Choose the correct answer

16) The mathematical relation for Newton's second law is .....

a) $F = \frac{\Delta mv}{\Delta t}$ b) $F = \frac{\Delta mv^2}{\Delta t}$ c) $F = \frac{v \Delta m^2}{\Delta t}$ d) $F = \frac{m \Delta p}{\Delta t}$

17) The ratio between the net force that affects on the body and the time rate of change of its velocity according to Newton's second law is the .....

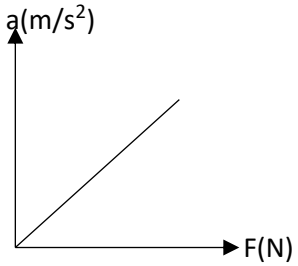
a) momentum of the body b) mass of the body

c) energy of the body d) acceleration of the body

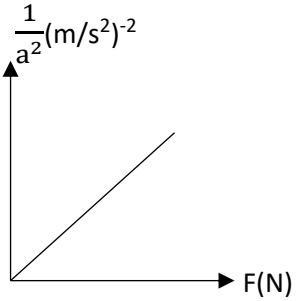
18) The unit that is equivalent to $kg.m.s^{-1}$ is .....

a) N b) N.s c) N/s d) $N.S^2$

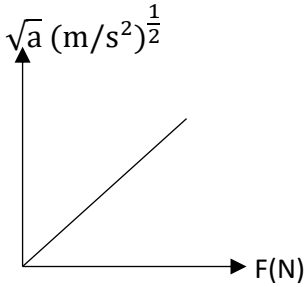
19) The diagram that represents Newton's second law is the .....



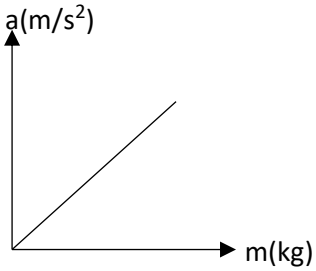
(a)



(b)



(c)

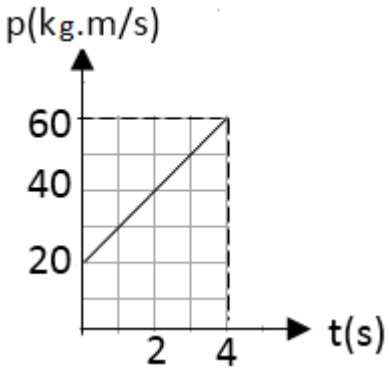


(d)

20) The opposite graph represents the relation between the momentum and the time for the body that moves in straight line on horizontal frictionless surface under the effect of constant force, then the acting force on the body equals .....

a) 6 N a) 10 N

c) 15 N d) 18 N



21) If a force of 2 N acts on an object of mass 0.5 kg, the object moves with an acceleration of .....

a) 0.25 m/s b) $1 m/s^2$

c) $2.5 m/s^2$ d) 4 m/s

22) An object of mass 10 kg is accelerating by $2 m/s^2$, so the acting force on it equals .....

a) 5 N b) 10 N c) 15 N d) 20 N

23) The force that acts on an object of mass 5 kg to change its velocity from 7 m/s to 3 m/s in an interval of 2 s is ……..

a) 10 N b) 5 N c) – 2 N d) – 10 N

24) If a force acting on a body is doubled while its mass is decreased to half, acceleration of its motion …….

a) decreases to its half b) increases to the double
c) increases four times d) decrease to its quarter

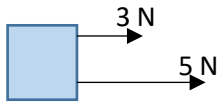
25) a vehicle of mass 500 kg and another of mass 1500 kg are moving at the same acceleration. The force acting on the heavier vehicle will be …….. the force acting on less mass vehicle

a) equal to b) half c) twice d) three times

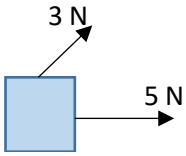
26) the ratio between the acceleration of the body of mass 2 kg to that of a body of 4 kg when they move under the effect of the same force is ……..

a) $\frac{2}{1}$ b) $\frac{1}{2}$ c) $\frac{4}{1}$ d) $\frac{1}{4}$

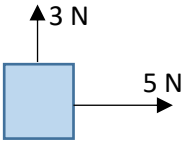
27) Two forces 3 N and 5 N acts on a certain body, which of the following figures represents the least value of the acceleration by which the body will move? ……..(cancelled)



