UPCAT Review: Physics (Day 2)

July 3, 2010

Adrian George Lim

Some common mistakes people make when solving problems:

- Mixing Units
- Expressing the Answer in the Wrong Units
- Swapping Radians and Degrees
- Getting Sines and Cosines Mixed Up
- Not Treating Vectors as Vectors
- Neglecting Latent Heat
- Getting Refraction Angles Wrong
- Using the Wrong Rays in Ray Diagrams
- Getting the Signs Wrong in Kirchhoff Loops
- Adding Resistors Incorrectly

Some online Physics tutorials and resources:

The Physics Classroom: www.physicsclassroom.com/
ThinkQuest: library.thinkquest.org/10796
HyperPhysics: hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
Roman Goc's Physics Tutorial: www.staff.amu.edu.pl/~romangoc
Physics 24/7 Tutorial: www.physics247.com/physics-homework-help/index.shtml
University of Guelph's Tutorial: www.physics.uoguelph.ca/tutorials/tutorials.html
Tutor4Physics: www.tutor4physics.com
Kenneth R. Koehler's Tutorial Page: www.rwc.uc.edu/koehler/biophys/text.html
Fear of Physics's Problem Solver: www.fearofphysics.com/index2.html
Vector Resolver: www.walter-fendt.de/ph14e/forceresol.htm

Coverage

Kinematics

Newton’s Laws

Work, Energy, and Power

Linear Momentum

Rotational Motion

Newton’s Law of Gravitation

Oscillations

Thermodynamics

Electric Forces and Fields

Electric Potential and Capacitance

Direct Current Circuits

Magnetic Forces and Fields

Electromagnetic Induction

Waves

Optics

Kinematics

$$v = v_0 + at$$
$$v_{ave} = (v_0 + v)/2$$
$$\Delta x = v_0 t + \tfrac{1}{2}at^2$$
$$v^2 = v_0^2 + 2a\,\Delta x$$

Newton's Laws

$$F_{net} = ma$$

$$F_G = mg$$

$$g = 9.8\ m/s^2 = 9.8\ N/kg$$

$$F_s = \mu_s F_N$$

$$F_k = \mu_k F_N$$

$$F_{action} = -F_{reaction}$$

$$a = v^2/r;\ F_c = mv^2/r$$

Work, Energy, and Power

$$W = F \Delta x$$

$$U = mgh$$

$$K = \tfrac{1}{2}mv^2$$

$$W_{total} = \Delta K$$

$$K_i + U_i = K_f + U_f$$

$$P = W / t$$

Linear Momentum

$$p = mv$$

$$F = \Delta p / \Delta t$$

$$J = F \Delta t$$

$$J = \Delta p$$

$$\text{total } p_{before} = \text{total } p_{after}$$

Rotational Motion

$$\tau = rF_{\perp}$$

$$L = rF_{\perp} = rmv_{\perp}$$

$$\tau_{net} = \Delta L / \Delta t$$

$$L = I\omega$$

$$\omega = \Delta\theta / \Delta t$$

$$\alpha = \Delta\omega / \Delta t$$

$$\Delta\theta = \Delta s / r$$

$$v = r\omega$$

$$a = r\alpha$$

$$\Delta\theta = \omega\Delta t$$

$$\omega = \omega_0 + \alpha t$$

$$\Delta\theta = \omega_0 t + \tfrac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\Delta\theta$$

Newton's Law of Gravitation

$$F = Gm_1m_2 / r^2$$

$G = 6.67 \times 10^{-11}$ N·m/kg^2

$T^2 / a^3 \rightarrow$ constant for all planets

(a = length of semi-major axis)

Oscillations

$$F_s = -kx$$
$$U_s = \tfrac{1}{2}kx^2$$
$$U_{s\text{-}max} = \tfrac{1}{2}kA^2$$
$$T = 1 / f,\ f = 1 / T$$
$$f = (1/2\pi)\sqrt{(k/m)}$$
$$T = 2\pi\sqrt{(m/k)}$$
$$v_{max} = A\sqrt{(k/m)}$$

Thermodynamics

$T(°F) = (9/5)\ T(°C) + 32$

$T(K) = T(°C) + 273.15$

$Q = mc\Delta T$

$Q = mL$

$\Delta L = \alpha L_i \Delta T$

$\Delta V = \beta V_i \Delta T$

$P = F\ /\ A$

$PV = nRT$

$(R = 8.31\ J/mol \cdot K;$

$N_A = 6.022\times10^{23})$

$K_{avg} = (3/2)\ k_B T$

$(k_B = 1.38\times10^{23}\ J/K)$

$v_{rms} = \sqrt{(3k_B T/m)}$

$v_{rms} = \sqrt{(3RT/M)}$

$k_b = R/N,\ mN_A = M$

$W = P\Delta V$

$Q = nC_v\Delta T$

$Q = nC_p\Delta T$

$C_p = C_v + R$

$\Delta U = Q - W$

Electric Forces and Fields

$$F_E = kq_1q_2/r^2$$

$$(k = 9\times10^9\ N\cdot m^2/C^2)$$

$$E = F_{on\ q}\ /\ q$$

$$E = kQ/r^2$$

Electric Potential and Capacitance

$$\Delta U_E = -W_E$$

$$\Delta V = \Delta U_E/q$$

$$V = kQ/r$$

$$C = Q/\Delta V$$

$$C = \varepsilon_0 A/d \text{ (parallel-plate capacitor)}$$

$$1\ C/V = 1\ F$$

$$C_P = C_1 + C_2 + \ldots \text{ (parallel)}$$

$$1/C_S = 1/C_1 + 1/C_2 + \ldots \text{ (series)}$$

Direct Current Circuits

$$I = \Delta Q / \Delta t$$

$$R = \Delta V / I$$

$$R = \rho L / A$$

$$P = IV = IR^2 = V^2 / R$$

$$I = \varepsilon / R$$

$$R_S = R_1 + R_2 + \ldots \text{ (series)}$$

$$1/R_P = 1/R_1 + 1/R_2 + \ldots \text{ (parallel)}$$

Magnetic Forces and Fields

$$F_B = |q|vB \sin\theta$$

direction of F_B:

