PHYSICS 534

ANSWERS

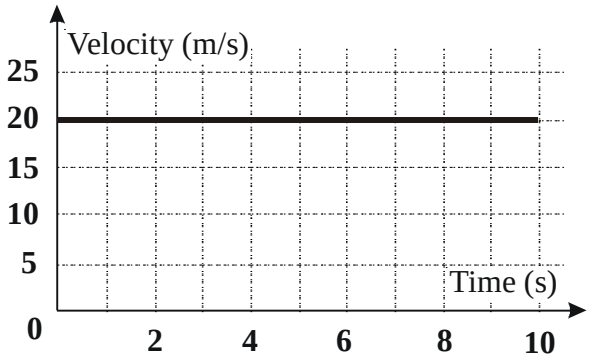
EXE E-28 Acceleration Part-1 /2

Karl Siegbahn was awarded the Nobel prize for physics in 1924 for his work with X-ray spectroscopy.

SIEGBAHN

The following graphs refer to the motion of a 100 kg cart. For each case, sketch the velocity-time curve (from t = 0 to t = 10 s) then answer the questions.

1. The cart travels at a constant velocity of 20 m/s for 10 s.



a) What distance did it travel?

200 m (20 m/s)(10 s)

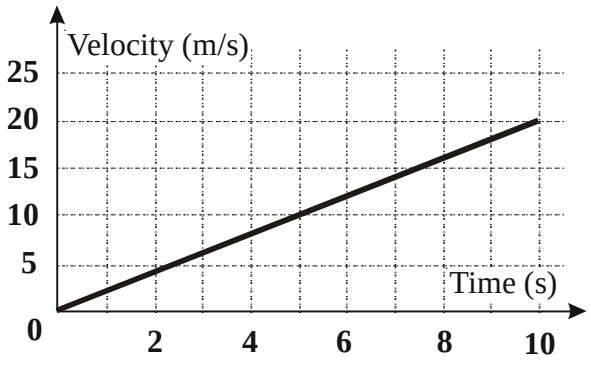
b) What was its acceleration?

Zero (System is at rest)

c) What was the resultant force?

Zero (System is at rest)

2. From rest, the cart reaches a velocity of 20 m/s in 10 s.



a) What distance did it travel?

100 m (20 m/s)(10 s)/2

b) What was its acceleration?

2 m/s² ($a = \frac{\Delta V}{\Delta t} = \frac{20\ m/s}{10\ s}$)

c) What was the resultant force?

200 N ($F_R = ma$ = 100 kg x 2 m/s²)

3. Starting at 25 m/s, the cart suddenly decelerates to a stop at a rate of 5 m/s^2.

a) What distance did it travel?

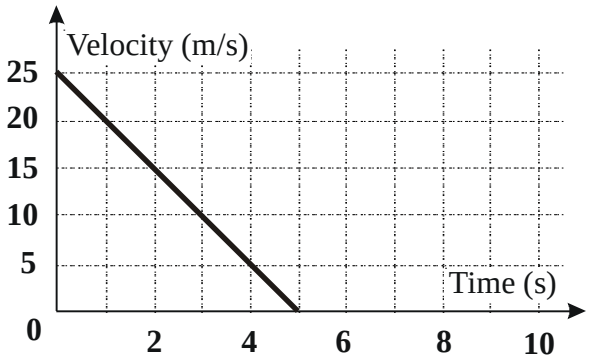
62.5 m (25 m/s)(5 s)/2

b) What was its acceleration?

-5 m/s^2 ($a = \frac{\Delta v}{\Delta t} = \frac{-25 \text{ m/s}}{5 \text{ s}}$)

c) What was the resultant force?

-500 N ($F_R = ma$ = 100 kg x -5 m/s^2)



4. Starting at 10 m/s, the cart accelerates uniformly to a velocity of 20 m/s in 10 s.

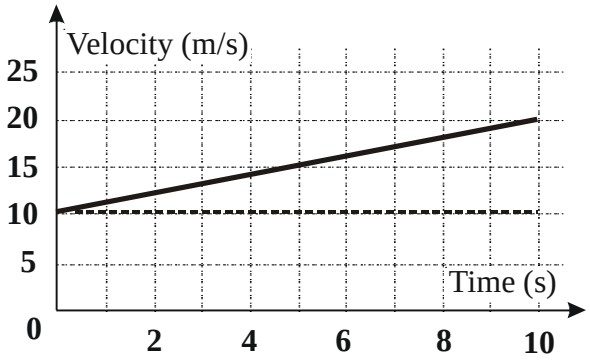
a) What distance did it travel?

