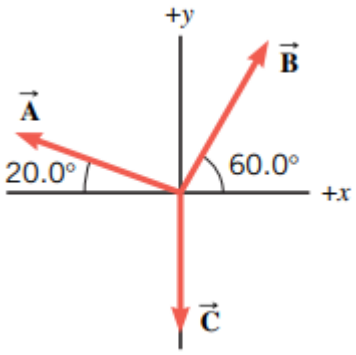
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
Marks	8	13	10	12	12	15	20	10	100
Marks obtained									

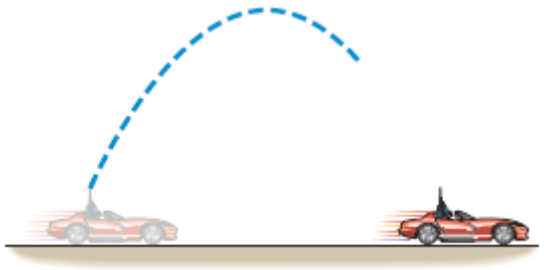
Question 1: Units and Measurements **[8]**

1. The three displacement vectors in the drawing have magnitudes of A = 5.00 m, B = 5.00 m, and C = 4.00 m. Find the resultant (magnitude and directional angle) of the three vectors by means of the component method. Express the directional angle as an angle above/below the positive or negative x axis. (8)



Question 2: Kinematics in one and two dimensions [13]

2.1 Suppose you are driving in a convertible with the top down. The car is moving to the right at a constant velocity. As the diagram illustrates, you point a rifle straight upward and fire it. In the absence of air resistance, would the bullet land **behind you, ahead of you, or in the barrel of the rifle?** Explain your answer in details. (3)



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2.2 A football was shot at an angle of $40°$ above the horizontal with the speed of $22\ m/s$. Ignoring the effects of air resistance, calculate:

2.2.1 the maximum height reached by the ball. (4)

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2.2.2 the time the ball travel before it hits the ground. (4)

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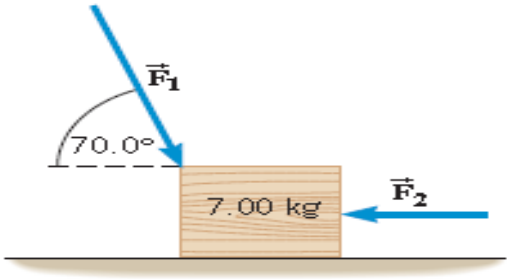
2.2.3 What is the magnitude and direction of acceleration at maximum height? (2)

Question 3: Newton's laws **[10]**

3.1 State Newton's first law of motion (2)

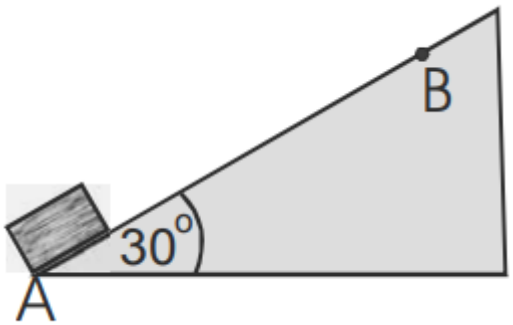
3.2 A person has a choice of either pushing or pulling a sled at a constant velocity, as the drawing illustrates. ***Friction is present.*** If the angle θ is the same in both cases, does it require less force to push or to pull the sled? Explain your answer (3)

3.3 Two forces, F_1 and F_2, act on the 7.00 kg block shown in the drawing. The magnitudes of the forces are F_1 = 59.0 N and F_2 = 33.0 N. Calculate the horizontal acceleration (magnitude and direction) of the block. (5)



Question 4: Work and Energy **[12]**

4.1 A block is kicked at the bottom of an inclined plane (at point A) so that it starts sliding upwards with an initial speed of 2,9 ms-1. The mass of the block is 3,1 kg. A frictional force of 6,5 N is acting on the block. The block comes to rest at point B.