same as $v \times B$ if q is positive

opposite $v \times B$ if q is negative

$$qvB = mv^2/r;\ r = mv / qB$$

$$F_B = IlB \sin\theta$$

$$F_B = I(l \times B)$$

$$B \propto I / r$$

Electromagnetic Induction

$$F_B = q(v \times B)$$

$$\varepsilon = vBl \text{ (motional emf, sliding rod)}$$

$$\Phi_B = B_{\perp}A = B \cdot A = BA \cos \theta$$

$$\varepsilon_{avg} = -\Delta\Phi_B / \Delta t$$

Waves

$$\lambda = vT$$

$$\lambda f = v$$

$$T = 1/f$$

$$v = \sqrt{(F_T/\mu)}$$

$$\lambda_n = 2L / n$$

$$f_n = nf_1$$

$$v = \sqrt{(B / \rho)}$$

$$f_{beat} = | f_1 - f_2 |$$

$$f_D = [(v \pm v_D) / (v \pm v_S)] f_S$$

Optics

$\Delta l = m\lambda$ (constructive interference)

$\Delta l = (m + \frac{1}{2})\lambda$ (destructive interference)

$y_m = m\lambda L / d$

$n = c/v$

$n_1 \sin \theta_1 = n_2 \sin \theta_2$

$f = R / 2$ (spherical mirror)

$1/s_o + 1/s_i = 1/f$

$M = h_i / h_o = - q / p$

Some units and conversions:

SI Units

length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
temperature	Kelvin	K

Basic Unit 1 meter – 1 gram – 1 liter

Metric Prefixes

T	tera	1×10^{12}	10^{12}
G	giga	1×10^{9}	10^{9}
M	mega	1×10^{6}	10^{6}
hk	hectokilo	1×10^{5}	10^{5}
ma	myria	1×10^{4}	10^{4}
k	kilo	1×10^{3}	10^{3}
h	hecto	1×10^{2}	10^{2}
d	deka	1×10^{1}	10^{1}
d	deci	1×10^{-1}	10^{-1}
c	centi	1×10^{-2}	10^{-2}
m	milli	1×10^{-3}	10^{-3}
dm	decimilli	1×10^{-4}	10^{-4}
cm	centimilli	1×10^{-5}	10^{-5}
μ	micro	1×10^{-6}	10^{-6}
n	nano	1×10^{-9}	10^{-9}
p	pico	1×10^{-12}	10^{-12}

30 s

1. A force F of strength 20 N acts on an object of mass 3 kg as it moves a distance of 4 m. If F is perpendicular to the 4 m displacement, the work it does is equal to

- A 0 J
- B 60 J
- C 80 J
- D 600 J
- E 2,400 J
- X I don’t know.

30 s

1. A force F of strength 20 N acts on an object of mass 3 kg as it moves a distance of 4 m. If F is perpendicular to the 4 m displacement, the work it does is equal to

- A 0 J
- B 60 J
- C 80 J
- D 600 J
- E 2,400 J
- X I don't know.

A

30 s

2. A box of mass m slides down a frictionless inclined plane of length L and vertical height h. What is the change in its gravitational potential energy?

- **A** $-mgL$
- **B** $-mgh$
- **C** $-mgL/h$
- **D** $-mgh/L$
- **E** $-mghL$
- **X** I don't know.

30 s

2. A box of mass m slides down a frictionless inclined plane of length L and vertical height h. What is the change in its gravitational potential energy?

- A $-mgL$
- B $-mgh$
- C $-mgL/h$
- D $-mgh/L$
- E $-mghL$
- X I don't know.

B

3. A block of mass 3 kg slides down an inclined plane of length 6 m and height 4 m. If the force of friction on the block is a constant 3.5 N as it slides from rest at the top of the incline, what is its speed at the bottom?

- **A** 5 m/s
- **B** 6 m/s
- **C** 8 m/s
- **D** 9 m/s
- **E** 10 m/s
- **X** I don't know.

60 s

3. A block of mass 3 kg slides down an inclined plane of length 6 m and height 4 m. If the force of friction on the block is a constant 3.5 N as it slides from rest at the top of the incline, what is its speed at the bottom?

- A 5 m/s
- B 6 m/s
- C 8 m/s
- D 9 m/s
- E 10 m/s
- X I don't know.

C

30 s

4. A force of 200 N is required to keep an object sliding at a constant speed of 2 m/s across a rough floor. How much power is being expended to maintain this motion?

- A 50 W
- B 100 W
- C 200 W
- D 400 W
- E Cannot be determined from the information given
- X I don't know.

30 s

4. A force of 200 N is required to keep an object sliding at a constant speed of 2 m/s across a rough floor. How much power is being expended to maintain this motion?

- A 50 W
- B 100 W
- C 200 W
- D 400 W
- E Cannot be determined from the information given
- X I don't know.

D

45 s

5. An object of mass 2 kg has a linear momentum of magnitude 6 kg·m/s. What is the object's kinetic energy?

- **A** 3 J
- **B** 6 J
- **C** 9 J
- **D** 12 J
- **E** 18 J
- **X** I don't know.

45 s

5. An object of mass 2 kg has a linear momentum of magnitude 6 kg·m/s. What is the object's kinetic energy?

- A 3 J
- B 6 J
- C 9 J
- D 12 J
- E 18 J
- X I don't know.

C

7. A ball of mass 0.5 kg, initially at rest, acquires a speed of 4 m/s immediately after being kicked by a force of strength 20 N. For how long did this force act on the ball?

- A 0.01 s
- B 0.02 s
- C 0.1 s
- D 0.2 s
- E 1 s
- X I don’t know.

45 s

7. A ball of mass 0.5 kg, initially at rest, acquires a speed of 4 m/s immediately after being kicked by a force of strength 20 N. For how long did this force act on the ball?

- A 0.01 s
- B 0.02 s
- C 0.1 s
- D 0.2 s
- E 1 s
- X I don't know.

C

45 s

8. A box with a mass of 2 kg accelerates in a straight line from 4 m/s to 8 m/s due to the application of a force whose duration is 0.5 s. Find the average strength of this force.

- A 2 N
- B 4 N
- C 8 N
- D 12 N
- E 16 N
- X I don’t know.

45 s

8. A box with a mass of 2 kg accelerates in a straight line from 4 m/s to 8 m/s due to the application of a force whose duration is 0.5 s. Find the average strength of this force.

