

# Physics 100, midterm exam, 10/23/2001

Name \_\_\_\_\_

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INSERT YOUR CHOICE IN THE EMPTY SLOT ON THE RIGHT. YOU CAN MARK ANY OTHER PART OF THE EXAM WHILE THINKING, BUT THOSE MARKS WILL NOT BE USED TO ADD OR SUBTRACT POINTS FROM YOUR GRADE. WRITE YOUR NAME ON THE EXAM NOW.

1) Early Greeks knew (to a fair approximation)

- A) the size of the Earth.
- B) the size of the moon.
- C) the Earth-moon distance.
- D) all of the above.
- E) none of the above.

Answer: D

2) A sheet of paper can be withdrawn from under a container of milk without toppling it if the paper is jerked quickly. This best demonstrates that

- A) gravity tends to hold the milk carton secure.
- B) the milk carton has inertia.
- C) there is an action-reaction pair of forces.
- D) the milk carton has no acceleration.
- E) none of these.

Answer: B

3) Whirl a rock at the end of a string and it follows a circular path. If the string breaks, the tendency of the rock is to

- A) continue to follow a circular path.
- B) follow a straight-line path.

Answer: B

4) An airplane that flies at 100 km/h with a 10 km/h tailwind travels at 110 km/h relative to the ground. If it instead flies into a 10 km/h headwind, its groundspeed is

- A) 90 km/h.
- B) 100 km/h.
- C) 110 km/h.
- D) 120 km/h.

Answer: A

5) A hockey puck is set in motion across a frozen pond. If ice friction and air resistance are neglected, the force required to keep the puck sliding at constant velocity is

- A) equal to the weight of the puck.
- B) zero newtons.
- C) the weight of the puck divided by the mass of the puck.
- D) the mass of the puck multiplied by 9.8 meters per second per second.
- E) none of these.

Answer: B

6) A heavy object and a light object are dropped at the same time from rest in a vacuum. The heavier object reaches the ground

- A) at the same time as the lighter object.
- B) later than the lighter object.
- C) sooner than the lighter object.

Answer: A

7) Compared to the mass of a certain object on Earth, the mass of the same object on the moon is

- A) less.
- B) the same.
- C) more.

Answer: B

- 8) If an object falls with constant acceleration, the velocity of the object must
- A) continuously change by the same amount each second.
  - B) be constant also.
  - C) continuously decrease.
  - D) continuously change by varying amounts depending on its speed.
  - E) none of these.

Answer: A

- 9) When a rock thrown straight upwards gets to the exact top of its path, its
- A) velocity is about 10 m/s and its acceleration is about 10 meters per second per second.
  - B) velocity is about 10 m/s and its acceleration is zero.
  - C) velocity is zero and its acceleration is zero.
  - D) velocity is zero and its acceleration is about 10 meters per second per second.
  - E) none of these.

Answer: D

- 10) The newton is a unit of
- A) inertia.
  - B) density.
  - C) force.
  - D) mass.

Answer: C

- 11) In which case would you have the largest mass of gold? If your chunk of gold weighed 1 N on the
- A) moon.
  - B) planet Jupiter.
  - C) Earth.

Answer: A

- 12) An object is propelled along a straight-line path by a force. If the net force were doubled, the object's acceleration would
- A) quadruple.
  - B) double.
  - C) stay the same.
  - D) halve.
  - E) none of these.

Answer: B

- 13) The brakes of a speeding truck are slammed on and it skids to a stop. If the truck were heavily loaded so that it had twice the total mass, the skidding distance would be
- A) 1/2 as far.
  - B) 1 1/2 times as far.
  - C) 2 times as far.
  - D) 4 times as far.
  - E) the same.

Answer: E

- 14) When a falling object has reached its terminal velocity, its acceleration is
- A) g.
  - B) zero.
  - C) constant.

Answer: B

- 15) An elephant and a feather fall from a tree through the air to the ground below. The amount of air-resistance force is greater on the
- A) elephant.
  - B) feather.
  - C) is the same on each.

Answer: A

- 16) A 10-kilogram block is pushed across a horizontal surface with a horizontal force of 20 N against a friction force of 10 N. The acceleration of the block in meters per second per second is
- A) 1.
  - B) 2.
  - C) 5.
  - D) 10.
  - E) none of these.

