NTCI REVIEW EXAM

SPH4 **Gr 12 Physics Exam** December 1995

TIME 2.0 hours 2:00 pm

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## SECTION A: *Multiple Choice.*

____ 1. If a car accelerates at 26.5 km/h/s, then find the acceleration in $m/s^2$.

A) 1.59 $m/s^2$
B) 7.36 $m/s^2$
C) 26.5 $m/s^2$
D) 95.4 $m/s^2$
E) 442 $m/s^2$

____ 2. A bicycle can accelerate from rest to 30 km/h in 5.0 s. What is the acceleration of the bicycle?

A) 0.6 $m/s^2$
B) 1.7 $m/s^2$
C) 22 $m/s^2$
D) 42 $m/s^2$
E) 600 $m/s^2$

____ 3. What is the average force exerted on the 65 kg bicycle and rider in question #2?

A) 39 N
B) 110 N
C) 375 N
D) 640 N
E) 1400 N

____ 4. During my bicycle ride, I travel at 25.0 km/h for 15 minutes, then at 20.0 km/h for 10 minutes. What is my average speed?

A) 19 km/h
B) 20 km/h
C) 22.5 km/h
D) 23 km/h
E) 25 km/h

____ 5. How far does the bicycle travel during this time?

A) 9.6 km
B) 9.4 km
C) 5.8 km
D) 54 km
E) 0

____ 6. A stone is dropped from a window and hits the ground 1.8 s later. How far above the ground is the window?

A) 8.8 m
B) 16 m
C) 18 m
D) 32 m
E) 320 m

____ 7. What is the speed of the stone as it just hits the ground?

A) 0
B) 13 m/s
C) 18 m/s
D) 19 m/s
E) 310 m/s

____ 8. If the stone is thrown horizontally at a speed of 1.0 m/s instead of dropped, then how much faster will hit the ground?

A) 0 (same time)
B) 0.1 s
C) 0.7 s
D) 1.7 s
E) 1.9 s
F) None of the above (It will take longer)

____ 9. If the stone is thrown upwards, then the speed (compared to #7) of the stone as it hits the

ground is:
A) zero.
B) less than before.
C) greater than before.
D) the same as before.
E) None of the above - there is not enough information.

____ 10. A jet airplane's engines push hot gases out the rear of the engine. The reaction to this force is exerted:
A) by the air on the hot gas.
B) by the hot gas on the air.
C) by the hot gas on the engine.
D) by the wings on the air.
E) by the air on the wings.

____ 11. When a parachutist is falling towards the earth at a slow constant speed. The total upward force exerted on her (and her parachute) by the air is:
A) zero.
B) much smaller than the force of gravity.
C) slightly smaller than the force of gravity.
D) equal to the force of gravity.
E) slightly greater than the force of gravity.

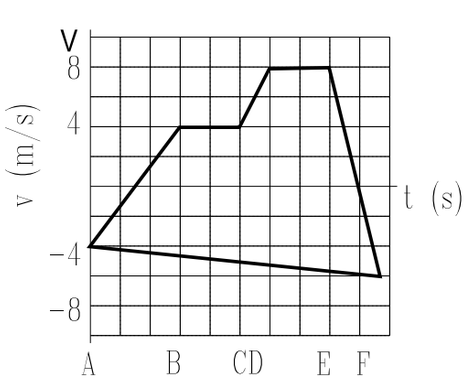
____ 12. What is the force of gravity on the space shuttle ($m = 4.4 \times 10^5$ kg) with an orbital radius of ($7.1 \times 10^6$ m) by the earth ($M = 5.98 \times 10^{24}$ kg) is:
A) $3.5 \times 10^6$ N
B) $4.3 \times 10^6$ N
C) $1.2 \times 10^{13}$ N
D) $2.5 \times 10^{13}$ N
E) $5.2 \times 10^{16}$ N

____ 13. A boat travels at 15 m/s on still water. On a river, the boat travels upstream against the current of 5.0 m/s. What is the velocity of the boat in relation to the shore?
A) 5.0 m/s
B) 10. m/s
C) 15 m/s
D) 20. m/s
E) 22. m/s

____ 14. The boat in #14 is moving perpendicular to the river. In what direction does the boat move in relation to the shore?
A) 90° from the shore.
B) 72° from the shore.
C) 71° from the shore.
D) 19° from the shore.
E) 18° from the shore.