- A 2 N
- B 4 N
- C 8 N
- D 12 N
- E 16 N
- X I don't know.

E

30 s

9. A ball of mass m traveling horizontally with velocity v strikes a massive vertical wall and rebounds back along its original direction with no change in speed. What is the magnitude of the impulse delivered by the wall to the ball?

- **A** 0
- **B** $\frac{1}{2}mv$
- **C** mv
- **D** $2mv$
- **E** $4mv$
- **X** I don't know.

30 s

9. A ball of mass m traveling horizontally with velocity v strikes a massive vertical wall and rebounds back along its original direction with no change in speed. What is the magnitude of the impulse delivered by the wall to the ball?

- **A** 0
- **B** $\frac{1}{2}mv$
- **C** mv
- **D** $2mv$
- **E** $4mv$
- **X** I don't know.

D

45 s

10. Two objects, one of mass 3 kg and moving with a speed of 2 m/s and the other of mass 5 kg and speed 2 m/s, move toward each other and collide head-on. If the collision is perfectly inelastic, find the speed of the objects after the collision.

- A 0.25 m/s
- B 0.5 m/s
- C 0.75 m/s
- D 1 m/s
- E 2 m/s
- X I don't know.

45 s

10. Two objects, one of mass 3 kg and moving with a speed of 2 m/s and the other of mass 5 kg and speed 2 m/s, move toward each other and collide head-on. If the collision is perfectly inelastic, find the speed of the objects after the collision.

- A 0.25 m/s
- B 0.5 m/s
- C 0.75 m/s
- D 1 m/s
- E 2 m/s
- X I don't know.

B

30 s

11. A professional golfer drives a golf ball 230 meters down the fairway. When the club head strikes the golf ball

- A the impact force on the golf ball is greatest
- B the impact force on the club head is greatest
- C the impact force is the same for both
- D the impact force has no effect on the club
- E the impact force has no effect on the ball
- X I don’t know.

30 s

11. A professional golfer drives a golf ball 230 meters down the fairway. When the club head strikes the golf ball

- A the impact force on the golf ball is greatest
- B the impact force on the club head is greatest
- C the impact force is the same for both
- D the impact force has no effect on the club
- E the impact force has no effect on the ball
- X I don’t know.

C

12. The catcher prepares to receive a pitch from the pitcher. As the ball reaches and makes contact with his glove, the catcher pulls his hand backward. This action reduces the impact of the ball on the catcher's hand because

- **A** the energy absorbed by his hand is reduced.
- **B** the momentum of the pitch is reduced.
- **C** the time of impact is increased.
- **D** the time of impact is reduced.
- **E** the force exerted on his hand remains the same.
- **X** I don't know.

30 s

12. The catcher prepares to receive a pitch from the pitcher. As the ball reaches and makes contact with his glove, the catcher pulls his hand backward. This action reduces the impact of the ball on the catcher's hand because

- A the energy absorbed by his hand is reduced.
- B the momentum of the pitch is reduced.
- C the time of impact is increased.
- D the time of impact is reduced.
- E the force exerted on his hand remains the same.
- X I don't know.

C

45 s

13. An object, originally at rest, begins spinning under uniform angular acceleration. In 10 s, in completes an angular displacement of 60 rad. What is the numerical value of the angular acceleration?

- A $0.3\ rad/s^2$
- B $0.6\ rad/s^2$
- C $1.2\ rad/s^2$
- D $2.4\ rad/s^2$
- E $3.6\ rad/s^2$
- X I don't know.

45 s

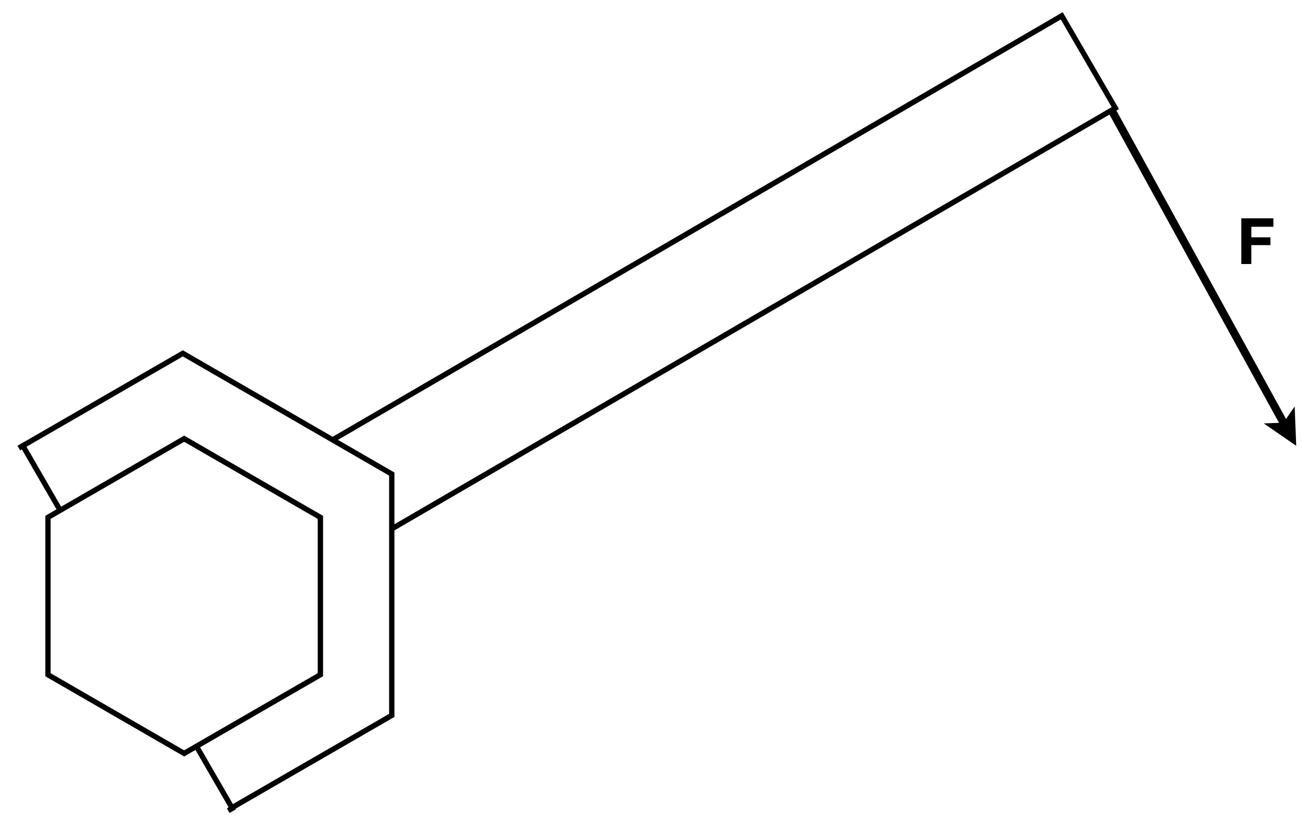
13. An object, originally at rest, begins spinning under uniform angular acceleration. In 10 s, in completes an angular displacement of 60 rad. What is the numerical value of the angular acceleration?