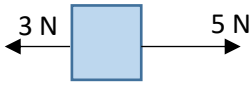
a)



b)



c)



d)

28) A horizontal force of 24 N acts on a body of mass 5 kg to move it on horizontal surface with acceleration of 3 m/s^2, then the magnitude of the friction forces equals …..

a) 6 N b) 8 N c) 9 N d) 39 N

29) A wooden block of mass 2 kg was moving along horizontal plane when affected by force of 6 N. if the frictional force was 2 N, the acceleration of motion equals?……

a) 6 m/s^2 b) 2 m/s^2 c) – 3 m/s^2 d) – 4 m/s^2

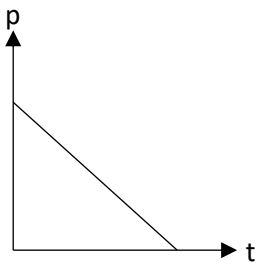
30) The weight of a body is 120 N on Earth, so its weight on the weight on the moon = ... N
(Notice that the acceleration due to the gravity on the moon = $\frac{1}{6}$ the acceleration due to the gravity on the Earth

a) 20 b) 60 c) 100 d) 120

31) A car of mass 1000 kg started motion from rest with a uniform acceleration, so its momentum after 2 s was 4 x 10^3 kg.m/s, thus after from starting motion, its momentum will be … Kg.m/s

a) 8 x 10^3 b) 16 x 10^3 c) $4\sqrt{2}$ x 10^3 d) $8\sqrt{2}$ x 10^3

32) The opposite graph represents the relation between the momentum of a body that is affected by a force F and the time, so the force that acts on the body is ……



a) absent
b) in the same direction of motion
c) in the opposite direction of motion
d) perpendicular to the direction of motion

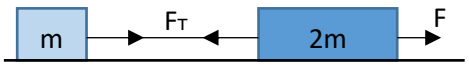
31) A car of mass 240 kg starts its motion from rest on a straight horizontal road under the effect of a force of 750 N, so its velocity reached 5 m/s after a distance of 10 m, then the friction force between the car and the surface of Earth = ……

a) 150 N b) 200 N c) 300 N d) 450 N

32) In the opposite figure: the net force on the bigger mass will be……..

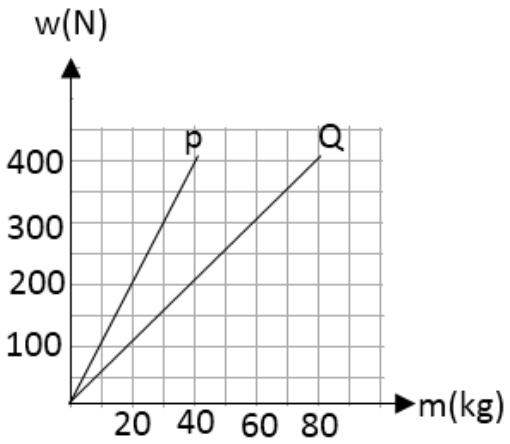
a) greater than 2 N b) equal to 2 N
c) less than 2 N d) no correct answer

33) Two bodies that are connected to the rope of negligible mass are placed on a smooth surface. If an external force (F) acts as in the opposite figure, then the tension force (F_T) in the rope equals …….



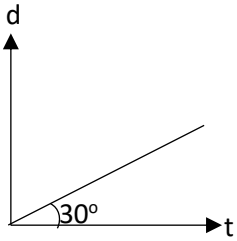
a) zero b) 2 F c) F d) $\frac{F}{3}$

34) The opposite graph represent the relation between the weight and the mass of a group of bodies when they are placed on two planets P and Q. if a body that weights 650 N 2on planet P is translated to planet Q, then ……..

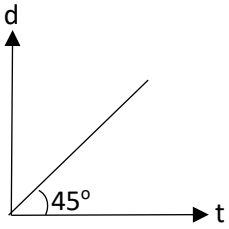


	The mass of the body on planet Q (kg)	The weight of the body on planet Q (N)
a)	130	325
b)	130	1300
c)	65	325
d)	65	1300

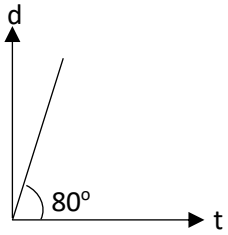
35) The following graphs illustrate a group of objects that have the same mass and they are all drawn to the same scale, so the graph that express the object with highest momentum is…….