____ 15. In what direction must the boat in #14 travel in order to reach its destination directly across the river?
A) 90° from the shore.
B) 72° from the shore upstream.
C) 71° from the shore downstream.
D) 19° from the shore upstream.
E) 18° from the shore upstream.

Using the following velocity-time graph, answer the following questions:




____ 16. What is the displacement during the segment CD?
A) 4 m
B) 5 m
C) 6 m
D) 13 m
E) 48 m

____ 17. What is the corresponding displacement-time graph for the interval BD?
A) B) C) D) E)

(Pictures disappeared - draw it!)

____ 18. What is the corresponding acceleration-time graph for the interval EF?
A) B) C) D) E)

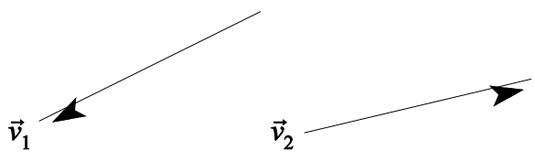
(Pictures disappeared - draw it!)

____ 19. At what time is the object at its maximum displacement
A) 3 s
B) 5 s
C) 6 s
D) 8 s
E) 9 s

____ 20. You walk 5 km east then 4 km north. What is the magnitude of your displacement?
A) 0
B) 1.0 m
C) 6.4 m
D) 9.0 m
E) 41 m

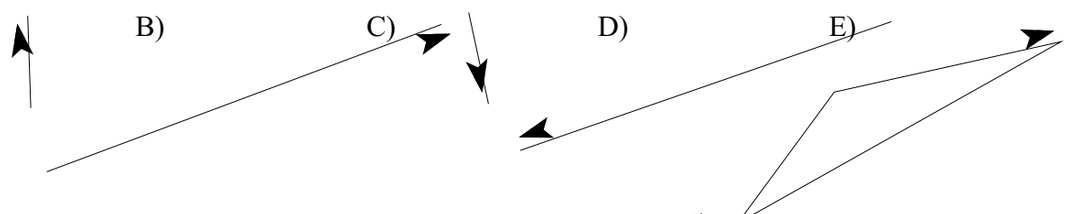
____ 21. When a ball bounces, it hits the ground at 2.5 m/s and rebounds at 1.9 m/s in 0.10 s. What is the acceleration of the ball?
A) 0
B) 4.4 m/s$^2$ [down]
C) 6 m/s$^2$ [up]
D) 9.8 m/s$^2$ [down]
E) 44 m/s$^2$ [up]

Use the following vectors to answer the following questions:



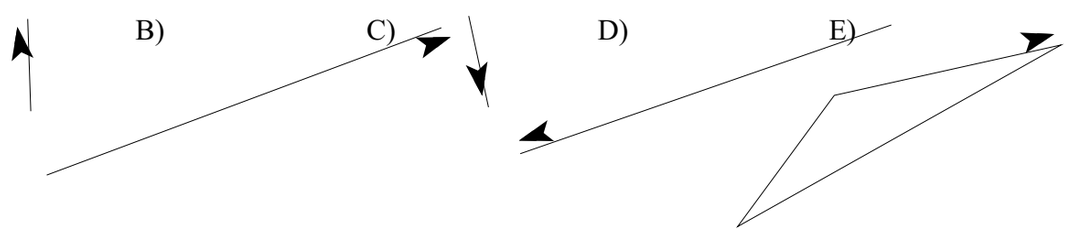

____ 22. Given the vectors $\vec{v}_1$ **and** $\vec{v}_2$, which vector best represents $\vec{v}_1 + \vec{v}_2$?

A) B) C) D) E)



