

Physics Diagnostic Assessment

This diagnostic assessment is solely to help guide your decisions about which courses you should study to increase the likelihood of a successful outcome on the Praxis. The results on this assessment will not be used for any other purpose.

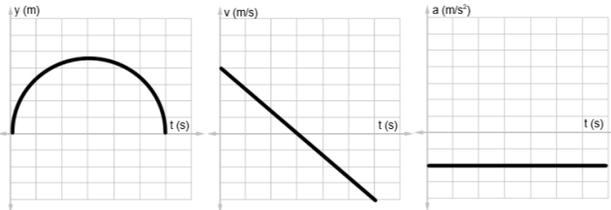
These questions represent our best judgement as to what is assessed on the Praxis exam and the last course in the sequence of NJCTL courses in which that topic is taught. Hence, if you do well on the questions from an early course, you can better focus your efforts on later courses.

To make this effective it is important that you **do not guess** on questions since if you get them correct by chance you may mislead yourself. Similarly, if you find you struggle or take an excessive amount of time to do a problem, you may be better served by leaving it blank since it would probably be worth learning that topic more thoroughly.

Since this assessment cannot thoroughly probe each aspect of a topic given its limited length, taking the above instructions to heart would give you a more informative result than by trying your best to maximize your score.

The questions are grouped such that the questions from the last course in the physics sequence are at the beginning and the questions from PRAXIS II are at the end. That is simply providing you the information you need as to where you should begin the sequence of courses leading to taking the Praxis Exam.

1. A rock is thrown straight up from the edge of a cliff. The rock reaches the maximum height of 15 m above the edge and then falls down to the bottom of the cliff 35 m below the cliff. What is the magnitude of the displacement of the rock?
 A. 15 m B. 35 m C. 50 m D. 65 m
2. A student drops a pebble from the edge of a vertical cliff. The pebble hits the ground 4 s after it was dropped. What is the height of the cliff?
 A. 20 m B. 40 m C. 60 m D. 80 m
3. An object is thrown in horizontal with an initial velocity $v_0 = 5 \text{ m/s}$ from the roof of a building 40 m tall. How much later does it hit the ground?
 A. 4 s B. $\sqrt{5} \text{ s}$ C. $\sqrt{8} \text{ s}$ D. 10 s

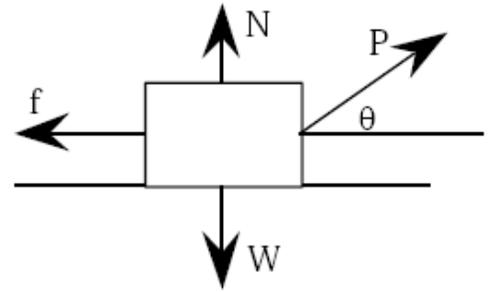


4. The graphs above represent the position, velocity, and acceleration as a function of time for a marble moving in one dimension. Which of the following could describe the motion of the marble?
 A. Rolling along the floor and then bouncing off a wall.
 B. Rolling down one side of a bowl and then rolling up the other side.
 C. Rolling up a ramp and then rolling back down.
 D. Falling and then bouncing elastically off a hard floor.



5. A system of two blocks is accelerated by an applied force of magnitude F on the frictionless horizontal surface. The tension in the string between the blocks is:
 A. $3F$
 B. $5F$
 C. $3/8 F$
 D. $1/3 F$

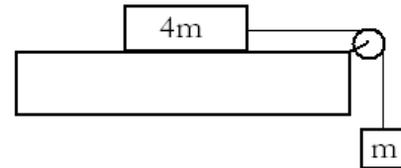
6. A student pulls a wooden box along a rough horizontal floor at constant speed by means of a force P as shown to the right. Which of the following must be true?
- $P > f$ and $N < W$.
 - $P > f$ and $N = W$.
 - $P = f$ and $N > W$.
 - $P = f$ and $N = W$.



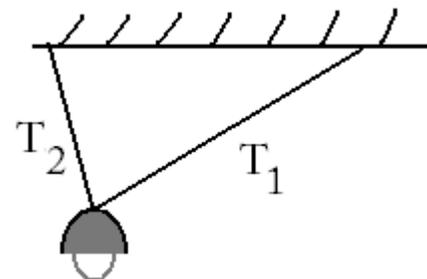
7. Two blocks are attached by a compressed spring and are initially held at rest on a frictionless surface. The blocks are then released simultaneously. If block I has four times the mass of block II, which of the following quantities is the same for both blocks as the spring pushes the two blocks away from each other?
- Speed
 - Velocity
 - Acceleration
 - Force on each block



8. A block of mass $4m$ can move without friction on a horizontal table. This block is attached to another block of mass m by a string that passes over a frictionless pulley. If the masses of the string and the pulley are negligible, what is the magnitude of the acceleration of the descending block?
- g
 - $g/5$
 - $g/4$
 - $2g/3$

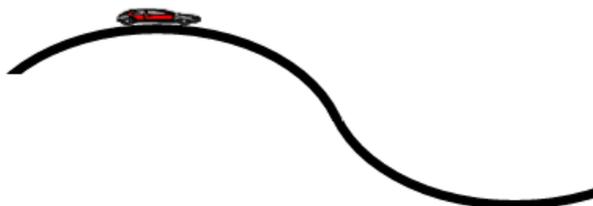
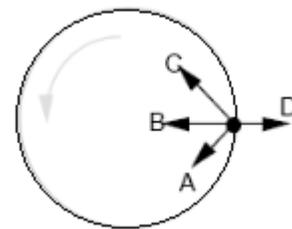


9. A lamp of mass m is suspended from two cables of **unequal length** as shown to the right. Which of the following is true about the tensions T_1 and T_2 in the cables?
- $T_1 > T_2$
 - $T_1 = T_2$
 - $T_2 > T_1$
 - $T_1 + T_2 = mg$



10. An object, shown in the accompanying figure, moves in uniform circular motion. Which arrow best depicts the net force acting on the object at the instant shown?