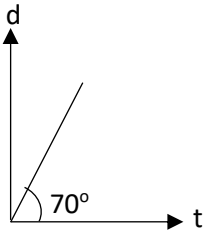
a)



b)



c)



d)

36) A boy pushes a 10 kg crate across the floor with a constant force of 10 N against a force of friction. The box accelerates at rate of 0.1 m/s^2. What if the magnitude of the opposing frictional force?.....

a) 0 b) 1 N c) 5 N d) 9 N

37) A jet flies horizontally where its engines produce a total of 20000 N of forward thrust. If the jet's mass is 50000 kg and it accelerates at 0.3 m/s^2. So what is the magnitude of the air resistance against which the jet flies?.....

a) 1000 N b) 3000 N c) 5000 N d) 10000 N

38) A car with mass of 1000 kg travels at 30 m/s. the driver applies his brakes for a uniform deceleration and comes to complete stop in 60 m. assuming that forward motion is positive, what is the net force acting on the car?.....

a) 7500 N b) 5000 N c) – 5000 d) – 75000

39) A bowler applies a constant net force of 100 N on a 5 kg bowling ball over a time period of 1.5 s before he releases the ball. If the ball starts from rest, so what will be its final velocity?...

a) 5 m/s b) 10 m/s c) 20 m/s d) 30 m/s

40) A girl pushes a 10 kg box from rest across a horizontal floor with a force of 50 N. The force of friction opposing her is 45 N. if the box uniformly accelerates from rest to final velocity of 2 m/s, how much time did it take to get that velocity? …….

a) 1 s b) 2 s c) 3 s d) 4 s

41) A rocket goes from rest to 9.6 km/s in 8 minutes. The rocket's mass is 8×10^6 kg. Assuming a constant acceleration, what is the net force acting on the rocket? ……

a) 1.6×10^5 N b) 9.6×10^5 N c) 9.6×10^6 N d) 160×10^6 N

42) A 1000 kg car is initially travelling at 30 m/s. the driver applies the brakes suddenly and the friction from the road exerts 9000 N of force on the car. If the car uniformly decelerates to a complete stop, how far does the car travel during the braking process? …….

a) 2 m b) 50 m c) 100 m d) 200 m

43) At the very beginning of the dash. A 70 kg runner accelerates uniformly from rest to 10 m/s in 0.5 s as she moves in the positive direction. What is the net force acting upon the runner?

a) – 7000 N b) – 1400 N c) 0 N d) 1400 N

44) Rank of following scenarios from the smallest acceleration to the greatest acceleration:

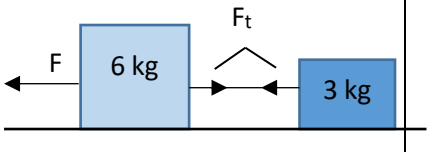
i. Net force F applied to a mass M
ii. Net force 2 F applied to a mass M
iii. Net force F applied to a mass 2 M
iv. Net force 2 F applied to a mass 2 M

a) ii > i= iv > iii b) i > ii > iii > iv c) iii > iv = i > ii d) iv > ii > iii > i

45) Two static objects of mass 2 kg, 18 kg are affected by two equal forces. They moved in straight line and covered the same displacement, so the ratio between their final velocities $\frac{v_1}{v_2}$=

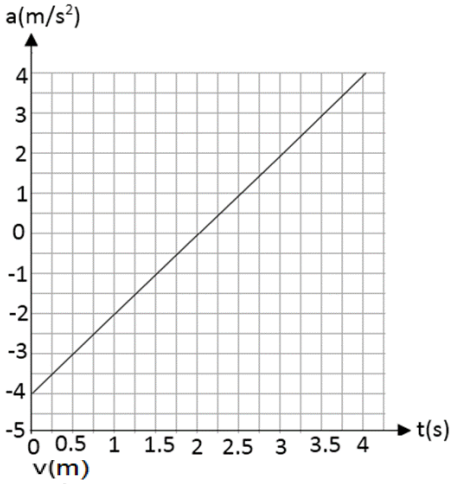
a) $\frac{9}{1}$ b) $\frac{3}{1}$ c) $\frac{1}{3}$ d) $\frac{1}{9}$

46) Two objects on a frictionless surface are connected with a rope of negligible mass. An external force (F) acted on them as in figure, then the tensions in the rope=



a) zero b) 2F c) F d) $\frac{F}{3}$

47) The acceleration of a 5 kg object over time is shown in this graph.