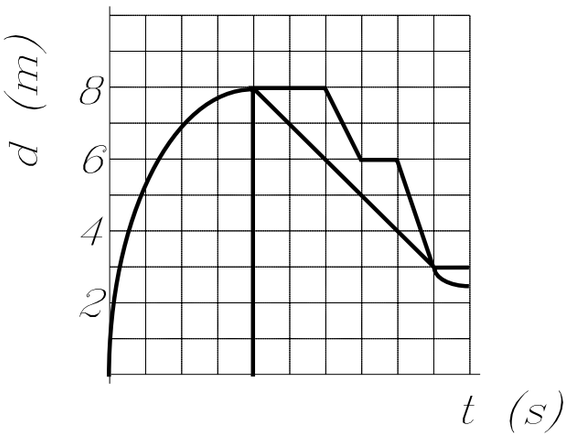
____ 23. Given the same vectors $\vec{v}_1$ **and** $\vec{v}_2$, which vector best represents $\Delta\vec{V}$?

A) B) C) D) E)



# SECTION B :

1. Use the displacement-time graph to answer the following questions:




   a. Find the velocity at t = 2.0 s.

   b. During which time intervals is the motion constant?

   c. During which time intervals is the acceleration non-zero?

   d. Sketch a (rough) graph of the corresponding v-t graph.

*(7)*

2. State Newton's First Law and give an example showing how the law applies.

*(3)*

3. A grade 12 physics student asks you about Newton's laws: "If, for every force there exists an equal and opposite reaction force, then all forces in nature come in equal and opposite pairs, and therefore all forces are balanced. Thus since there can never be such a thing as an unbalanced force, how can an object ever be accelerated?" Explain and correct the student's misconception.

*(3)*

4. In space we often say that an astronaut is "weightless". Why is this not really correct?

*(2)*

# SECTION C : *Show full solutions - part marks will be given.*

***Vector diagrams and Free Body Diagrams MUST be provided.***

1. As an investigator into motor vehicle accidents you have two problems:

   a. A 750 kg car leaves skid marks 33.5 m long in order to stop. If 8.6 m/s$^2$ is the maximum acceleration when maximum braking occurs, what is the minimum initial velocity? Was the car speeding in the 60 km/h zone?

*(3)*

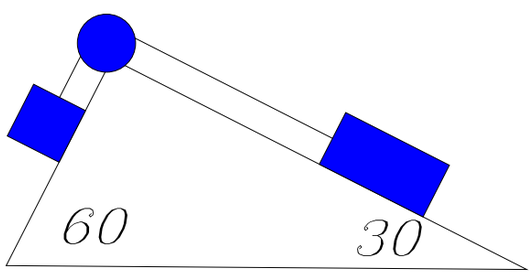
   b. Another car is found 45 m east of a ramp and 15 m below. At the point where the car left the ramp, the ramp sloped up at 5°. What was the speed of the car as it left the ramp? No skid marks were found.

*(6)*

2. You are pulling a 60 kg sled eastward on a level snow covered field with a force of 15 N at an angle of 30° to the horizontal. ~~If the coefficient of friction is 0.020, then~~ find the net-force and acceleration of the sled.

*(8)*

3. Find the acceleration of the masses and the tension in the string in the following diagram. (*Frictionless)*




*(7)*

   $m_a$ = 5.0 kg

   $m_b$ = 1.0 kg

4. An object starts from rest and accelerates at 3.0 m/s$^2$ [E] for 5.0 s. It's velocity remains constant for the next 6.0 s and then comes to rest after uniformly accelerating at 4.0 m/s$^2$ [W].

   a. Find the total displacement.

   b. Find the total time taken.

   c. Find the average velocity for the motion.

*(8)*

5. In a proposed space station, the station will rotate to simulate gravity.

   a. If the space station has a radius "R", then calculate the period of rotation to provide the proper earth gravity.

   b. Unfortunately, as you (mass = 65 kg) move towards the centre of the space station, your centripetal acceleration will not be the same. At half the radius "R", what will be your weight?

*(2+4)*