Sample Exam - BIT1002A

Multiple Choices Questions - Circle correct answer

1. A car travels around a circular track maintaining a constant speed. What is the direction of the car's acceleration?
   a. Acceleration is zero with constant speed.
   b. Acceleration is in the direction of motion.
   c. Acceleration is toward the centre of the circle.
   d. Acceleration is outward from the centre of the circle.

2. A force is applied to a massive object initially at rest. If the object remains at rest even with the force being applied what can we conclude about the force?
   a. The force is smaller than the force of inertia
   b. The force is smaller than the force of kinetic friction
   c. The force is smaller than the force of static friction
   d. The force is smaller than the normal force

3. An elastic collision between two balls where one is initially at rest results in the ball initially at rest moving off in the same direction as the moving ball with the same velocity, and the ball initially moving stays at rest. What do we know about these two balls?
   a. The ball initially at rest has more mass than the moving ball
   b. The ball initially moving has more mass than the ball initially at rest
   c. The balls must have the same mass
   d. Kinetic energy of the two ball is not conserved

4. As an object's velocity approaches the speed of light, which of the following **<u>does not</u>** happen to the object as seen by an external observe?
   a. Its kinetic energy is smaller
   b. Time advances more slowly
   c. Its mass gets larger
   d. Its length gets smaller

5. Light rays parallel to the principal axis strike a concave mirror, what happens to the reflected rays?
   a. They all pass through the focal point on the same side of the mirror.
   b. They all pass through the focal point on the opposite side of the mirror.
   c. They are reflected back along a line parallel to the principal axis.
   d. They diverge and their backtraces cross at the focus on the opposite side.

6. A stationary observer hears the sound of the siren on a fire engine become higher pitched as it accelerates to full speed. What can we conclude about the motion of the fire engine?
   a. It is slowing down
   b. It is moving away from the observer
   c. It is moving in a circular arc around the observer
   d. It is moving toward the observer

7. A light ray strikes an interface at an angle less than the critical angle, what happens?
   a. The light ray is reflected back into the original medium.
   b. The light ray passes through unaffected
   c. The light ray passes into the new medium bent toward the normal
   d. The light ray passes into the new medium bent away from the normal

8. An observer measures the intensity of a wave from a single source. Some time later the observer makes another measurement of the intensity from the same position and measures a larger value, what must have occurred?
   a. Source moved farther away
   b. Source power output decreased
   c. Source power output increased
   d. Source amplitude decreased

9. A mass connected to a spring is pulled some distance and released. The mass is then connected to another spring with a larger spring constant how is the motion different than with the first spring?
   a. The period will increase
   b. The frequency will increase
   c. The velocity at the max displacement will increase
   d. The total energy in the system will decrease

10. When a damped harmonic oscillator is driven by a force with a frequency that matches the natural frequency of the oscillator what is the result?
   a. Sudden increase in amplitude
   b. Critical damping
   c. Over damping
   d. Under damping

11. All images produced by an object between the focus and a converging lens are
   a. inverted
   b. on the same side of the lens as the object
   c. at the opposite focal length
   d. same size as the object

12. The closed end of pipe with one open and one closed end must contain what?
    a. A pressure node
    b. A pressure anti-node
    c. Highest frequency wave
    d. Lowest frequency wave

13. An arrow is fired at a bird some distance in the sky. It travels in an arc, just missing its mark at the height of its trajectory. What do we know about the horizontal component of its velocity at the highest point of its motion?
    a. it is zero
    b. starting to increase due to the downward pull of gravity
    c. starting to decrease due to the downward pull of gravity
    d. the same as its initial horizontal velocity at launch

14. A block is attached to a compressed string. The spring is released and the block slides some distance and comes to a stop. What happens to the energy stored in the spring?
    a. It is transferred as kinetic energy to the block which is lost as work due to friction.
    b. It is transferred to the gravitational potential energy of the block.
    c. It is returned to the spring once the block comes to a stop.
    d. It stays constant within the spring.

15. Light enters water (with a high index of refraction) from air (a low index of refraction) what is the effect?
    a. The frequency increases
    b. The wavelength increases
    c. The amplitude decreases
    d. The velocity decreases

16. Two separate collisions are observed, one collision results in a larger transfer of momentum than the other. What does this tell us about this collision?
    a. There is a larger impulse
    b. There is larger inertia
    c. Momentum is not conserved
    d. Total energy is not conserved

17. A traveller makes a long journey but after period of time returns to his initial starting point. What is his average velocity?
    a. The total distance travelled divided by the time taken.
    b. Zero. **Since displacement is zero**
    c. Larger than his instantaneous velocity.
    d. Opposite to the direction of the average speed.

18. An object is dropped from two different heights, each time landing on the same spring, what can be said about spring at when the object lands
    a. The higher height will give the smallest compression of the spring
    b. The higher height will give the largest compression of the spring
    c. Acceleration is the same for both, so they will both produce the same compression
    d. Gravity is affecting each object differently, so no way to tell

19. A space ship travels near the speed light to reach a nearby star, according to an observer on earth tracking the ship how will the travel time measured compare to his counterpart aboard the space ship?
    a. Time is constant
    b. Travel time must be the same
    c. Travel time will be longer
    d. Travel time will be shorter

20. A force is applied to an object to produce a net acceleration, what can we conclude
    a. The momentum of the object is remaining constant
    b. There is net work being done on the object
    c. There is no friction between the object and the ground
    d. Kinetic energy is being conserved

21. A truck blows its air horn (a pipe with a closed end) on a cold day. How does the pitch change if the truck blows it horn on a hot day?
    a. It gets higher
    b. It gets lower
    c. It stays the same
    d. It produces a beat pattern