150 m (10 m/s)(2 s)/2 + (10 m/s)(10 s)

b) What was its acceleration?

1 m/s^2 ($a = \frac{\Delta v}{\Delta t} = \frac{10 \text{ m/s}}{10 \text{ s}}$)

c) What was the resultant force? **100 N** ($F_R = ma$ = 100 kg x 1 m/s^2)



5. Starting from rest, the cart reaches a velocity of 20 m/s in 2 s. For the next 4 s, it maintains a constant velocity. It then comes to a stop by decelerating at 5 m/s^2.

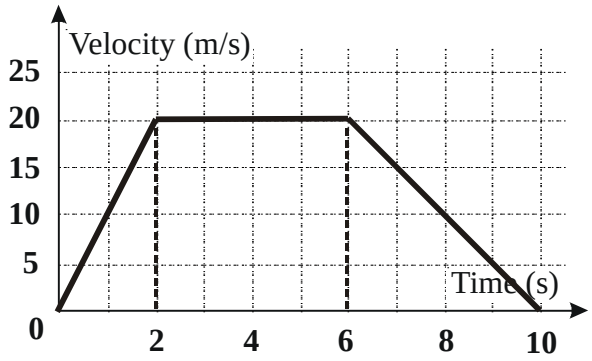
a) What (total) distance did it travel?

140m

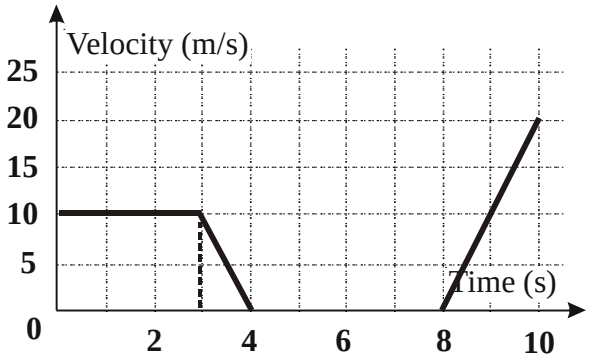
b) How long did it take to decelerate?

4s

c) What was the ***decelerating force***? **500N**



6. Starting at 10 m/s, the cart goes at a constant velocity for 3 s whence it decelerates to a stop in a time of 1 s. After remaining motionless for 4 s, it accelerates at 10 m/s^2.



a) What (total) distance did it travel?

55 m

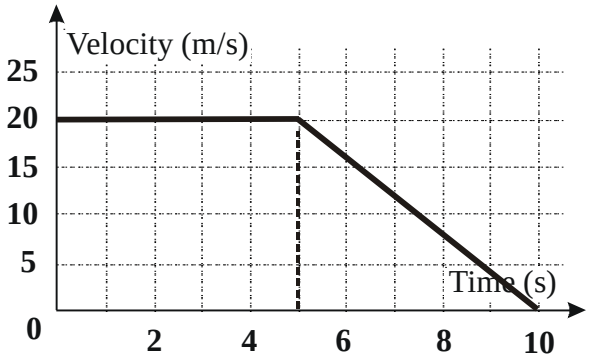
b) What was the ***resultant force*** at t = 2 s?

Zero

c) What was the ***accelerating force***? **1000 N**

d) What was the ***resultant force*** at t = 3.5 s? **-1000 N**

7. Starting at 20 m/s, the cart moves at constant velocity for 5 seconds. It then decelerates at 4 m/s^2.



a) What (total) distance did it travel?

150 m

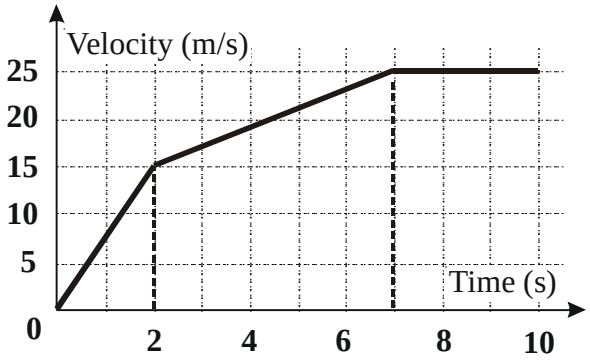
b) How long did it take to decelerate?

5 s

c) What was the ***decelerating force***? **400 N**

d) What is the velocity at t = 6 s? **16 m/s**

8. From rest, the cart accelerates at 7.5 m/s^2 for 2 s. It then accelerates at 2 m/s^2 for 5 s after which it travels at constant velocity for the last 5 s.



a) What (total) distance did it travel?