A. A B. B C. C D. D



11. A car is traveling on a road in hilly terrain, see figure above. Assume the car has speed v and the tops and bottoms of the hills have radius of curvature R . The driver of the car is most likely to feel weightless:

A. at the top of a hill when $v = \sqrt{gR}$
B. at the bottom of a hill when $v > \sqrt{gR}$
C. going down a hill when $v < \sqrt{gR}$
D. at the top of a hill when $v < \sqrt{gR}$

12. A hypothetical planet has a mass of half that of the Earth and a radius of twice that of the Earth. What is the acceleration due to gravity on the planet in terms of g , the acceleration due to gravity at the Earth?

A. g
B. $g/2$
C. $g/4$
D. $g/8$

13. Two moons orbit a planet in nearly circular orbits. Moon A has orbital radius r , and moon B has orbital radius $4r$. Moon A takes 20 days to complete one orbit. How long does it take moon B to complete an orbit?

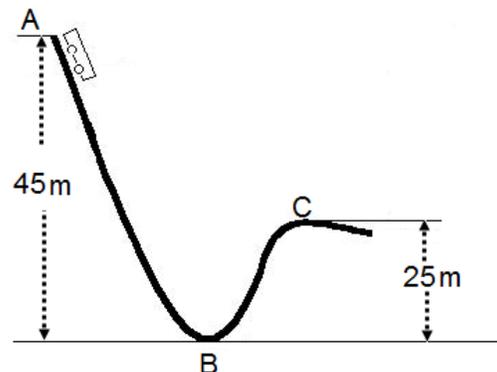
A. 20 days
B. 80 days
C. 160 days
D. 320 days

14. A student pushes a box across a horizontal surface at a constant speed of 0.6 m/s. The box has a mass of 40 kg, and the coefficient of kinetic friction is 0.5. The power supplied to the box by the person is:

A. 40 W
B. 60 W
C. 120 W
D. 150 W

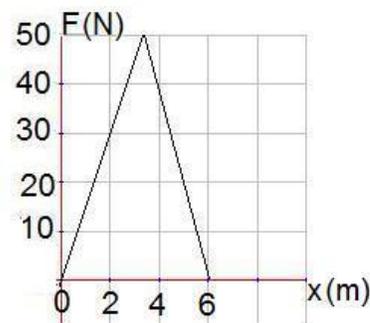
15. A 500 kg roller coaster car starts from rest at point A and moves down the curved track, as shown to the right. Assume the track is frictionless. Find the speed of the car at the lowest point B.

A. 10 m/s
B. 20 m/s
C. 30 m/s
D. 40 m/s



16. An object with a mass of 2.0 kg is initially at rest at a position $x = 0$. A non-constant force F is applied to the object over a displacement of 6.0 m, as shown in the graph to the right. What is the total work done on the object at the end of 6.0 m?

A. 200 J
B. 190 J
C. 170 J
D. 150 J

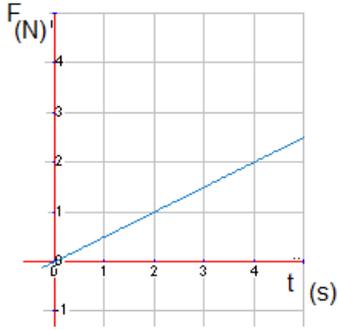


17. Two projectiles A and B are launched from the ground with velocities of 50 m/s at 60° (projectile A) and 50 m/s at 30° (projectile B) with respect to the horizontal. Assuming there is no air resistance involved, which projectile has greater kinetic energy when it reaches the highest point?

A. projectile A
B. projectile B
C. they both have the same non-zero kinetic energy
D. they both have zero kinetic energy

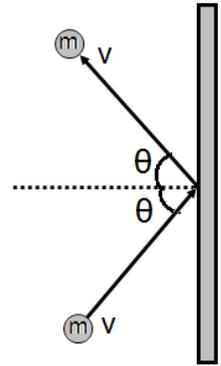
18. A 3 kg ball is dropped onto a concrete floor. What is the magnitude of the ball's change in momentum if its speed just before striking the floor is 7 m/s and its rebound speed is 3 m/s?