What is the net force at 1 s?.....

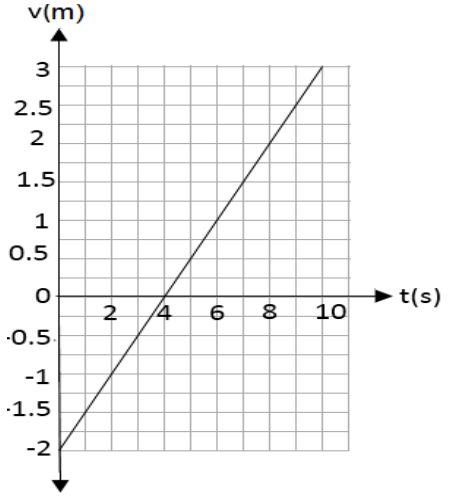
a) – 10 N

b) – 5 N

c) – 2.5 N

d) 5 N

48) A boy is pushing a 50 kg crate across a frictionless surface. The velocity is changing with time as shown in this graph. What is the magnitude of the force that the boy applies to the crate? .....



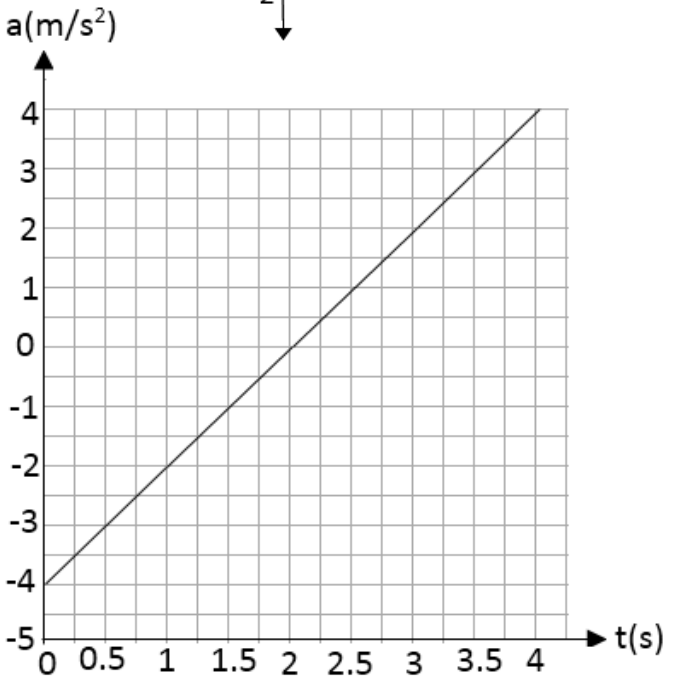
a) 5 N

b) 10 N

c) 15 N

d) 25 N

49) The (acceleration time graph of an object's motion is shown in this figure. At what time will the forces acting on it become balanced?.....



a) 0 s

b) 1 s

c) 2 s

d) 3 s

50) if the kinetic energy of the two bodies a and b is the same and the mass of body a is four times the mass of body b, so the ration between their linear momentums ($\frac{P_a}{P_a}$) (cancelled)

a) $\frac{1}{2}$ b) $\frac{2}{1}$ c) $\frac{1}{4}$ d) $\frac{4}{1}$

51) Two bodies x , y have the same mass if $(KE)_X = 4(KE)_Y$,So the linear momentum of body (x) equals ……..(cancelled)

a) P_y b) $2\ P_y$ c) $4\ P_y$ d) $8\ P_y$

second; Essay questions

1) Explain Newton's first law is a special case of Newton's second law

Newton's second law states that the net force that acts on a body is directly proportional to the body's acceleration (F α a) and when the acting net force vanishes (∑F = 0), also the acceleration vanishes according to this law. which means that the body keeps its state of rest or motion with certain constant velocity which is the same as what stated in Newton's first law, hence the first law of Newton is a special case of the second law of Newton in which the resultant force equals zero.

write down the mathematical relation and mention what the slope equals:

Mathematical relation	slope
a) F =ma	$\frac{F}{m} = a$
b) F =ma	$\frac{F}{a} = m$
c) F =ma	am=F
d) W=mg	$\frac{W}{m} = g$
e) F=ma	$\frac{a}{F} = \frac{1}{m}$
f) P =mv	$\frac{P}{m} = V$
g) P=mv	$\frac{P}{V} = m$