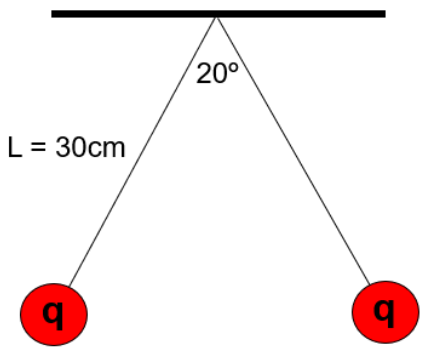
4.1.1 Draw a force diagram showing the forces acting on the block while it is moving upward. (4)

4.1.2 Calculate the total work done on the block (5)

4.1.3 Calculate the component of the resultant force on the block, parallel to the plane. (3)

Question 5: Electric forces and electric field **[12]**

5.1 Two 8 grams equally charged balls are suspended on earth as shown in the diagram below. The length of each chord attached to the charge is 30 cm while the angle between chords is 20^0.

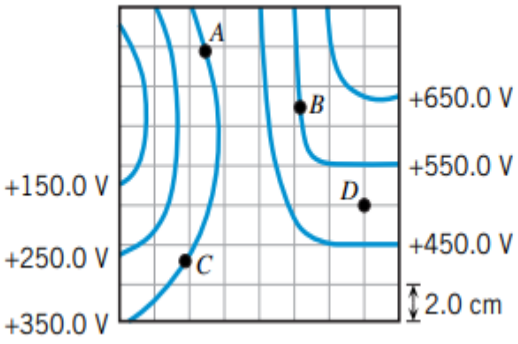


5.1.1 State the principle of conservation of charge. (2)

5.1.2 Calculate the charge on each ball. (10)

Question 6: Electric Potential **[15]**

6.1 The drawing shows a graph of a set of equipotential surfaces seen in cross section. Each is labeled according to its electric potential. A $+2.8 \times 10^{-7}$ C point charge is placed at position A. Calculate the work that is done on the point charge by the electric force when it is moved:



6.1.1 from A to B (4)

6.1.2 from A to C. (1)

6.4 A particle with a charge of −1.5 μC and a mass of 2.5 × 10−6 kg is released from rest at point A and accelerates toward point B, arriving there with a speed of 42 m/s. The only force acting on the particle is the electric force.

6.4.1 Which point is at the higher potential? Give your reasoning. (2)

6.4.2 Calculate the potential difference between A and B($V_B - V_A$). (8)

Question 7: Reflection and refraction [20]

7.1 An object is placed 6.00 cm in front of a concave mirror that has a 10.0-cm focal length.

7.1.1 the location of the image. (4)

7.1.2 If the object is 1.2 cm high. Calculate the image height (3)

7.1.3 Is the image upright or inverted? Explain. (2)

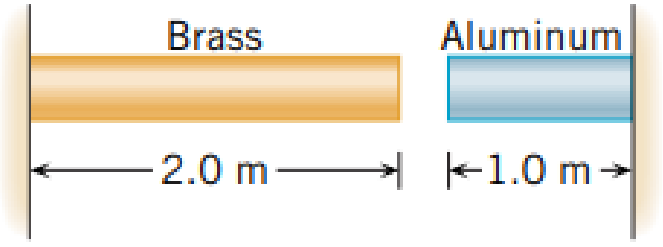
7.2 Define the term: Refraction. (2)

7.3 A convex lens with focal length 3 cm with an object 2 cm to the left of the lens. Using an accurately scaled drawn ray diagram, determine where the image is located. (9)

Question 8: Temperature and heat **[10]**

8.1 What is a bimetallic strip? (2)

8.2 The brass bar ($\alpha = 19 \times 10^{-6}$ $(C^0)^{-1}$) and the aluminium bar ($\alpha = 23 \times 10^{-6}$ $(C^0)^{-1}$) in the drawing are each attached to an immovable wall. At 28 °C the air gap between the rods is 1.3×10^{-3} m. At what temperature will the gap be closed? (8)



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