A. 10 kg-m/s
B. 15 kg-m/s
C. 30 kg-m/s
D. 60 kg-m/s

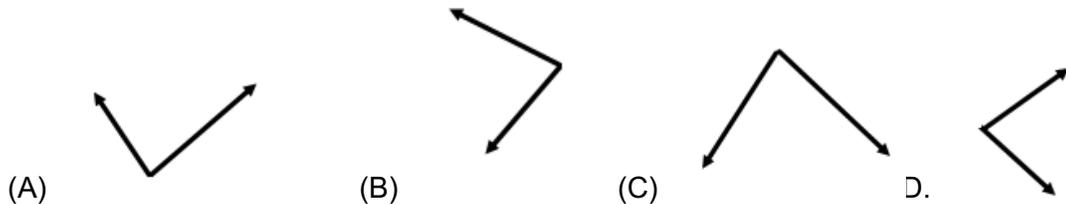


19. An object with a mass of 2.0 kg is accelerated from rest. The above graph shows the magnitude of the net force as a function of time. At $t = 4.0$ s the object's velocity is closest to which of the following?
- A. 2.0 m/s
 - B. 4.0 m/s
 - C. 10 m/s
 - D. 13 m/s

20. As shown above, a tennis ball of mass, m rebounds from a vertical wall with the same speed v as it had initially. What is the change in momentum of the ball?
- A. $2mv\sin\theta$
 - B. $2mv\cos\theta$
 - C. $2mv$
 - D. zero

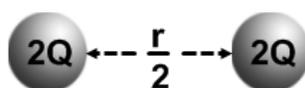
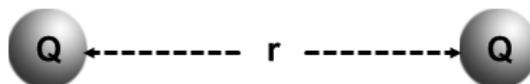
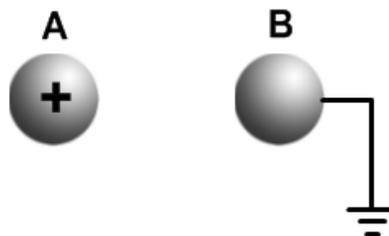


21. An object with an initial momentum shown above collides with another object at rest. Which of the following combinations of two vectors may represent the momentum of the two objects after the collision?



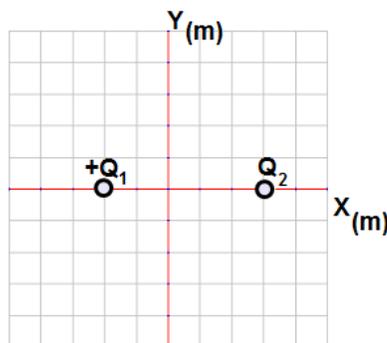
22. Sphere A carries a net positive charge, and sphere B is neutral. They are placed near each other on an insulated table. Sphere B is briefly touched with a wire that is grounded. Which statement is correct?

- A. sphere B remains neutral
- B. sphere B is now positively charged
- C. sphere B is now negatively charged
- D. sphere B is now positive and sphere A is negative



23. Two charged objects with an equal charge of Q , separated by a distance r attract each other with a certain force. If the charges on both objects are doubled and the separation is halved, the force between them is:

- A. 4 times greater
- B. 2 times greater
- C. 4 times less
- D. 16 times greater



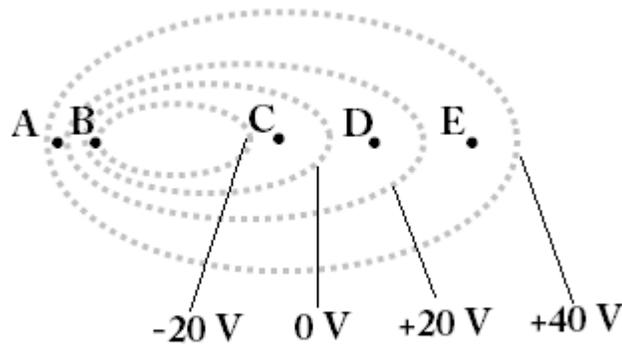
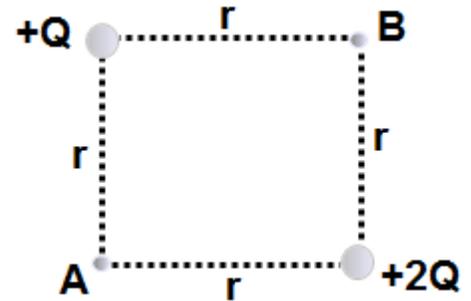
24. A point charge $Q_1 = +4.0 \mu\text{C}$ is placed at point $x = -2 \text{ m}$. A second charge Q_2 is placed at point $x = +3 \text{ m}$. The net electric field at the origin is zero. What is the magnitude and sign of charge Q_2 ?

- | Magnitude | Sign |
|-----------------------|--------------|
| (A) $9.0 \mu\text{C}$ | (A) Positive |
| (B) $6.0 \mu\text{C}$ | (B) Positive |
| (C) $3.0 \mu\text{C}$ | (C) Positive |
| (D) $9.0 \mu\text{C}$ | (D) Negative |

25. Which of the following statements about conductors under electrostatic conditions is true?
- A. Charge that is placed on the surface of a conductor always spreads evenly over the surface.
 - B. The electric potential inside a conductor is always zero.
 - C. The electric field at the surface of a conductor is tangent to the surface.
 - D. The surface of a conductor is always an equipotential surface.