- A $0.3\ rad/s^2$
- B $0.6\ rad/s^2$
- C $1.2\ rad/s^2$
- D $2.4\ rad/s^2$
- E $3.6\ rad/s^2$
- X I don’t know.

C

14. In an effort to tighten a bolt, a force F is applied as shown in the figure. If the distance from the end of the wrench to the center of the bolt is 20 cm and F = 20 N, what is the magnitude of the torque produced by F?

45 s



A 0 N·m

B 1 N·m

C 2 N·m

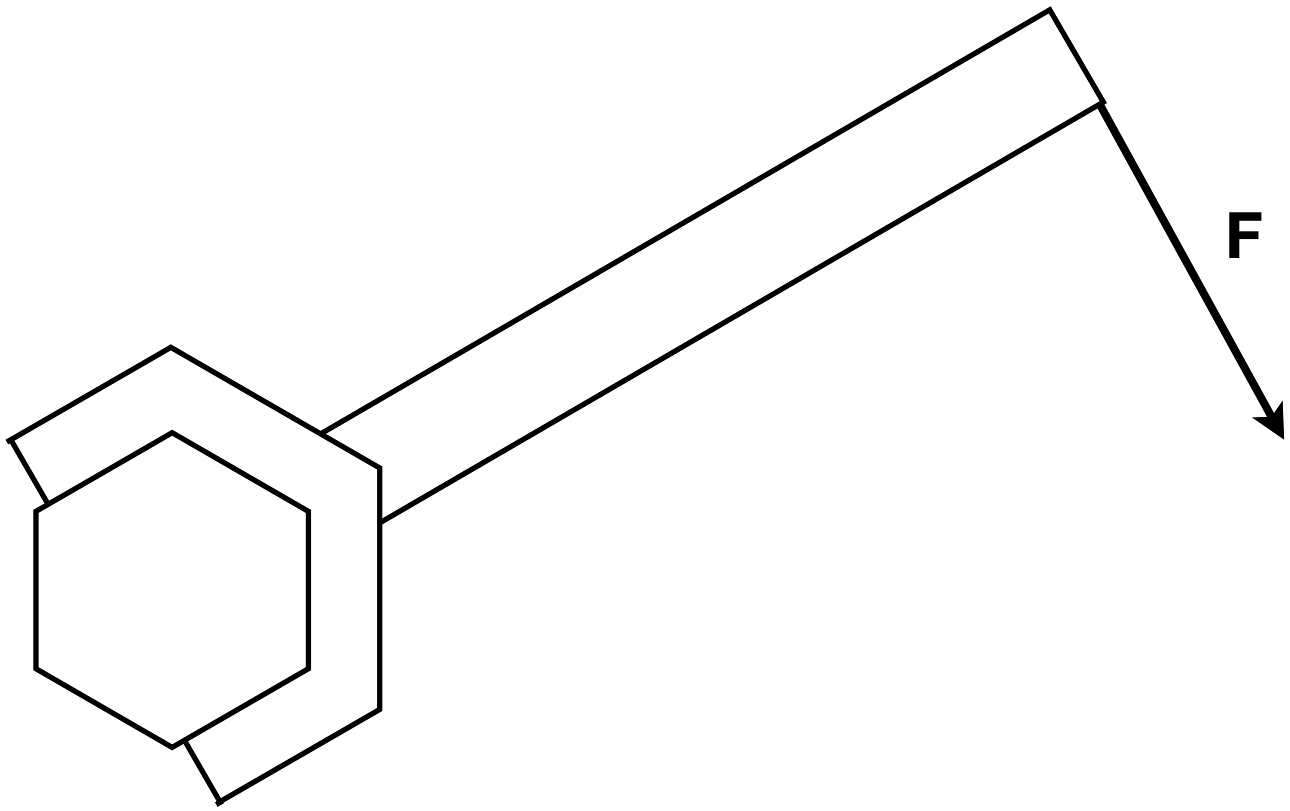
D 4 N·m

E 10 N·m

X I don't know.

45 s

14. In an effort to tighten a bolt, a force F is applied as shown in the figure. If the distance from the end of the wrench to the center of the bolt is 20 cm and F = 20 N, what is the magnitude of the torque produced by F?