22. An object produces an image in a convex mirror, if we find the image height to be larger than the object height, what can we conclude about the image?
    a. The image is closer to the mirror than the object
    b. The image is farther from the mirror than the object
    c. The image is inverted
    d. The image is real

23. Two objects collide and change direction; however the total kinetic energy following the collision is smaller than before. What does this indicate
    a. There must be a third object to carry away momentum
    b. The collision is elastic
    c. The collision is inelastic
    d. Momentum will not be conserved

24. An identical force is applied to two separate objects one with an inertia much larger than the other. Assuming no other forces like friction are involved what is the outcome of the application of this force.
    a. The object with smaller inertia experiences a smaller acceleration
    b. The object with larger inertia experiences a smaller acceleration
    c. The objects maintain uniform velocity and zero acceleration
    d. The inertia is redistributed to maintain constant acceleration

25. A beam of initially unpolarized light is incident on a polarizer with a transmission axis aligned along the vertical direction. Which of the following will happen?
    a. The intensity is reduced by half and light emerges polarized parallel to the transmission axis
    b. The intensity is increased by half and light emerges polarized parallel to the transmission axis
    c. The intensity is reduced by half and light emerges polarized perpendicular to the transmission axis
    d. The intensity is increased by half and light emerges polarized perpendicular to the transmission axis

Calculation Questions

1. **All questions have equal weight.**
2. **Answers questions in the *exam booklet*. Clearly identify the questions**
3. **Show all work and calculations performed for full marks**
4. **Mark sure your work is legible**
5. **Use 3 significant figures and scientific notation when appropriate.**
6. **Be sure to include the appropriate units for all answers**

1. A 15 tall cm object is placed 20.0 cm in front of a diverging lens with a focal length of 5.0 cm. What is the height of the image?
   +3 cm

2. A 20 g mass is attached to a spring with a force constant of 99 N/m. If the mass is pulled a distance of 15 cm to the right, what is the maximum velocity achieved by the mass?
   10.6 m/s

3. An open ended pipe is played so that it produces a frequency of 300 Hz in the 3rd overtone. If being played on a day where the temperature is 21°C, what is the length of the pipe?
   2.29 m

4. A 250 kg crate is pushed across a stone floor, producing a coefficient of friction of 0.35, by a fork lift. What force does the fork lift need to produce in order to keep the crate moving with a constant velocity?
   858 N

5. A light beam with a wavelength of 550 nm enters a thin layer of a crystal with an index of refraction of 1.67. If the crystal was engineered to have a thickness the equivalent of 50 wavelengths how thick is the crystal?
   1.65×10^{4} nm = 1.65×10^{-5} m

6. A 5 kg cannonball is fired horizontally off of a cliff 75 m above the ground with a velocity of 35 m/s, how much time does it take for the cannonball to reach the ground.
   ~~**0.256 s**~~ **3.95 s**

7. A golf ball sits on a tee and is struck by a club. The 50 g ball achieves a launch speed of 28 m/s after immediately after the club hit. If the club produces an average force of 100 N, what is its contact time with the ball?
   0.0140 s

8. A 30 kg object, initially at rest, slides down a hill 25 m in height. If friction does 3855 J of non-conservative work on the object, what is its velocity at the bottom of the hill?
   27.3 m/s

9. A race car speeds toward the finish line, at 212 km/h, where a journalist hears the cars engine produce a sound of 58 Hz. What is the frequency of the engine that the driver hears? - missing information need speed of sound (assume 25°C) = 346 m/s
   49.6 m/s

10. A beam of light enters a thin plastic sheet (n=1.30) from air at an angle of 36° to the normal. If the thin plastic sheet sits on top of a glass block (n=1.40) what angle does the light travel in the glass?

    24.8°

11. Two balls of putty (10 g and 17 g respectively) are launched at each other from opposite directions. If the initial velocity of each ball is 5.7 m/s and they stick together following the collision what is the velocity of the combined putty blob?

    1.48 m/s in the direction of the 17 g speed initially

12. A mass of 13 g is attached to a spring (k=22 N/m), pulled to the right a distance of 13 cm. What mass is necessary to produce a period twice as long as this system?

    52 g

13. A mass is attached to a vertically hanging spring (k=13 N/m) and released the spring is stretched a distance of 10 cm, what is the mass of the object?

    ~~6.63 g~~ 6.63×10^{-2} kg (use conservation of energy $E_{spring}=E_{gravity}$)

14. A sled is launched from the top of a hill (18 m high elevated 12° above the horizontal) with a velocity of 8.5 m/s if at the bottom of the hill the sled comes to a stop how what force of friction did the sled experience (assume friction is constant during the decent) Hint: Use work-energy? – missing information mass of sled use 240 kg

    1360 N ($W_{NC}=E_f - E_i$ and $W_{NC}=F_f d$)

15. A 15 cm high candle appears inverted in a concave mirror with radius 30 cm. If the image is located 12 cm from the mirror and is 10 cm high, where is the object located?

    30.0 cm (using $1/f = 1/p + 1/q$)
    18.0 cm (using $h_i/h_o=-q/p$)
    Information given in the question is contradictory – either is correct in this case

16. A shot-put is launched a horizontal distance of 58 m. If its initial velocity was 13 m/s at a 40° angle above the horizontal, what is the maximum height the shot-put achieved?

    3.56 m (use $v_2^2=v_1^2-2gy$; $v_2=0$ at max height – also note 58 m horizontal distance is not correct given this initial velocity it should be 17.0 m)