26. Points A and B are each the same distance r from two unequal charges, $+Q$ and $+2Q$. The work required to move a charge q from point A to point B is:

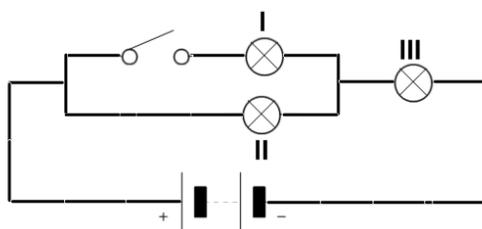
- A. dependent on the path taken from A to B
- B. directly proportional to the distance between A and B
- C. positive
- D. zero



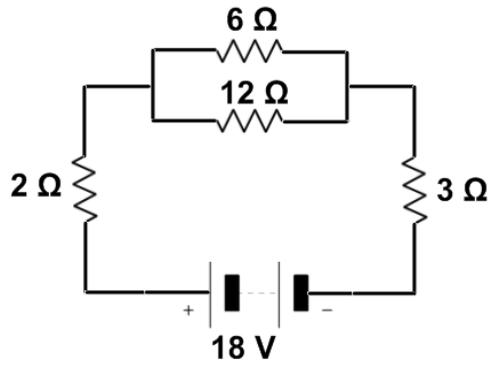
27. An electric field is presented by a series of equipotential lines. At which location is the electric field strength the greatest?
- A. E
 - B. B
 - C. C
 - D. D



28. Two conducting spheres of different radii are charged with the same charge $-Q$. What will happen to the charge if the spheres are connected with a conducting wire?
- A. Negative charge flows from the large sphere to the smaller sphere until the electric field at the surface of each sphere is the same
 - B. Negative charge flows from the smaller sphere to the larger sphere until the electric field at the surface of each sphere is the same
 - C. Negative charge flows from the large sphere to the smaller sphere until the electric potential at the surface of each sphere is the same
 - D. Negative charge flows from the smaller sphere to the larger sphere the electric potential at the surface of each sphere is the same
29. A parallel-plate capacitor is connected to a battery. The capacitor is fully charged before the battery is disconnected. A uniform dielectric with a constant K is inserted between the plates. What is the ratio between the energy stored in the capacitor with the inserted dielectric U_k to the energy without dielectric U_0 ?
- A. $1/K$ B. $1/K^2$ C. $K/1$ D. $K^2/1$



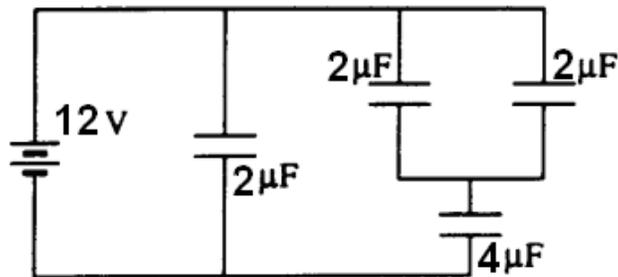
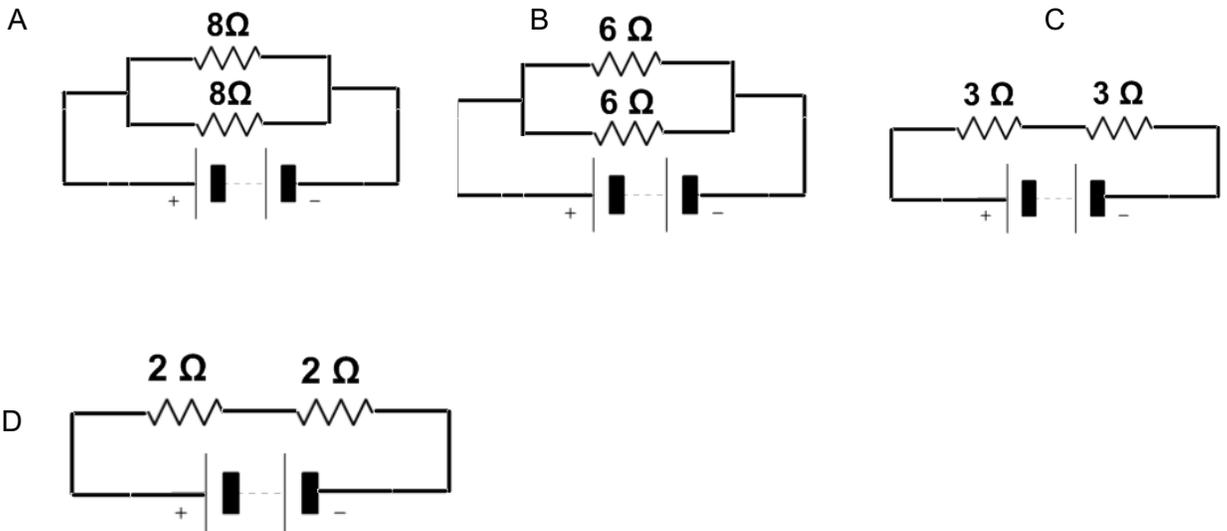
30. The circuit in the diagram above contains three identical light bulbs connected as shown. Initially, a switch connected to light bulb I is closed. Which of the following is correct about brightness of light bulb II and III is correct when the switch is open?
- | <u>Bulb II</u> | <u>Bulb III</u> |
|------------------|-----------------|
| A. Gets brighter | Gets dimmer |
| B. Gets dimmer | Gets brighter |
| C. Gets brighter | Gets brighter |
| D. Gets dimmer | Gets dimmer |



31. What the potential difference across the $2\ \Omega$ resistor in the circuit above?

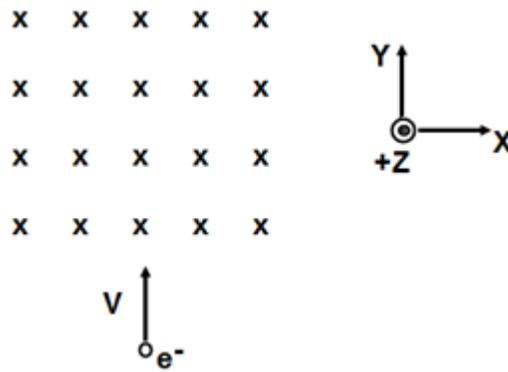
- A. 1 V B. 2 V C. 4 V D. 6 V

32. Five different electric circuits are connected to the same battery with negligible resistance. Which circuit produces the greatest power dissipation?