3)

$m_A < m_B < m_C$

$A_A < B_B < C_C$

4)

a) The resultant force will be zero, So the rope will not move to any direction.

b) The rope will move to the direction of the greater force

5)

$W_E = W_m$

$$\frac{m_E}{g_E} = \frac{m_m}{g_m}$$

$$\frac{m_E}{g_E} = \frac{m_m}{\frac{1}{6}g_E}$$

$$m_E = 6\, m_m$$

I prefer to have a piece of gold on the Earth

6) to prevent inertia and decrease the time impact .

7) $F = ma = \frac{\Delta P}{\Delta t} = \frac{\Delta mv}{\Delta t}$

$$\Delta P \; \alpha \; \Delta t$$

$$\frac{P_1}{P_2} = \frac{t_1}{t_2}$$

$$\frac{P}{P_2} = \frac{t}{2t}$$

$$P_2 = 2P$$

8) Car (y) moves with larger acceleration because it has the smaller mass and accordirg to the relation $\frac{F}{m} = a$,the acceleration is inversely proportional to the mass at constant net force.

Third: problems

1)

$P_1 = P_2$

$mv_1 = mv_2$

$v_2 = \frac{m_1 V_1}{m_2} = \frac{5x20}{15} = 6.67 m/s$

---

2)

$$a = \frac{V_f - V_i}{t}$$

$$\frac{(108 - 54)x\frac{5}{18}}{10} = a = 1.5\ m/s^2$$

F =10 x1.5 =15 N

---

3) F=ma

=4x 2=8N

$d = v_i t + \frac{1}{2} a t^2$

$10 = 0 + \frac{1}{2} x 2 x t^2$

$$t^2 = 16$$

t=4 sec

---

4) a) F=ma

=30 x3 =90 N

b) $a = \frac{v_f - v_i}{t} = \frac{8-0}{6}$

$=1.333333 m/s^2$

F=ma=1.333 x 30=40 N

c) $d = v_i t + \frac{1}{2} a t^2$

$50 = 0 + \frac{1}{2} x\ a\ x 5^2$

$a = 4 m/s^2$

F=ma=4 x 30=120 N

5)

a) $a=\frac{v_f-v_i}{t}$

$-5=\frac{0-20}{t}$

t=4 sec

b) $v_f^2=v_i^2+2ad$

$0^2=20^2+2x-5xd$

d=40 m

c) friction force in the opposite direction

F=ma=-5 x 600

= - 3000 N

Calculate the resultant force and the acceleration of each mass in the following figures:

	1	2
F	400-150=250N	Fx=200-200=0 Fy=800-770=30
a	$a=\frac{F}{m}=\frac{250}{50}$=5m/s²	$a=\frac{F}{m}=\frac{30}{20}$= -1.5m/s²

$a=\frac{F}{m}=\frac{100}{10}$=10 m/s²

7)

$v_f^2=v_i^2+2ad$

$20^2=10^2+2x10xd$ d=15 m

8) a) P=mv=1200 x 20=24000 Kg.m/s

b) $a=\frac{v_f-v_i}{t}$ $a=\frac{0-20}{5}$ a= -4 m/s²

$v_f=v_i+at$= 20 – x4 x3 = 8 m/s

P=mv=1200 x 8=9600 Kg.m/s

c) F=ma=1200 x -4

= - 2800 N

9)

b) V=72 km/h =20 m/s

$F=\frac{\Delta p}{\Delta t}$

= -2 x 10 $^3=\frac{\Delta p}{2}$

$\Delta p = -10^4$ kg.m/s

a) $\Delta p = m\Delta v = m(v_f - v_i)$

$-10^4 = 725(v_f - 20)$

$v_f = 6.2\ m/s$

10) $\frac{a_1}{a_2} = \frac{m_2}{m_1}$

$\frac{a_1}{20} = \frac{1}{5}$

$a_1 = \frac{20}{5} = 4$ m/s²

---

11) $a_1 = 8$ m/s²

$a_2 = \frac{48-0}{3} = 16$ m/s²

$$\frac{a_1}{a_2} = \frac{m_2}{m_1}$$

$$\frac{8}{16} = \frac{m_2}{5}$$

$$m_2 = \frac{40}{16} = 2.5\ kg$$

---

12) v_i=20 m/s (مش مكتوبة في المسألة زودها)

