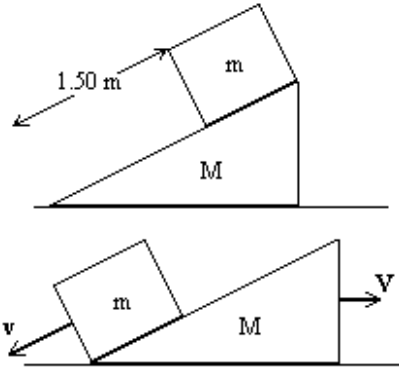



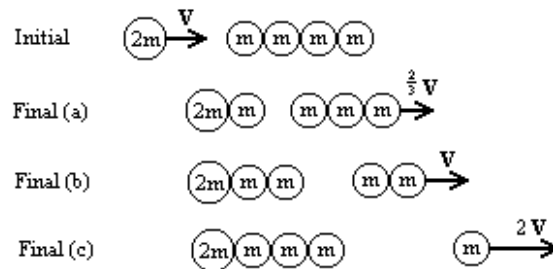
15. A lift moves against a constant resistance force of 200 N that directly opposes the motion. If the weight of this lift is 3000 N, what force is required to move the lift upwards with a constant speed of 1.0 m s^{-1} ? What force is required if the same lift is to accelerate downwards at the rate of 1.0 m s^{-2} ? Most lifts have a retarding force that clamps on to the lift when the support cable breaks, if the above lift has an additional resistance of 2000 N when the cable breaks, what will be the resulting acceleration? In this problem you may use $g = 10.0 \text{ m s}^{-2}$.

16		<p>A small block of negligible dimensions and a mass of $m = 0.50 \text{ kg}$, slides down a large wedge of mass $M = 1.00 \text{ kg}$. The wedge forms a moving ramp at 30° from the horizontal and the block is initially at rest 1.50 m up this ramp. Both the wedge and the block slide without friction.</p> <p>Find the kinetic energy of the block and the wedge when the block reaches the bottom of the ramp. Find the total horizontal momentum of the block and the wedge at this point.</p>
17.		<p>Under the right conditions, one can assume that a skier's skis provide no frictional resistance with the snow. Two stationary skiers are faced with a 100 m high hill and ideal ski conditions. One skier chooses to descend down a flat slope that is 20° above the horizontal while the other goes straight down a flat slope of 60°. What is the speed of each skier at the bottom of the hill and how long does each take to descend? If both skiers weigh 700 N, find the kinetic energy of each at the bottom of the slope. If one skier skis straight down a 500 m hill, what will be the speed at the bottom? Is this a reasonable speed?</p>

18. Two skiers have a race down a short hill under resistance free conditions, the hill the hill has a height of 10.0 m . One skier starts with a speed of 10.0 m s^{-1} and goes 20 m straight down a 30° slope. The second skier has a standing start and skis 14.1 m straight down a 45° slope. If both skiers start together, which skier reaches the bottom first?

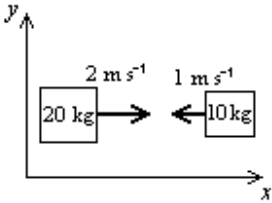
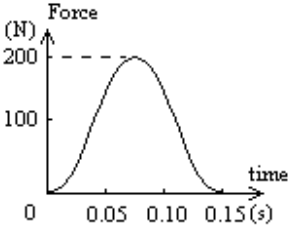
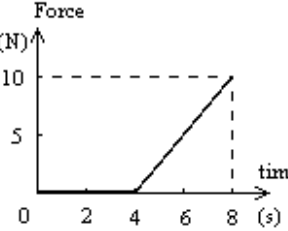
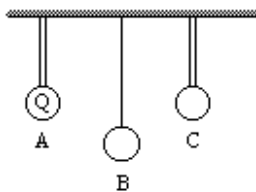
19		<p>Two metal blocks of 20.0 kg and 10.0 kg float in space with a light unattached compressed spring between them. If the spring is released so that both blocks are pushed apart and the 10.0 kg block moves away with a velocity 1.50 m s^{-1} to the right, what is the corresponding velocity of the 20.0 kg block? What kinetic energy is gained from the expansion of the spring?</p>
----	--	---

20.



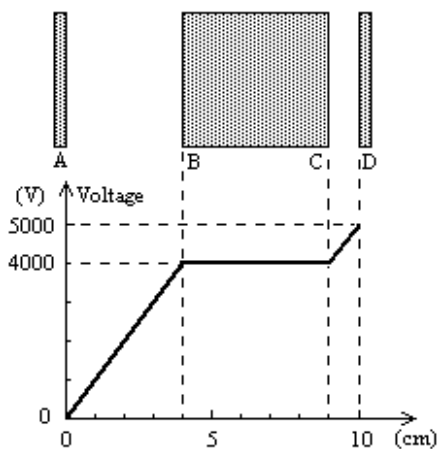
A mass of $2m$ moving to the right with a speed V collides with four stationary masses each of mass m and initially in contact. After an elastic collision, the larger $2m$ mass remains in stationary contact with at least one other mass while the others move off together as shown. Which of the final states is most likely?