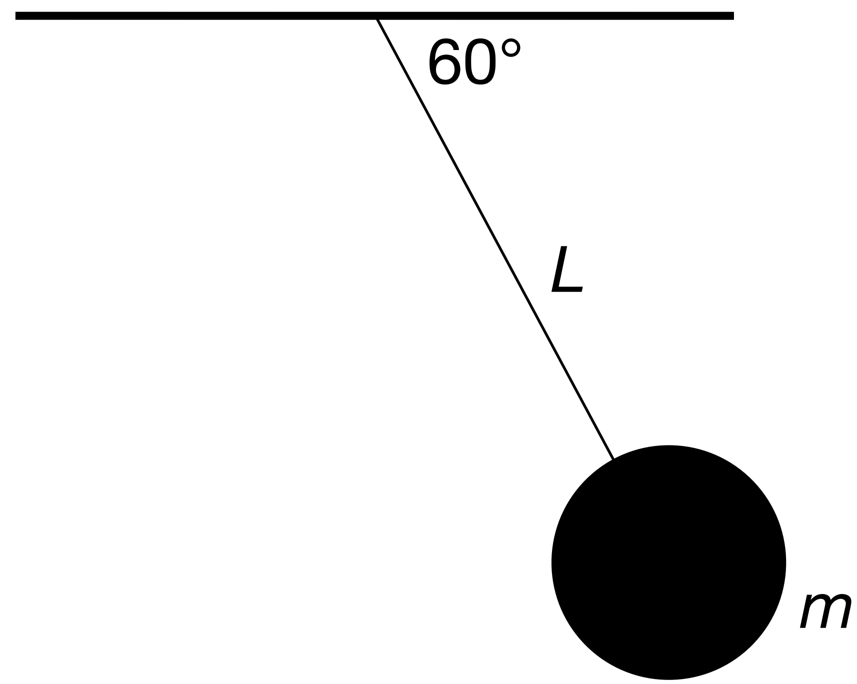


- **A** 0 N·m
- **B** 1 N·m
- **C** 2 N·m
- **D** 4 N·m
- **E** 10 N·m
- **X** I don't know.

D

15. In the figure, what is the torque about the pendulum's suspension point produced by the weight of the bob, given that the length of the pendulum , L, is 80 cm and m = 0.50 kg?

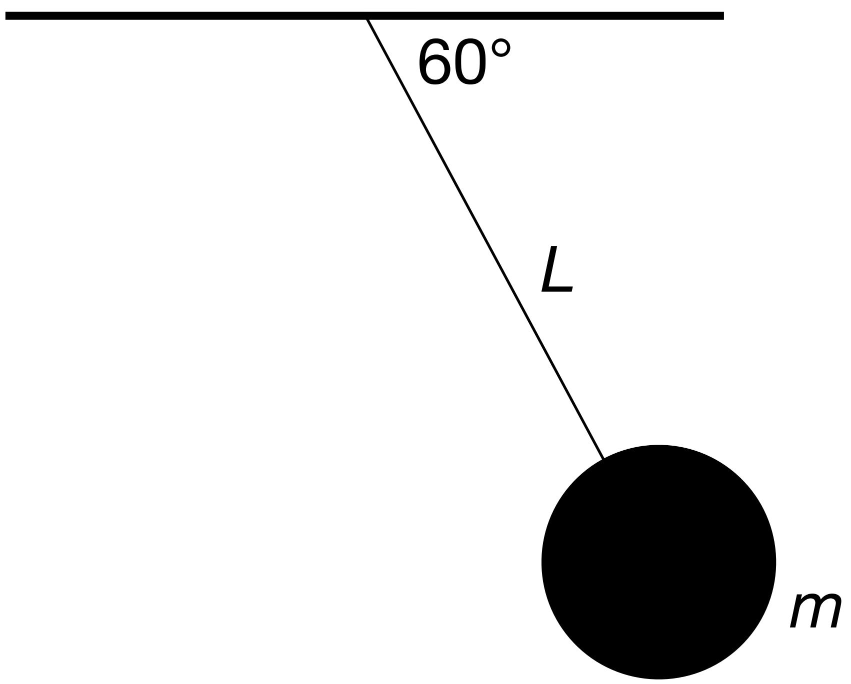
45 s



- **A** 0.49 N·m
- **B** 0.98 N·m
- **C** 1.7 N·m
- **D** 2.0 N·m
- **E** 3.4 N·m
- **X** I don't know.

15. In the figure, what is the torque about the pendulum's suspension point produced by the weight of the bob, given that the length of the pendulum , L, is 80 cm and m = 0.50 kg?

45 s

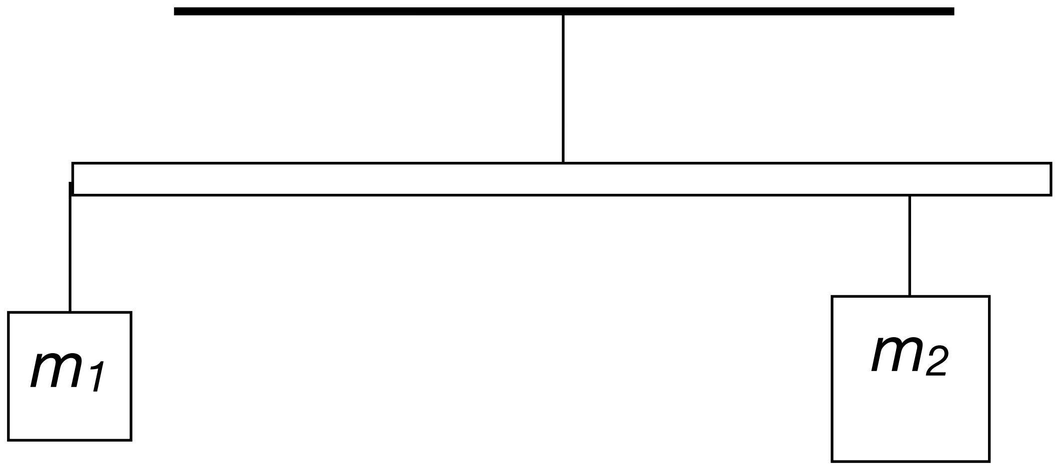


- A 0.49 N·m
- B 0.98 N·m
- C 1.7 N·m
- D 2.0 N·m
- E 3.4 N·m
- X I don't know.

D

16. A uniform meter stick of mass 1 kg is hanging from a thread attached at the stick's midpoint. One block of mass m1 = 3 kg hangs from the left end of the stick, and another block, of unknown mass m2, hangs below the 80 cm mark on the meter stick. If the stick remains at rest in the horizontal position shown above, what is m2?