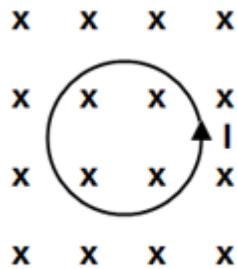


33. The equivalent capacitance for this network is:

- A $1\ \mu\text{F}$ B $2\ \mu\text{F}$ C $3\ \mu\text{F}$ D $4\ \mu\text{F}$



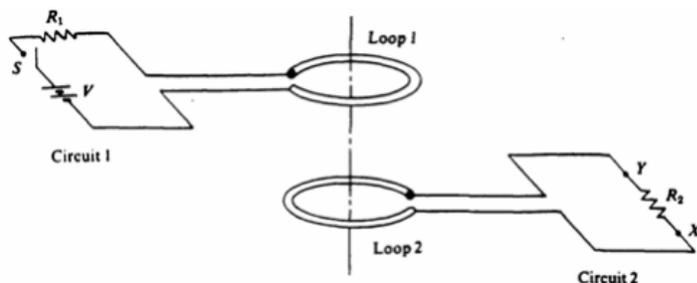
34. An electron enters a region of uniform magnetic field in the -Z direction. What is the direction of the magnetic force on the electron due to the magnetic field?
- +X direction
 - +Y direction
 - X direction
 - Y direction



35. A circular loop of wire carries current in a counterclockwise direction. The loop is placed in a uniform magnetic field directed into the page. What is the effect of the magnetic force on the loop due to the field?
- Rotates with respect to its axis
 - Rotates with respect to its diameter
 - Contracts in size
 - Expands in size
36. Parallel wires carry currents I_1 and I_2 in the same direction and separated by a distance d . The magnitude of the magnetic force between the wires is F_0 . What is the force between the wires if each current is doubled and the separation is quadrupled?
- $2F_0$
 - $4F_0$
 - F_0
 - $F_0/2$

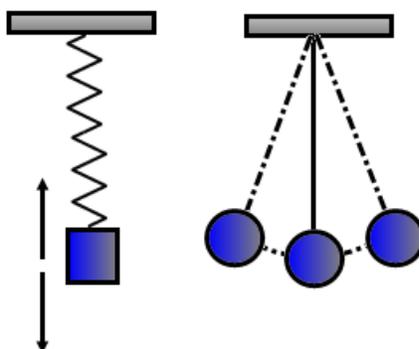
37. Which of the following laws is used to find the direction of the induced current in a loop of wire placed in a changing magnetic field?

- A. Lenz's Law
- B. Faraday's Law
- C. Ampere's Law
- D. Gauss's Law



38. How does the current flow through resistor R_2 behave once switch S is closed?

- A. From point Y to X
- B. From point X to Y
- C. The current oscillates between X and Y
- D. There is no current through the resistor



39. Two oscillating systems: spring-mass and simple pendulum undergo SHM with an identical period T . If the mass in each system is doubled which of the following is true about the new period?