21		<p>Two frictionless pucks that move on a horizontal air table are shown just after a collision. If the mass of puck A is 0.10 kg and the collision was elastic, find the mass of puck B and the velocity of puck A before the collision. Assume puck B was stationary before the collision.</p>
22.		<p>Two frictionless pucks that move on a horizontal air table are shown just after a collision. The mass of puck A is 2.00 kg and the mass of puck B is 1.00 kg. If A was stationary before the collision, find the initial speed of puck B. Was this an elastic collision?</p>

23.		<p>Two metal blocks of 20.0 kg and 10.0 kg float towards each other with speeds of 2.0 m s^{-1} and 1.0 m s^{-1} as shown. After a collision, the 20.0 kg block is at rest. Find the velocity of the 10.0 kg block and the change of kinetic energy caused by the collision.</p>
24.		<p>A 0.20 kg cricket ball strikes a bat with a speed of 30 m s^{-1} perpendicular to the surface of the bat. A plot of the impact force against time is shown in the figure. Estimate the speed that the ball leaves the bat.</p>
25.		<p>For the accompanying force vs. time diagram, find a numerical equation for the force that acts between 4 and 8 seconds. If this force is applied to a 2.0 kg mass, that had a velocity of 5.0 m s^{-1} in the direction of the force between 0 and 4 seconds, what is the acceleration of the mass at 6 seconds? What is the speed of the mass at 8 seconds?</p>
26.		<p>Three identical conducting spheres (A,B and C) are suspended by insulating supports. Sphere B is free to move so that it can share half of any charge when in contact with another sphere. Sphere A is initially charged with a charge Q. If B touches A then C, what is the charge on each sphere? If this procedure is repeated many times, what is the ultimate charge on each sphere?</p>

27. Repeat problem 26 for the case when sphere B is only able to hold one third of the charge that is shared between the spheres on contact.

28



Two parallel conducting plates (A and D) are arranged so that when they carry charge, a uniform field is found between them. Plate A is connected to earth while plate D is charged to 5000 V, the spacing between A and D is 10.0 cm as shown. An uncharged conducting block with parallel faces is inserted between A and D so that all faces are parallel with $AB = 4.0$ cm and $CD = 1.0$ cm.

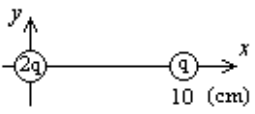
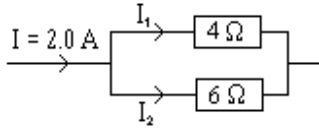
What is the electric field strength between A and D before the block BC is put in position. When BC is put in position. When BC is in position, a charge of -1.00×10^{-6} C is found on the surface of faces A and C, what charge will be found on the surface of face B? Use the plot of voltage against distance to determine the electric field in the regions AB, BC and CD. If the voltage at D is reduced to 2000 V, find the electric field in the regions AB, BC and CD.

29. In the table below, the first row gives the separation between two charges (in metres). Of the remaining four rows A, B, C, and D, one indicates the magnitude of the electrostatic force (in newtons) between the charges, while another row shows the variation in electrostatic energy (in joules) as the distance between the charges varies. Plot the data given in rows A, B, C and D, against $1/r$ and $1/r^2$, and determine which row gives the force and which the energy.

r (m)	3.00×10^{-2}	4.00×10^{-2}	5.00×10^{-2}	6.00×10^{-2}	7.00×10^{-2}	10.00×10^{-2}
A	858	443	265	174	122	54
B	300	169	108	75	55	27
C	51.9	33.7	24.1	18.3	14.6	8.5
D	9.0	6.7	5.4	4.5	3.9	2.7

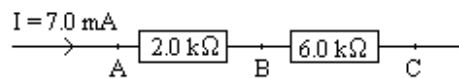
Use your graphs to find the magnitude of the force and the electrostatic energy between the two charges when $r = 8.0 \times 10^{-2}$ m.

30. A particle of mass 0.100 kg and a charge of 1.00 C is released in a uniform field of 1000 V m^{-1} in the x -direction. What is the increase in kinetic energy after the charge has gone 0.10 m in the x -direction? If the particle also had an initial velocity of 10.0 m s^{-1} in the y -direction, what is its velocity after it has gone 0.10 m in the x -direction?
31. A particle of mass $1.00 \times 10^{-6} \text{ kg}$ and charge $1.60 \times 10^{-5} \text{ C}$ moves through a uniform electric field of $1.00 \times 10^6 \text{ V m}^{-1}$ in the x -direction. If the particle crosses the point $x = 0.050 \text{ m}$ and $y = 0$ with a velocity of $1.00 \times 10^3 \text{ m s}^{-1}$ in the y -direction, find the velocity and position of the particle at a time $5.00 \times 10^{-6} \text{ s}$ after crossing the point (x, y) .

32.		Two positive charges are fixed (as shown) on the x -axis. The electric field from each charge is proportional to the amount of charge and the inverse square distance from the charge. Find the points on the x -axis where the magnitudes of the fields from each charge are equal. Hence find the point where the total field is zero. If the charge at the origin of the axes is changed to $-2q$, where is the new zero field point?
33.		Find I_1 , I_2 and the voltage across the 6.0Ω resistor for the circuit fragment shown.

34. An ammeter has a resistance of 10.0Ω and can measure a full-scale current of 10.0 mA . Calculate the value of a single resistor that can be connected to the ammeter to enable it to read 50.0 mA full-scale. Would this resistor be added in series or parallel to the ammeter?

35.



For the above fragment of a circuit, find the voltages between AB, BC and AC.

36. A voltmeter has a resistance of $100 \text{ k}\Omega$ and can measure a full-scale voltage of 10.0 V . Calculate the value of a single resistor that can be connected to the voltmeter to enable it to read 50.0 V full-scale. Would this resistor be added in series or in parallel to the voltmeter?