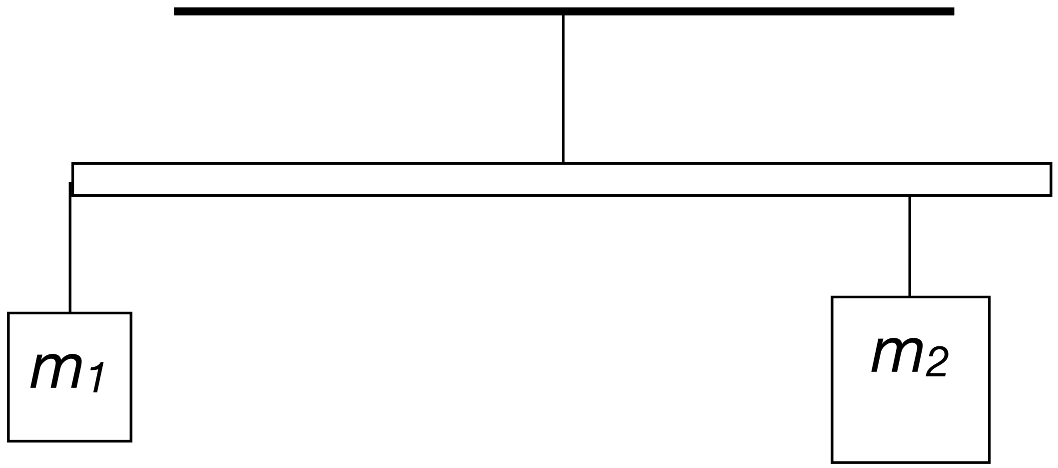
45 s



- A 4 kg
- B 5 kg
- C 6 kg
- D 8 kg
- E 9 kg
- X I don't know.

16. A uniform meter stick of mass 1 kg is hanging from a thread attached at the stick's midpoint. One block of mass m1 = 3 kg hangs from the left end of the stick, and another block, of unknown mass m2, hangs below the 80 cm mark on the meter stick. If the stick remains at rest in the horizontal position shown above, what is m2?

45 s



- A 4 kg
- B 5 kg
- C 6 kg
- D 8 kg
- E 9 kg
- X I don't know.

B

17. A child is swinging on a swing set. As the child reaches the lowest point in her swing

- **A** the tension in the rope is equal to her weight.
- **B** the tension in the rope supplies a centrifugal force.
- **C** her kinetic energy is at maximum.
- **D** her tangential acceleration equals gravity.
- **E** her angular velocity is minimum.
- **X** I don’t know.

30 s

17. A child is swinging on a swing set. As the child reaches the lowest point in her swing

- **A** the tension in the rope is equal to her weight.
- **B** the tension in the rope supplies a centrifugal force.
- **C** her kinetic energy is at maximum.
- **D** her tangential acceleration equals gravity.
- **E** her angular velocity is minimum.
- **X** I don't know.

C

18. An Olympic diver performs a 3-½ somersault. During his dive he uses the tuck position so that he will have

- A larger angular momentum.
- B smaller angular momentum.
- C larger rotational rate.
- D smaller rotational rate.
- E longer time in the air.
- X I don't know.

30 s

18. An Olympic diver performs a 3-½ somersault. During his dive he uses the tuck position so that he will have

- A larger angular momentum.
- B smaller angular momentum.
- C larger rotational rate.
- D smaller rotational rate.
- E longer time in the air.
- X I don't know.

C

19. A hanging weight stretches a spring 8 cm. If the weight is doubled and the spring constant is not exceeded, how much will the spring stretch?

- **A** 4 cm
- **B** 8 cm
- **C** 12 cm
- **D** 16 cm
- **E** 20 cm
- **X** I don’t know.

30 s

19. A hanging weight stretches a spring 8 cm. If the weight is doubled and the spring constant is not exceeded, how much will the spring stretch?

- A 4 cm
- B 8 cm
- C 12 cm
- D 16 cm
- E 20 cm
- X I don’t know.

D

45 s

20. Which if the following is/are characteristics of simple harmonic motion?

I. The acceleration is constant.

II. The restoring force is proportional to the displacement.

III. The frequency is independent of the amplitude.

- A II only
- B I and II only
- C I and III only
- D II and III only
- E I, II, and III
- X I don't know.

45 s

20. Which if the following is/are characteristics of simple harmonic motion?
    I. The acceleration is constant.
    II. The restoring force is proportional to the displacement.
    III. The frequency is independent of the amplitude.

- A II only
- B I and II only
- C I and III only
- D II and III only
- E I, II, and III
- X I don't know.

D

21. A block attached to an ideal spring undergoes simple harmonic motion. The acceleration of the block has its maximum magnitude at the point where

- A the speed is the maximum.
- B the potential energy is the minimum.
- C the speed is the minimum.
- D the restoring force is the minimum.
- E the kinetic energy is the maximum.
- X I don't know.

45 s

21. A block attached to an ideal spring undergoes simple harmonic motion. The acceleration of the block has its maximum magnitude at the point where

- A the speed is the maximum.
- B the potential energy is the minimum.
- C the speed is the minimum.
- D the restoring force is the minimum.
- E the kinetic energy is the maximum.
- X I don't know.

C

22. A spring-block simple harmonic oscillator is set up so that the oscillations are vertical. The period of the motion is T. If the spring and block are taken to the surface of the moon, where the gravitational acceleration is 1/6 of its value here, then the vertical oscillations will have a period of

- A $T/6$
- B $T/3$
- C $T/\sqrt{6}$
- D T
- E $T\sqrt{6}$
- X I don't know.

45 s

22. A spring-block simple harmonic oscillator is set up so that the oscillations are vertical. The period of the motion is T. If the spring and block are taken to the surface of the moon, where the gravitational acceleration is 1/6 of its value here, then the vertical oscillations will have a period of

- **A** $T/6$
- **B** $T/3$
- **C** $T/\sqrt{6}$
- **D** T
- **E** $T\sqrt{6}$
- **X** I don't know.

D

45 s

Questions 23–25 relate to the following.

The choices below give a description of the quantities listed above. Match the statement below with the quantity it describes above.

23. The number of wave crests passing a given point per unit of time.
24. The distance between two points or two consecutive waves.
25. The product of the frequency and the wavelength.

- A Frequency
- B Amplitude
- C Wavelength
- D Velocity
- E Period
- X I don't know.

45 s

Questions 23–25 relate to the following.

The choices below give a description of the quantities listed above. Match the statement below with the quantity it describes above.

23. The number of wave crests passing a given point per unit of time.
24. The distance between two points or two consecutive waves.
25. The product of the frequency and the wavelength.

A Frequency

B Amplitude

C Wavelength

D Velocity

E Period

X I don't know.

A

Questions 23–25 relate to the following.

The choices below give a description of the quantities listed above. Match the statement below with the quantity it describes above.

