Physics 103 October 5, 2000 Exam 1 --- EXAM AAAAA

6. Using the dimensions for the variables given in the table,

Variable	Dimension
f	$\frac{1}{[\mathrm{T}]}$
l	[L]
g	$\frac{[\mathrm{L}]}{[\mathrm{T}]^2}$

determine which one of the following expressions is correct.

A) $f = 2\pi lg$

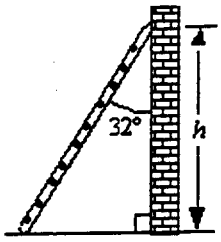
B) $2\pi f = \sqrt{\frac{g}{l}}$

C) $f = \frac{g}{2\pi l}$

D) $2\pi f = \sqrt{\frac{l}{g}}$

E) $f = 2\pi\sqrt{gl}$

7. A 2.5-m ladder leans against a wall and makes an angle with the wall of 32° as shown in the figure. What is the height h above the floor where the ladder makes contact with the wall?



A) 1.6 m
B) 1.9 m
C) 1.3 m
D) 2.4 m
E) 2.1 m

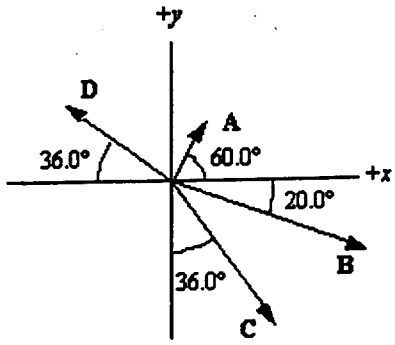
8. Three vectors **A**, **B**, and **C** add together to yield zero: $\mathbf{A} + \mathbf{B} + \mathbf{C} = \mathbf{0}$. The vectors **A** and **C** point in *opposite* directions and their magnitudes are related by the expression : $A = 2C$. Which one of the following conclusions is correct?

A) **A** and **B** have equal magnitudes and point in opposite directions.
B) **B** and **C** have equal magnitudes and point in the same direction.
C) **B** and **C** have equal magnitudes and point in opposite directions.
D) **A** and **B** point in the same direction, but **A** has twice the magnitude of **B**.
E) **B** and **C** point in the same direction, but **C** has twice the magnitude of **B**.

9. The x and y components of a displacement vector are –3.00 m and +4.00 m, respectively. What angle does this vector make with the positive x axis?

A) 127°
B) –53.0°
C) 53.0°
D) 233°
E) 37.0°

10. Use the component method of vector addition to find the components of the resultant of the four displacements shown in the figure. The magnitudes of the displacements are: $A = 2.25$ cm, $B = 6.35$ cm, $C = 5.47$ cm, and $D = 4.19$ cm.



	x component	y component
A)	6.93 cm	–2.19 cm
B)	1.09 cm	–3.71 cm
C)	5.45 cm	–2.82 cm
D)	3.71 cm	–1.09 cm
E)	2.19 cm	–6.92 cm

11. A car starts from rest and accelerates at a constant rate in a straight line. In the *first* second the car covers a distance of 2.0 meters. How fast will the car be moving at the end of the *second* second?

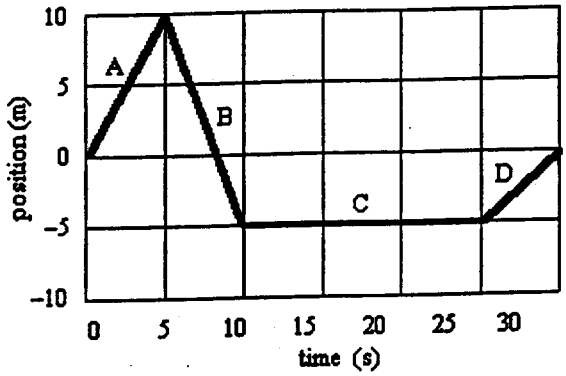
A) 32 m/s
B) 4.0 m/s
C) 8.0 m/s
D) 16 m/s
E) 2.0 m/s

12. A race car has a speed of 80 m/s. At t = 0, the driver starts decelerating at -4 m/s^2. How far will the car travel before it stops?

A) 20 m
B) 1000 m
C) 400 m
D) 200 m
E) 800 m

Use the following to answer question 13:

An object is moving along the x axis. The graph shows its **position** from the starting point as a function of **time**.



Various segments of the graph are identified by the letters A, B, C, and D.

13. During which interval(s) is the object *moving* in the negative x direction?

A) during interval B only
B) during intervals B and C
C) during intervals C and D
D) during intervals B and D
E) during intervals B, C, and D

Use the following to answer question 14:

A tennis ball is shot vertically upward with an initial speed of 20.0 m/s from the surface of planet Krypton--a planet with no atmosphere. One second later, the ball has an instantaneous velocity in the upward direction of 15.0 m/s.

14. How long does it take the ball to reach its maximum height?

A) 4.0 s
B) 2.3 s
C) 8.0 s
D) 4.6 s
E) 2.0 s

Use the following to answer question 15:

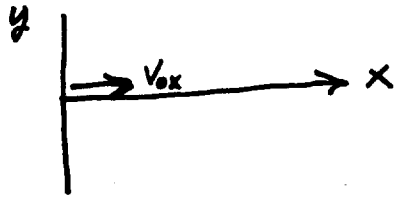
A projectile is fired at an angle of 60.0° above the horizontal with an initial speed of 30.0 m/s.