$v_f^2 = v_i^2 + 2ad$

$0^2 = 20^2 + 2xax40$

a= -5 m/s²

$$F_f = ma = 8\ x - 5 = -40\ N$$

---

13) $F_m = F_a - F_f$

$ma = 300 - 50$

500 a=250

a=0.5 m/s²

$F_m = 500\ x \frac{1}{2}$=20 N

14)

a) $a=\frac{F}{m}$

$=\frac{600}{1200}$

$a=0.5\ m/s^2$

b) $v_f=v_i+at$

$= 0 + 0.5 \times 30$

$= 15\ m/s$

c) $d=v_i t+\frac{1}{2}at^2$

$d = 0 +\frac{1}{2} \times \frac{1}{2} \times a \times 30^2$

$d = 225\ m$

---

15)

$a= g\ (\frac{m_1-m_2}{m_1+m_2})$

$= 10\ (\frac{7-5}{7+5})$

$a=1.67\ m/s^2$

---

16)

$a=\frac{F}{m_1+m_2+m_3}$

$\frac{36}{12}= 3\ m/s^2$

$T_1=\frac{m_1}{m_1+m_2+m_3} \times F$

$= \frac{2}{12} \times 36=6N$

$T_2=\frac{m_1+m_2}{m_1+m_2+m_3} \times F$

$= \frac{6}{12} \times 36= 18N$

---

17)

$T_1=\frac{m}{6m} \times F$

$= \frac{1}{6} \times F$

$T_2=\frac{3m}{6m} \times F$

$= \frac{1}{3} \times F$

---

18)

$m=\frac{F}{a}$

$=\frac{3000}{3}=1000\ kg$

$W=mg =1000 \times 9.8 =9800\ N$

19) W=mg =50 x 9.8 =490 N
m=50 kg mass doesn't

---

20) W=mg =225 x 9.8 =490 N
m=50 kg mass doesn't change

---

21) $m=\frac{F}{a}$

$=\frac{100}{5}$

m=20 kg

$v_f^2=v_i^2+2ad$

$20^2=10^2+2xa\ x\ 30$

a= 5 m/s²

W=mg =20 x 10 =200 N

---

22) (m=24 kg عدل)

$a=\frac{v_f-v_i}{t}$ $a=\frac{40-25}{2}$ a= 7.5 m/s²

F=ma=7.5 x 24 =180 m/s²

---

23)

W=mg
400=m x 10
m=40 kg

$a=\frac{F}{m}$

$=\frac{200}{40}$

a= 5 m/s²

$v_f=v_i+at$

= 5 + 5 x 3

= 20 m/s

---

25)

$v_f^2=v_i^2+2ad$

$9^2=165^2+2xa\ x\ 2.3\ x10^{-2}$

a= - 4.07 x 10^{-5}m/s²

F=ma=3711.415 N

26)

$F=\frac{1}{2}$ w

$ma=\frac{1}{2}$ mg

$a=\frac{1}{2}$ g= 5 m/s²

$v_f=v_i+at$

= 0 + 5 x 2

= 10 m/s

$d=v_it+\frac{1}{2}at^2$

$d = 0 +\frac{1}{2}$ x 5 x a x2²

d =10 m

27) cancelled

27)

$a=\frac{v_f-v_i}{t}$

$v_{f1}-v_{f2}$

$a\alpha\frac{1}{t}$

$$\frac{a_1}{a_2}=\frac{m_2}{m_1}=\frac{t_2}{t_1}=\frac{5}{3}$$

$$\frac{t_1}{t_2}=\frac{3}{5}$$

28,29) cancelled

30)

a) Velocity is constant

a=zero

$$F_T\cos 60 = F_f$$

$$F_T=\frac{200}{cos\ 60}=400\ \text{N}$$

$$F_m = F_T cos\ 60 - F_f$$

$$0.5x10^3\ x\ 2 = F_T cos\ 60 - 200$$

$$F_T = 2400\ \text{N}$$

31) a) 30 m/s

b) AB (positive acceleration) BC (zero acceleration)

	AB	BC	CD
Acceleration	$a=\frac{30-0}{40}=0.75$	Zero	$a=\frac{0-30}{20}=-1.5$
Force	F=ma=80x0.75=60 N	Zero	F=ma=80x-1.5=-120 N