Answer: A



- 26) No work is done by gravity on a bowling ball that rolls along a bowling alley because
- A) no distance is covered by the ball.
  - B) no potential energy is being converted to kinetic energy.
  - C) the force on the ball is at right angles to the ball's motion.
  - D) no force acts on the ball.
  - E) its kinetic energy remains constant.

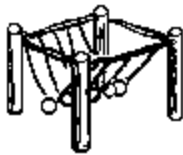
Answer: C

- 27) If the speed of a moving object doubles, then what else doubles?
- A) acceleration
  - B) kinetic energy
  - C) momentum
  - D) all of these
  - E) none of these

Answer: C

*A popular swinging-balls apparatus (shown below) consists of an aligned row of identical elastic balls suspended by strings so that the balls barely touch each other. When two balls are lifted from one end and released, they strike the row and two balls pop out from the other end.*

Figure 7-D



- 28) If instead one ball popped out with twice the velocity of the two, this would be a violation of conservation of
- A) energy.
  - B) momentum.
  - C) both of these.
  - D) none of these.

Answer: A

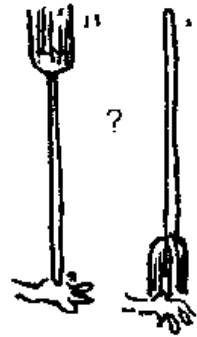
- 29) Newton discovered
- A) that gravity is universal.
  - B) gravity.
  - C) neither.

Answer: A

- 30) When a train makes a curve, the wheel on the outside part of the curve must travel (relative to the inside wheel)
- A) faster.
  - B) at the same speed.
  - C) slower.

Answer: A

Figure 8-A



- 31) An upright broom is easier to balance when the heavier end is
- A) nearest your hand.
  - B) highest, farthest from your hand.
  - C) same either way.

Answer: B

Figure 8-I



- 32) If you balance a broom horizontally on one finger, the center of gravity of the broom will be above your finger – closer to the bristles end than the handle end. If you saw the broom in two pieces at that point and weigh the two parts on a scale, you'll find that the heavier part is the
- A) handle part.
  - B) bristles part.
  - C) both the same weight.

Answer: B

- 33) According to Newton, doubling the distance between two interacting objects
- A) multiplies by 2 the gravitational force between them.
  - B) divides by 2 the gravitational force between them.
  - C) multiplies by 4 the gravitational force between them.
  - D) divides by 4 the gravitational force between them.

Answer: D

- 34) For the astronauts inside the orbiting space shuttle, there is no force of Earth gravity acting on them. This statement is
- A) sometimes true while in orbit.
  - B) always false.
  - C) always true while in orbit.

Answer: B

- 35) An Earth satellite is simply a projectile freely falling around the Earth.
- A) False.
  - B) True.

Answer: B

Figure 8-F



- 36) Suppose you are at the center of a large freely-rotating horizontal turntable in a carnival funhouse. As you crawl toward the edge, the angular momentum of you and the turntable
- A) remains the same, but the RPMs decrease.
  - B) decreases in direct proportion to your decrease in RPMs.
  - C) increases.
  - D) decreases.
  - E) none of these.

Answer: A

- 37) The reason the moon does not crash into the Earth is that the
- A) gravitational pull of other planets keeps the moon up.
  - B) moon has a sufficient tangential speed.
  - C) Earth's gravitational field is weak at the moon.
  - D) moon has less mass than the Earth.
  - E) none of these.

Answer: B

- 38) The main reason ocean tides exist is that the pull of the moon
- A) is greater on oceans closer to the moon and less on oceans farther from the moon.
  - B) and sun are in conjunction at high tides and in opposition at low tides.
  - C) and the sun on the oceans are in opposite directions.
  - D) is greater on the Earth because the moon is closer to Earth.
  - E) none of these.

Answer: A

- 39) After a rock that is thrown straight up reaches the top of its path and is starting to fall back down, its acceleration is (neglect air resistance)
- A) greater than when it was at the top of its path.
  - B) the same as it was at the top of its path.
  - C) less than when it was at the top of its path.

Answer: B

- 40) If the moon were covered with water, tidal effects by Earth would find the moon with
- A) 1 tidal bulge.
  - B) 2 tidal bulges.
  - C) 3 tidal bulges.
  - D) 4 tidal bulges.
  - E) no tidal bulges.