15. How long does it take the projectile to reach the highest point in its trajectory?

A) 1.5 s
B) 4.0 s
C) 2.7 s
D) 9.8 s
E) 6.2 s

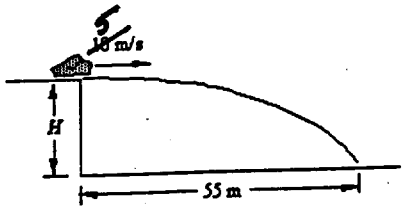
16. A projectile is fired horizontally with an initial speed of 57 m/s. What are the horizontal and vertical components of its displacement 3.0 s after it is fired?

	horizontal	*vertical*
A)	210 m	44 m
B)	170 m	−44 m
C)	210 m	0 m
D)	44 m	29 m
E)	170 m	−29 m



Use the following to answer questions 17-18:

A rock is kicked *horizontally* at a speed of 5 m/s from the edge of a cliff. The rock strikes the ground 55 m from the foot of the cliff of height H as suggested in the figure. Neglect air resistance.



17. How long is the rock in the air?
A) 11.0 s
B) 22.0 s
C) 1.2 s
D) 3.4 s
E) 1.0 s

18. What is the approximate value of H, the height of the cliff?
A) 700 m
B) 595 m
C) 830 m
D) 540 m
E) 270 m

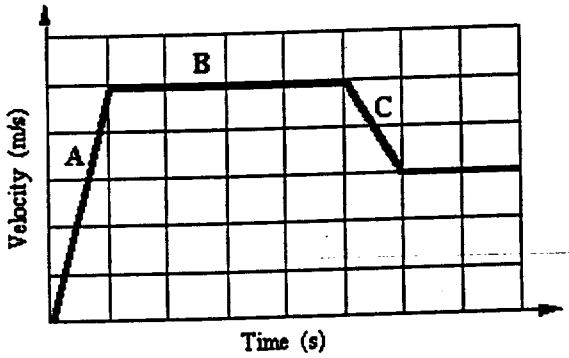
Use the following to answer question 19:

A spaceship is observed traveling in the positive x direction with a speed of 150 m/s when it begins accelerating at a constant rate. The spaceship is observed 25 s later traveling with an instantaneous velocity of 1500 m/s at an angle of 55° above the $+x$ axis.

19. What was the magnitude of the acceleration of the spaceship during the 25 seconds?

A) 57 m/s^2
B) 1.5 m/s^2
C) 28 m/s^2
D) 48 m/s^2
E) 7.3 m/s^2

20. The figure shows the **velocity** versus **time** curve for a car traveling along a straight line.

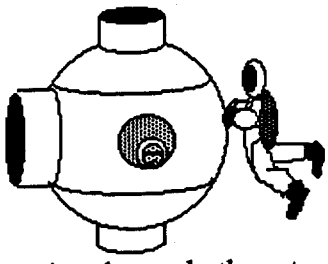


Which of the following statements is false?

A) No net force acts on the car during interval **B**.
B) Net forces act on the car during intervals **A** and **C**.
C) Opposing forces may be acting on the car during interval **B**.
D) Opposing forces may be acting on the car during interval **C**.
E) The magnitude of the net force acting during interval **A** is less than that during **C**.

Use the following to answer question 21:

In space, a 70.0-kg astronaut pushes to the left on a spacecraft with a force F.. (In orbit, both the astronaut and the spacecraft are weightless). The spacecraft has a total mass of 1.0×10^4 kg.



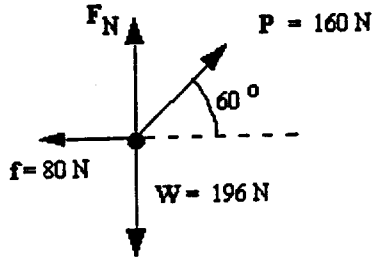
During the push, the astronaut accelerates to the right with an acceleration of 0.36 m/s^2.

21. Determine the magnitude of the acceleration of the spacecraft.

A) 3.97×10^{-4} m/s^2
B) 51.4 m/s^2
C) 0.36 m/s^2
D) 7.0×10^{-3} m/s^2
E) 2.5×10^{-3} m/s^2

Use the following to answer question 22:

A force **P** pulls on a crate of mass *m* on a rough surface. The figure shows the magnitudes and directions of the forces that act on the crate in this situation. **W** represents the weight of the crate. $\mathbf{F_N}$ represents the normal force on the crate, and f represents the frictional force.



22. What is the magnitude of $\mathbf{F_N}$, the normal force on the crate?

A) 57 N
B) 80 N
C) 196 N
D) 230 N
E) 160 N

23. A boy pulls a sled of mass 5.0 kg with a rope that makes an 60.0° angle with respect to the horizontal surface of a frozen pond. The boy pulls on the rope with a force of 10.0 N; and the sled moves with **constant velocity**. What is the coefficient of friction between the sled and the ice?

A) 0.10
B) 0.18
C) 1.0
D) 0.12
E) 0.20