Mass-spring

Simple pendulum

A. T

$\frac{T}{\sqrt{2}}$

B. $\frac{T}{\sqrt{2}}$

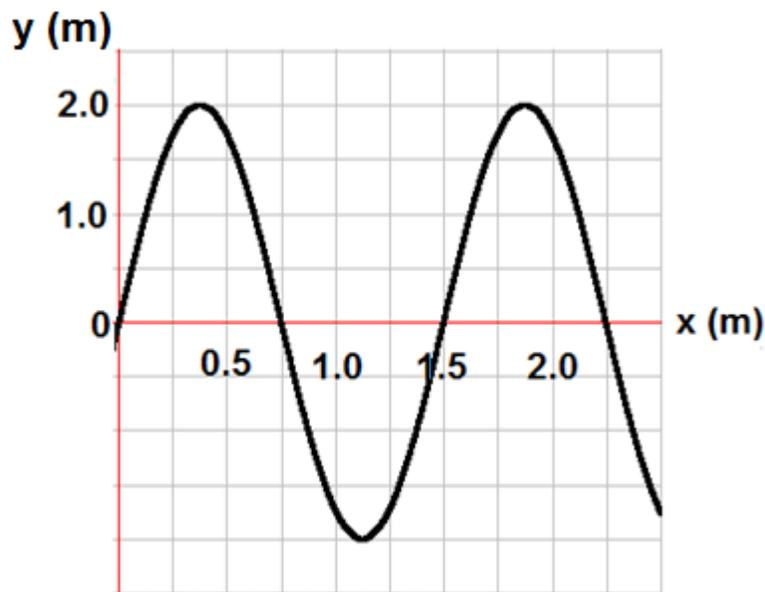
T

C. $\sqrt{2} T$

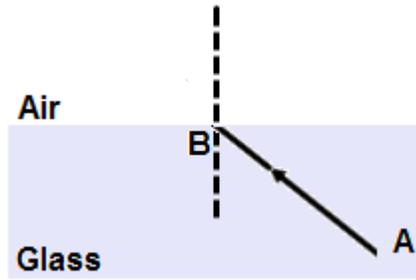
T

D. T

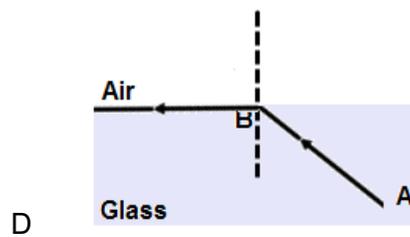
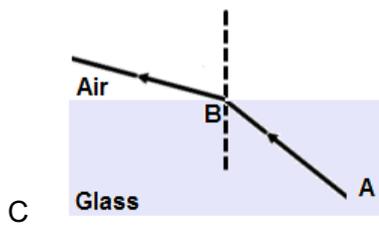
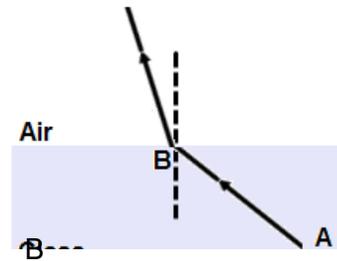
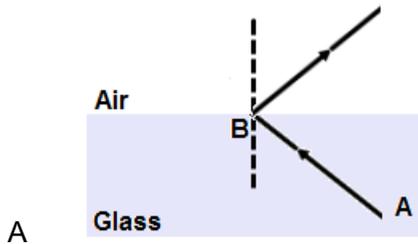
$\sqrt{2} T$



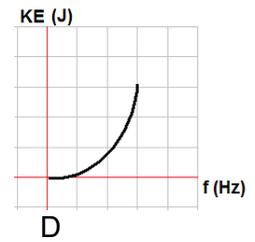
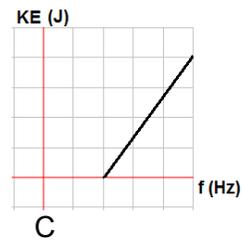
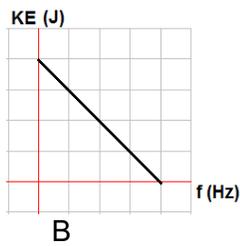
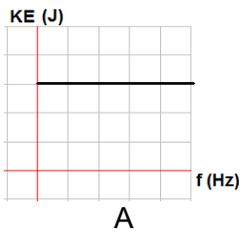
40. A “snapshot” of a wave is given on the graph. What is the speed of the wave if the frequency of oscillation is 16 Hz?
- A. 8 m/s B. 16 m/s C. 24 m/s D. 36 m/s
41. A sound wave travels from air into water. Which of the following doesn’t change?
- A. Frequency B. Amplitude C. Wavelength D. Speed of sound
42. A light beam spreads when it travels through a narrow slit. Which of the following can explain this phenomenon?
- A. Polarization
B. Dispersion
C. Diffraction
D. Refraction
43. A beam of coherent light with a wavelength of 600 nm is incident on a diffraction grating with a slit separation of $1.8 \mu\text{m}$. What is the maximum number of spectral orders can be observed on a screen?
- A. 1
B. 2
C. 3
D. 11
44. An object is placed at the focal point in front of a concave mirror. The image is located:
- A. The distance $d > R$
B. The distance $d < F$
C. The focal point
D. No image is formed



45. A light ray AB passes from glass into air at an angle less than the critical angle. Which of the following diagrams represents the refracted ray?



46. Which of the following graphs correctly relates the maximum kinetic energy of photoelectrons and the frequency of the incident light?



47. Which of the following formulas can be used to determine the de Broglie wavelength?
- A. $\lambda = h \cdot p$
 - B. $\lambda = h/p$
 - C. $\lambda = p/h$
 - D. $\lambda = mc/h$
48. According to the Bohr's theory of the hydrogen atom, electrons starting in the 4th energy level and eventually ending in the ground state could produce a total of how many different spectral lines?
- A. 3
 - B. 4
 - C. 6
 - D. 9
49. What is the missing element from the following equation ${}^{14}_6\text{C} \rightarrow ? + {}^0_{-1}e$?
- A. ${}^{13}_7\text{N}$
 - B. ${}^{12}_6\text{C}$
 - C. ${}^{16}_8\text{O}$
 - D. ${}^{14}_7\text{N}$
50. A 100 g sample of a radioactive element has a half-life of 5 days. How many grams of radioactive material will remain after 15 days?
- A. 50 g
 - B. 25 g
 - C. 16.7g
 - D. 12.5 g
51. What was a result of the Michelson-Morley experiment?
- A. The ether was established as the medium through which electromagnetic waves moved.
 - B. The ether does not exist and electromagnetic waves do not require a medium.
 - C. Newton's Laws are only valid in inertial reference systems.
 - D. The speed of light is not a constant in a vacuum.
52. Which of the following statements are true concerning Einstein's Theory of Special Relativity?
- A. The speed of light in a vacuum is constant as measured by any observer in an inertial reference frame.
 - B. The theory does not apply to matter moving near the speed of light.
 - C. It disproved Galilean-Newtonian Relativity's statement that mechanical physics laws are valid in inertial reference systems for matter moving at a small fraction of the speed of light.
 - D. All of the above.