23. The number of wave crests passing a given point per unit of time.
24. The distance between two points or two consecutive waves.
25. The product of the frequency and the wavelength.

- A Frequency
- B Amplitude
- C Wavelength
- D Velocity
- E Period
- X I don't know.

A C

45 s

Questions 23–25 relate to the following.

The choices below give a description of the quantities listed above. Match the statement below with the quantity it describes above.

23. The number of wave crests passing a given point per unit of time.
24. The distance between two points or two consecutive waves.
25. The product of the frequency and the wavelength.

- A Frequency
- B Amplitude
- C Wavelength
- D Velocity
- E Period
- X I don't know.

A C D

60 s

Questions 26–28 relate to the changes that could be made in the following scenario and the results such changes would produce. A pendulum swings at a rate of 0.75 vibrations/second.

26. The period of the vibrations would increase because…
27. The frequency of the vibrations would decrease because…
28. The velocity of the pendulum would increase because…

- **A** Mass of the bob was increased
- **B** Length of the pendulum was increased
- **C** Mass of the bob was decreased
- **D** Length of the pendulum was decreased
- **E** Displacement from zero was increased
- **X** I don’t know.

60 s

Questions 26–28 relate to the changes that could be made in the following scenario and the results such changes would produce. A pendulum swings at a rate of 0.75 vibrations/second.

26. The period of the vibrations would increase because…
27. The frequency of the vibrations would decrease because…
28. The velocity of the pendulum would increase because…

- A Mass of the bob was increased
- B Length of the pendulum was increased
- C Mass of the bob was decreased
- D Length of the pendulum was decreased
- E Displacement from zero was increased
- X I don't know.

B

60 s

Questions 26–28 relate to the changes that could be made in the following scenario and the results such changes would produce. A pendulum swings at a rate of 0.75 vibrations/second.

26. The period of the vibrations would increase because…
27. The frequency of the vibrations would decrease because…
28. The velocity of the pendulum would increase because…

- **A** Mass of the bob was increased
- **B** Length of the pendulum was increased
- **C** Mass of the bob was decreased
- **D** Length of the pendulum was decreased
- **E** Displacement from zero was increased
- **X** I don't know.

B **B**

60 s

Questions 26–28 relate to the changes that could be made in the following scenario and the results such changes would produce. A pendulum swings at a rate of 0.75 vibrations/second.

26. The period of the vibrations would increase because…
27. The frequency of the vibrations would decrease because…
28. The velocity of the pendulum would increase because…

- A Mass of the bob was increased
- B Length of the pendulum was increased
- C Mass of the bob was decreased
- D Length of the pendulum was decreased
- E Displacement from zero was increased
- X I don't know.

B B E

29. While anchored at sea, a captain notices the wave peaks are separated by 16 m and occur at a rate of 1 wave every 2 seconds. What is the velocity of these waves?

- **A** 4 m/s
- **B** 8 m/s
- **C** 16 m/s
- **D** 32 m/s
- **E** 64 m/s
- **X** I don't know.

45 s

29. While anchored at sea, a captain notices the wave peaks are separated by 16 m and occur at a rate of 1 wave every 2 seconds. What is the velocity of these waves?

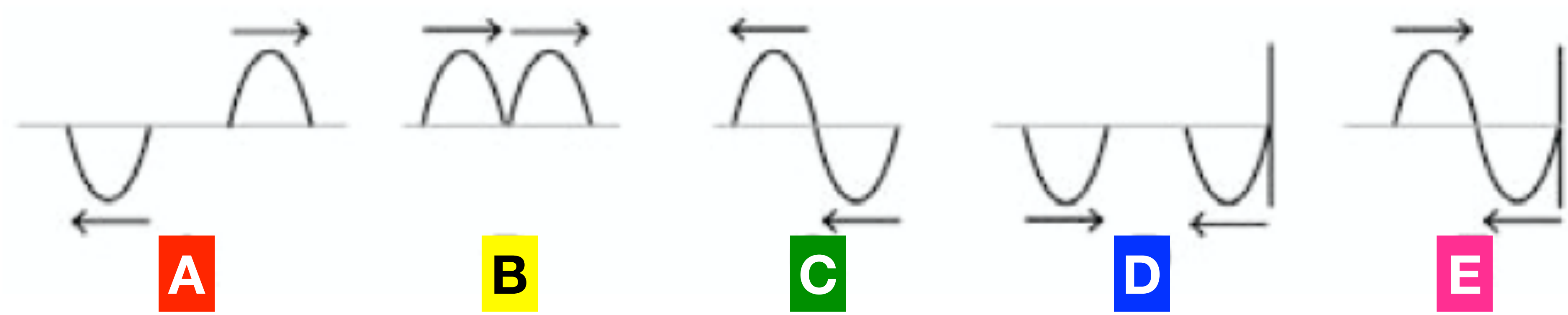
- A 4 m/s
- B 8 m/s
- C 16 m/s
- D 32 m/s
- E 64 m/s
- X I don't know.

B

Questions 30–32 refer to the waves shown below. Each wave is moving in the direction shown by the arrow.

Select the graph that answers the questions below.

30. Which set of pulses will soon show constructive interference?
31. Which set of pulses has already been through interference?
32. Which set of pulses will soon show destructive interference?

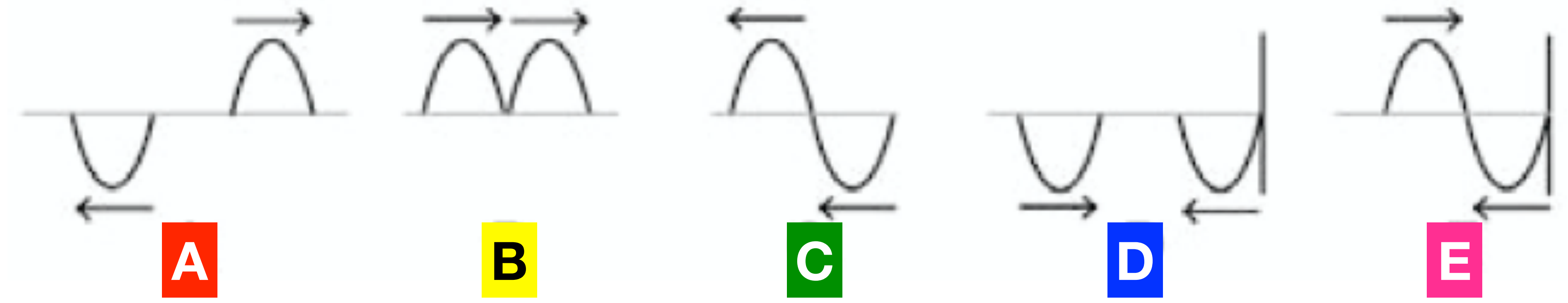


X I don’t know.