Answer: B

- 41) Angular momentum is conserved for a satellite in  
 A) circular orbit.                      B) elliptical orbit.  
 C) both of these.                      D) neither of these.

Answer: C

- 42) What prevents satellites such as the space shuttle from falling?  
 A) Nothing; they're falling continuously all around the Earth.  
 B) gravity  
 C) the absence of air drag

Answer: A

- 43) Brownian motion has to do with the  
 A) size of atoms.  
 B) atomic vibrations.  
 C) first direct measurement of atomic motion.  
 D) rhythmic movements of Brownians.  
 E) random motions of atoms and molecules.

Answer: E

- 44) In an electrically neutral atom, the number of protons in the nucleus is balanced by an equal number of  
 A) orbital electrons.  
 B) neutrons.  
 C) quarks.  
 D) all of these.  
 E) none of these.

Answer: A

- 46) When a chocolate bar is cut in half, its density is  
 A) doubled.  
 B) unchanged.  
 C) halved.

Answer: B

- 47) The factor that determines whether a substance is in the solid, liquid, gaseous, or plasma state is its  
 A) temperature.  
 B) atomic shell configuration.  
 C) composition.  
 D) atomic number.  
 E) none of these.

Answer: A

- 48) Airplane flight best illustrates  
 A) Pascal's principle.  
 B) Archimedes' principle.  
 C) Boyle's law.  
 D) Bernoulli's principle.

Answer: D

Figure 12-B



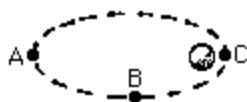
- 49) When weight is applied to the top of a stone arch, the stone blocks in the arch undergo  
 A) compression.                      B) tension.

Answer: A

- 50) If an elephant grows to twice its normal height, its weight will be multiplied by about  
 A) 2.  
 B) 4.  
 C) 6.  
 D) 8.  
 E) none of these.

Answer: D

Figure 10-D



- 45) A satellite describes an elliptical orbit about a planet, as shown. At which position is the satellite traveling the fastest?  
 A) A                      B) B                      C) C

Answer: C

- 51) What is the weight of water displaced by a 100-ton floating ship?
- A) depends on the ship's shape
  - B) less than 100 tons
  - C) 100 cubic meters
  - D) 100 tons
  - E) more than 100 tons

Answer: D

- 52) When a gamma ray is emitted by a nucleus, the nucleus then has appreciably less
- A) mass.
  - B) charge.
  - C) both of these.
  - D) neither of these.

Answer: D

- 53) A nucleon has more mass when it is
- A) inside the nucleus.
  - B) outside the nucleus.
  - C) both the same.

Answer: B

- 54) When a nucleus emits a beta particle, its atomic number
- A) remains constant, but its mass number changes.
  - B) changes, and so does its mass number.
  - C) remains constant, and so does its mass number.
  - D) changes, but its mass number remains constant.
  - E) none of these.

Answer: D

- 55) The half-life on an isotope is one day. At the end of three days, how much of the isotope remains?
- A) none
  - B) one half
  - C) one quarter
  - D) one eighth
  - E) none of these

Answer: D

- 56) When radium ( $A = 88$ ) emits an alpha particle, the resulting nucleus has atomic number
- A) 86.
  - B) 88.
  - C) 90.
  - D) 92.
  - E) none of these.

Answer: A

- 57) The half life of carbon 14 is 5730 years. If a 1-gram sample of old carbon is  $1/8$  as radioactive as 1-gram of a current sample, then the age of the old sample is about
- A) 716 years.
  - B) 11,500 years.
  - C) 17,200 years.
  - D) 22,900 years.
  - E) 46,000 years.

Answer: C

- 58) In the fissioning of uranium, a chain reaction is caused by
- A) the enormous energy release.
  - B) the conversion of mass to energy.
  - C) ejected neutrons.
  - D) the kinetic energy of the decay products.
  - E) none of these.

Answer: C

- 59) In both fission and fusion, mass
- A) is changed to the form of kinetic energy.
  - B) is created from energy of other forms.
  - C) remains the same.

Answer: A

- 60) Fusing two helium nuclei yields a net
- A) release of energy.
  - B) absorption of energy.
  - C) neither absorption nor release of energy.

Answer: A