53. Spaceship A is travelling at a velocity of $0.75c$. The pilot sets a microwave timer for 30 s and removes her food after that time interval. A clock on Spaceship B, traveling at $0.5c$ parallel to ship A, measures the food cooking for a different time. A ground observer on the planet Earth observes a different cooking time using his clock. According to Special Relativity, which person is measuring the proper time?
- A. The pilot on Spaceship A.
 - B. The pilot on Spaceship B.
 - C. The Earth observer.
 - D. All there are; there is no preferred proper time.
54. A cubical space station is moving at a relativistic speed along an arbitrary x axis. What happens to the x, y and z dimensions of the space station as measured by a stationary observer relative to the space station?
- A. X dimension remains constant, Y and Z dimensions decreases.
 - B. X dimension increases, Y and Z dimensions remain the same
 - C. X dimension decreases, Y and Z dimensions remain the same.
 - D. All three dimensions decrease.
55. A step-down transformer converts 12,000 V to a household voltage of 120 V. There are 25,000 turns in the primary coil. How many turns are in the secondary coil?
- A. 62 turns
 - B. 108 turns
 - C. 208 turns
 - D. 250 turns
56. A step-up transformer converts 6 V to 1200 volts. There are 100 turns in the primary coil. How many turns are in the secondary coil?
- A. 200
 - B. 2,000
 - C. 20,000
 - D. 200,000
57. What is the resonance frequency, ω_0 , of an RLC circuit containing a capacitor, $C = 8\mu\text{F}$, and an inductor, $L = 0.5\text{ H}$, in series?
- A. 200 rad/s
 - B. 400 rad/s
 - C. 500 rad/s
 - D. 600 rad/s

58. What is the resonance frequency, ω_0 , of an RLC circuit containing a capacitor, $C = 64 \mu\text{F}$, and an inductor, $L = 0.25 \text{ H}$, in series?

- A. 250 rad/s
- B. 400 rad/s
- C. 500 rad/s
- D. 600 rad/s

59. The average molecular kinetic energy of a gas depends on:

- A. Pressure
- B. Volume
- C. Temperature
- D. Number of moles

60. A sealed container of air is kept at a constant temperature. What will happen to the speed/average kinetic energy of the molecules of air in the container as time passes?

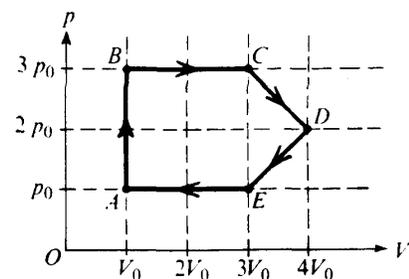
- A. The molecules will obey the second law of thermodynamics. Eventually, there will be no deviations in the speed of kinetic energy of the air molecules whatsoever.
- B. Some molecules will speed up and others will slow down, but the average speed and kinetic energy will be constant.
- C. The molecules will slow down, decreasing their average kinetic energy.
- D. There will be no change

61. An ideal gas is made up of monatomic molecules, each of the same mass. All of the following statements about this gas are true EXCEPT:

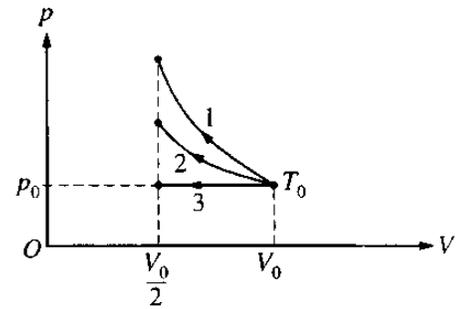
- A. The temperature of the gas is proportional to the average kinetic energy of the molecules.
- B. All of the molecules have the same speed.
- C. The molecules make elastic collisions with the walls of the container.
- D. The molecules make elastic collisions with each other.

62. An ideal gas undergoes a cyclic process as shown on the graph (right) of pressure p versus volume V . At which point is the gas at its highest temperature?

- A. A
- B. B
- C. C
- D. D



63. A certain quantity of an ideal gas initially at temperature T_0 , pressure p_0 , and volume V_0 is compressed to one-half its initial volume. As shown above, the process may be adiabatic (process 1), isothermal (process 2), or isobaric (process 3). Which of the following is true of the mechanical work done on the gas?



- A. It is greatest for process 1.
- B. It is greatest for process 3.
- C. It is the same for processes 1 and 2 and less for process 3.
- D. It is the same for processes 2 and 3 and less for process 1.

64. A boy swims a lake and initially dives 0.5 m beneath the surface. When he dives 1 m beneath the surface, how does the absolute pressure change?

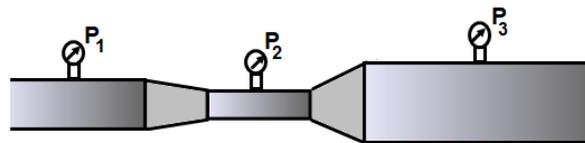
- A. It doubles
- B. It quadruples
- C. It cut to a half
- D. It slightly increases

65. A hydraulic lift has a small piston with an area of 2 cm^2 , and a large piston with an area of 80 cm^2 . What is the mechanical advantage of the hydraulic lift?

