



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: MA 278

COURSE NAME: THEORETICAL MECHANICS

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CLASS: MA II

TIME: 3 HOURS

Name: _____ Index Number: _____

ATTEMPT ALL QUESTIONS. EACH QUESTION CARRIES 1 MARK

1. A 600kg saloon car and a 710kg V8 Land Cruiser are in a 150 km race. Which car wins the race assuming drag, friction and F_{net} are the same for both?
2. A visitor to a lighthouse wishes to determine the height of the tower. She ties a spool of thread to a small rock to make a simple pendulum, which she hangs down the centre of a spiral staircase of the tower. If the period of oscillation is 9.40 s then the height of the tower is
3. Suppose the mass of the Earth were to suddenly double. The force of gravity between the Earth and the Moon would
4. The acceleration a of a body is inversely proportional to its mass m , directly proportional to the net force F , and in the same direction as the net force. This law is known as
5. A school boy is riding his bicycle with a thrust force of 150N. If the school boy is able to lift the bicycle with a force of 70N, what is the drag force?
6. A is characterised by its point of application, magnitude, and direction.
7. The maximum kinetic energy of a spring-mass system in Simple Harmonic Motion is
8. A birds flies by pushing down so that the air pushes it upward.
9. There was an accident involving an ant and a truck. When the police went to an accident scene, their preliminary investigation showed that the mass of the truck was 100g and its acceleration was 75km/hr. If the mass of the ant was 10g, what was its acceleration?
10. The mathematical model for the Universal Law of Gravity is given by
11. The mass of a rocket on its launching pad is mostly
12. In a rocket and its ejected combustion products as a system, the total mass is
13. A soccer player kicks a ball with 1500 N of force. The ball exerts a reaction force against the player's foot of

Use the information below to answer questions 14 and 15.

A train bus moving to the right at 10 m/s collides with a parked train bus. They stick together and roll along the track. If the moving car has a mass of 8,000 kg and the parked car has a mass of 2,000 kg, what is

14. the formula for finding their combined velocity after the collision?.....
15. their combined velocity after the collision?.....
16. Impulse is a way to measure a because it is not always possible to calculate force and time individually since collisions happen so fast.
17. is the resistance to changes in motion, net forces, changing velocity, and a changing direction.
18. is a collision in which after the collision the kinetic energy of the system is not conserved.
19. If the component of the net external force on a closed system is zero along an axis then the component of the of the system along that axis cannot change.
20. The quantities that is conserved during an elastic collision, but not conserved during an inelastic collision is known as
21. If we roll a cue ball at a second billiard ball that is at rest, what continues to move forward is the of the two-ball system.
22. The of an object is a measure of its resistance to change in rotation

Use the following information below to answer questions 23 to 28.

After the US army fired one of its grenades in a war field, a grenade particle P of mass 2 moved along the x-axis and was attracted toward origin O by a force whose magnitude was numerically equal to $8x$. If it was initially at rest at $x = 20$, find

23. the differential equation and its initial conditions describing the motion
24. the position of the particle at any time.....
25. the speed of the particle at any time.....
26. the velocity of the particle at any time.....
27. the amplitude of the vibration.....
28. the period and frequency of the vibration.....
29. Newton determine that, for the force exerted by the Sun on the planets to yield elliptical orbits, it is necessary for the force to be
30. If only conservative forces do work in a system, the total mechanical energy of the system is equal to
31. The maximum kinetic energy of a spring-mass system in Simple Harmonic Motion is equal to

32. Any vibrating system where the restoring force is proportional to the negative of the displacement is in
33. The is the single force that has the same effect on the object as all the individual forces acting together.
34. A basketball ball having 2kg mass and 6m/s velocity moves to the east. What is the momentum?
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35. An object of mass 3kg travels with a velocity 4m/s to the east. Then, it changed and moved toward west with a velocity of 3m/s. The impulse given to this object is
36. A box is dragged horizontally across a floor by a 100N force acting parallel to the floor. The work done by the force in moving it through a distance of 8m is
37. Find the power of the man who pushes the box 8m with a force of 15N in a 6seconds.
38. If an object vibrates or oscillates back and forth over the same path, each cycle taking the same amount of time, the motion is called
39. The kinetic energy of cue ball having mass 0.5 kg and velocity 10m/s is
40. If the spring is hung vertically, the only change is in the equilibrium position, which is at the point where the spring force equals the
41. When a periodic force is applied to a system, the motion is described as
42. In a motion where the frictional dissipation of energy is neglected, the motion is said to be
43. A fruit hangs from a tree. The fruit is a quarter of a kilogram and is about to fall to the ground. If the fruit is 10 meters from the ground, how much potential energy does it possess?
44. A Mathematician uses a simple pendulum that has a length of 37.10 cm and a frequency of 0.8190 Hz at a particular location on the Earth. The acceleration of gravity at this location is
45. harmonic motion is harmonic motion with a frictional or drag force.
46. include only the forces that the environment exerts on the object of interest.
47. Kepler's 3rd law relates a planet's distance from the Sun and its orbital
48. Forced oscillations are small unless the driving frequency is close to the natural frequency. When the driving frequency is equal to the natural frequency, the oscillations can be large and this is called
49. Starting at rest, an 1,800 kg rocket takes off, ejecting 100 kg of fuel per second out of its nozzle at a speed of 2,500 m/sec. The force on the rocket from the change in momentum of the fuel is
50. A train car moving to the right at 10 m/s collides with a parked train car. They stick together and roll along the track. If the moving car has a mass of 8,000 kg and the parked car has a mass of 2,000 kg, what is their combined velocity after the collision?

51. If the resultant force acting on a stationary object is zero, the object will remain stationary. True/False
52. When the acceleration of an object is zero and the velocity is positive, the object continues to move at a steady velocity in the same direction. True/False
53. A bullet can have the same momentum as a truck if it is moving fast enough. True/False
54. Acceleration is the rate at which an object changes its velocity. True/False
55. A girl is moving on a skateboard. The same force that is accelerating the girl forward, is not accelerating the skateboard backward. True/False
56. A baseball thrown by a pitcher, although having a small mass, cannot have a large amount of kinetic energy due to its fast velocity. True/False
57. A river flowing at a certain speed possesses kinetic energy because the water has a certain mass and it also has velocity. True/False
58. The velocity and acceleration for simple harmonic motion can be found by differentiating the displacement. True/False
59. Tree branches high up in a tree have potential energy because they can fall to the ground. True/False
60. Can an object have more than one center of Gravity? Yes/No/Somehow