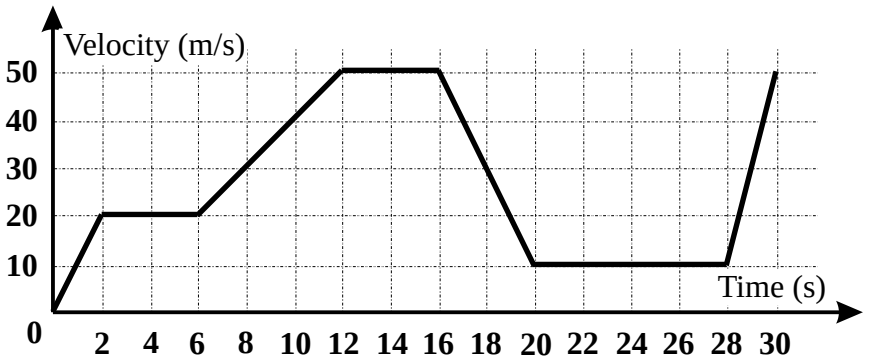
182.5 m

b) What was the resultant force at t = 1 s? **750 N**

c) What was the resultant force at t = 5 s? **200 N**

d) What was the resultant force at t = 8 s? **0**

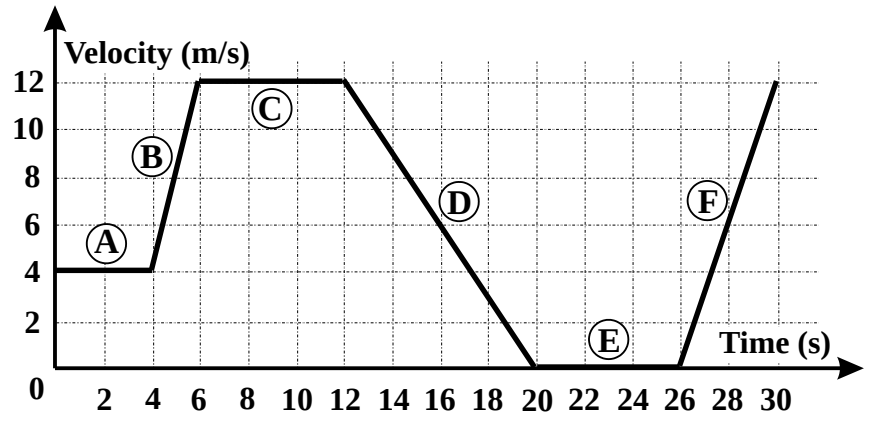
9. The graph below represents the velocity-time curve of a 1000 kg vehicle. Answer the following questions based on this graph.



a) Complete the table below listing the velocity, distance, acceleration and the resultant force at the specified times:

Time (s)	**Velocity** (m/s)	**Distance** (m)	**Acceleration** (m/s^2)	**Resultant force** (N)
t = 1	**10**	**5**	**10**	**10 000**
t = 4	**20**	**60**	**0**	**0**
t = 9	**35**	**182.5**	**5**	**5 000**
t = 15	**50**	**460**	**0**	**0**
t = 22	**10**	**650**	**0**	**0**
t = 25	**10**	**680**	**0**	**0**
t = 29	**30**	**730**	**20**	**20 000**

10. The graph below represents the velocity of an object plotted as a function of time.



a)	During which segment/s (A, B, C, D, E or F) is the object ***accelerating***?	**B, F**
b)	During which segment/s is the object ***decelerating***?	**D**
c)	During which segment/s is the object in ***equilibrium***?	**A, C, E**
d)	Which segment represents the ***greatest velocity***?	**C**
e)	Which segment represents the ***least velocity***?	**E**
f)	Which segment represents the ***greatest acceleration***?	**B**
g)	During which segment/s is the ***resultant force zero***?	**A, C, E**
h)	During which segment/s is the ***resultant force positive***?	**B, F**
i)	During which segment/s is the ***resultant force negative***?	**D**
j)	During which segment has the object traveled the ***greatest distance***?	**C**
k)	During which segment has the object traveled the ***least distance***?	**E**
l)	During which segment is the resultant force the ***greatest***?	**B**
m)	What is the ***average velocity*** during segment-A?	**4 m/s**
n)	What is the ***average velocity*** during segment-F?	**6 m/s**
o)	What is the ***average velocity*** for the first 12 seconds?	**8.7 m/s**

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