- A. 40
- B. 4
- C. 2
- D. 1

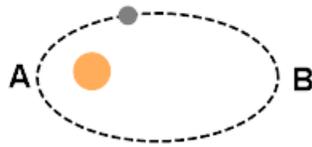
66. Water flows at a constant speed of 8 m/s through narrow section of the pipe. What is the speed of water in the section of the pipe where its radius is one-half of the initial radius?

- A. 64 m/s
- B. 32 m/s
- C. 8 m/s
- D. 2 m/s



67. Venturi tubes have three sections with different radii. Which of the following is true about manometer readings?

- A. $P_1 > P_2 > P_3$
- B. $P_1 < P_2 < P_3$
- C. $P_2 < P_1 < P_3$
- D. $P_3 = P_2 = P_1$



68. A planet moves in an elliptical orbit around the Sun. As it moves from point A to point B, which of the following is true about its speed and angular momentum?

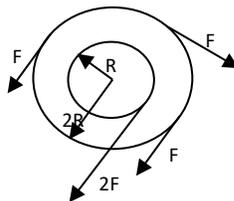
- | <u>Speed</u> | <u>Angular Momentum</u> |
|---------------------|-------------------------|
| A. Remains constant | Remains constant |
| B. Increases | Increases |
| C. Increases | Remains constant |
| D. Decreases | Remains constant |

69. A solid disk with a radius R rotates at a constant rate ω . Which of the following represents the period of rotations?

- A. $2\pi\omega$
- B. $\pi/2\omega$
- C. $2\pi/\omega$
- D. 2ω

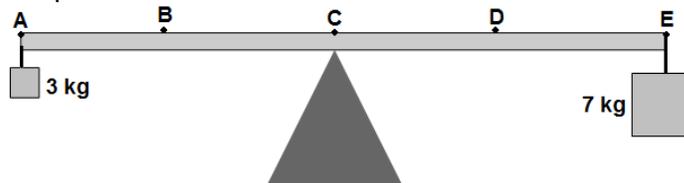
70. Two wheels are fixed to each other and are free to rotate about a frictionless axis through their concentric centers. Four forces are exerted tangentially to the wheels. The magnitude of the net torque is:

- A. zero
- B. FR
- C. $2FR$
- D. $4FR$



71. In the diagram below, two boxes with masses, 3 kg and 7 kg are attached to the ends of a 1 m long lever. At which of the following points should the lever be placed on a fulcrum in order to keep the lever at equilibrium?

- A. A or E
- B. B
- C. C
- D. D



72. An ice skater performs a fast spin by pulling her outstretched arms down and close to her body. What happens to her angular momentum with respect to the axis of rotation?
- A. increases
 - B. decreases
 - C. stays the same
 - D. depends on her initial rotational velocity
73. Which of the following are true for a scientific law?
- A. It needs to explain why the physical phenomena works as it does.
 - B. It needs to be true for all circumstances in nature.
 - C. The law can have restrictions on its applicability.
 - D. All of the above.
74. Proper preparation for an experiment should include:
- A. Becoming familiar with the operation of all the lab equipment that will be used.
 - B. Focusing mainly on the hypothesis and working on a “good enough” lab procedure.
 - C. A cursory review of general lab safety precautions.
 - D. All of the above.
75. A rectangular backyard is measured to have dimensions of 37 m and 17.25 m. What is the area of the backyard with the correct significant figures?
- A. 54 m
 - B. 54.2 m
 - C. 54.25 m
 - D. 54.3 m
76. A safety brief is required in which of the following situations?
- A. Only for experiments that require high voltage equipment.
 - B. Only for experiments that use high temperature objects.
 - C. Only for experiments that use corrosive chemicals.
 - D. A safety brief is required for all experiments.

77. Which of the following are/is renewable energy resources?

- A. Oil
- B. Natural gas
- C. Wind
- D. All of the above.

78. Which scientist was credited with the discovery of the neutron?

- A. Ernest Rutherford.
- B. J.J. Thomson.
- C. Robert Millikan and Harvey Fletcher.
- D. James Chadwick.

79. Which of the following numbers have 5 significant figures?

- A. 31,410
- B. 31,410.2
- C. 0.03141
- D. 0.31410

80. Thomas Young performed experiments that showed:

- A. the wave properties of light.
- B. the particle properties of light.
- C. the Earth moves in an elliptical orbit about the Sun.
- D. the wave properties of electrons.

Answer Key - Questions 1-50 Correspond to PHYS 6611: Trig Based Physics

1	B	26	D
2	D	27	B
3	C	28	D
4	C	29	A
5	C	30	A
6	A	31	C
7	D	32	B
8	B	33	D
9	C	34	A
10	B	35	C
11	A	36	C
12	D	37	A
13	C	38	B
14	C	39	C
15	C	40	C
16	D	41	A
17	B	42	C
18	C	43	C
19	A	44	D
20	B	45	C
21	D	46	C
22	C	47	B
23	D	48	C
24	A	49	D
25	D	50	D

Questions 51-80 Correspond to PHYS6607: Physics Praxis Review

51	B	66	B
52	A	67	C
53	A	68	D
54	C	69	C
55	D	70	D
56	C	71	D
57	C	72	C
58	A	73	C
59	C	74	A
60	B	75	A
61	B	76	D
62	C	77	C
63	A	78	D
64	D	79	D
65	A	80	A