown with a speed of  $20\text{ m/s}$ . A stationary receiver catches the ball and brings it to rest in  $0.08\text{ s}$ . What is the average force exerted on the receiver?

12. A mechanic pushes a 3000-kg car from rest to a speed  $v$ , doing 6000 J of work in the process. During this time, the car moves a distance of 30m. Neglecting friction between the car and the road. What is the final speed,  $v$ , of the car?
13. A railroad track has a curve of radius 300 m. The tracks are banked toward the inside of the curve at an angle of  $5^\circ$ . For what train speed was this curve designed if there is to be no sidewise force on the trains' wheels?
14. A cannon fires a cannonball with a muzzle velocity of 200m/s over level terrain. The cannonball strikes the ground 3200m away. What is the angle of projection of the cannonball?
15. A 4-kg mass is fastened to a light spring by means of a cord passing over a light, frictionless pulley. The mass is released from rest when the spring is unstretched. If the force constant of the spring is 100N/m, how far will the mass drop below its original position when it comes to rest?



16. A 500-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?

ENGINEERING ENTRANCE EXAMINATION

QUESTIONS IN CHEMISTRY

NOTE: ANSWER ANY 3 OUT OF 5 QUESTIONS

1. What is the molarity of 2 liters of aqueous solution formed from 588 grams of  $\text{H}_2\text{SO}_4$ ?
  2. Calculate the percentage by weight of oxygen in potassium sulphate,  $\text{K}_2\text{SO}_4$ .
  3. A certain compound containing Na, S, and O is found to have the following percentage compositions by weights: 29.1% Na; 40.5% S and 30.4% O. The empirical formula for this compound is:
  4. If 8.50 grams of,  $\text{Na}_2\text{SO}_4$ , are dissolved in 100 grams of water, what is the percent  $\text{Na}_2\text{SO}_4$  by weight in the solution?
  5. Oxygen has a volume of 100 ML at a temperature of  $20^\circ\text{C}$ . What will be its volume at  $100^\circ\text{C}$  at the same pressure?
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3. Calculate the percentage by weight of oxygen in potassium sulphate.

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