60 s

Questions 30–32 refer to the waves shown below. Each wave is moving in the direction shown by the arrow.

Select the graph that answers the questions below.
30. Which set of pulses will soon show constructive interference?
31. Which set of pulses has already been through interference?
32. Which set of pulses will soon show destructive interference?



D

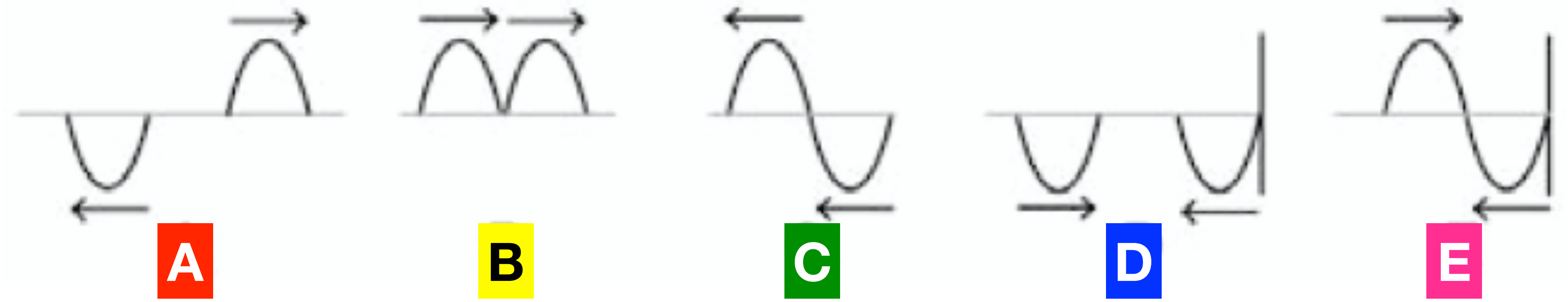
X I don't know.

60 s

Questions 30–32 refer to the waves shown below. Each wave is moving in the direction shown by the arrow.

Select the graph that answers the questions below.

30. Which set of pulses will soon show constructive interference?
31. Which set of pulses has already been through interference?
32. Which set of pulses will soon show destructive interference?



D A

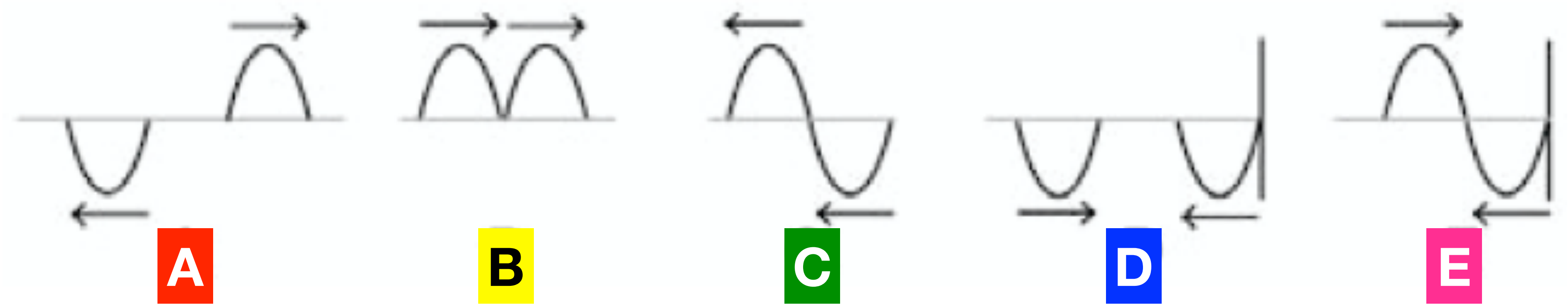
X I don't know.

60 s

Questions 30–32 refer to the waves shown below. Each wave is moving in the direction shown by the arrow.

Select the graph that answers the questions below.

30. Which set of pulses will soon show constructive interference?
31. Which set of pulses has already been through interference?
32. Which set of pulses will soon show destructive interference?



D A E

X I don't know.

33. While standing in front of a plane flat mirror and looking at yourself, you raise your right hand. Which is the best description of the image you see?

- A Erect and enlarged
- B Erect and reduced
- C Erect and reversed
- D Inverted and reversed
- E Inverted and reduced
- X I don’t know.

30 s

33. While standing in front of a plane flat mirror and looking at yourself, you raise your right hand. Which is the best description of the image you see?

- **A** Erect and enlarged
- **B** Erect and reduced
- **C** Erect and reversed
- **D** Inverted and reversed
- **E** Inverted and reduced
- **X** I don’t know.

C

34. A light ray is moving parallel to the principal axis of a concave mirror, which it strikes. How will the light ray be reflected?

- A Back upon itself
- B Through the focal point
- C Through the radius of curvature
- D Through a point equal to ½*f*
- E Through a point equal to 2*r*
- X I don't know.

30 s

34. A light ray is moving parallel to the principal axis of a concave mirror, which it strikes. How will the light ray be reflected?

- **A** Back upon itself
- **B** Through the focal point
- **C** Through the radius of curvature
- **D** Through a point equal to ½*f*
- **E** Through a point equal to 2*r*
- **X** I don't know.

B

35. If 360 g of water at 95°C is mixed with 275 g of water at 10°C, what is the resulting temperature of the water?

- A 37°C
- B 49°C
- C 58°C
- D 70°C
- E 82°C
- X I don't know.

45 s

35. If 360 g of water at 95°C is mixed with 275 g of water at 10°C, what is the resulting temperature of the water?

- A 37°C
- B 49°C
- C 58°C
- D 70°C
- E 82°C
- X I don't know.

C