Name _____

AUGUST 1999

PROVINCIAL EXAMINATION

MINISTRY OF EDUCATION

PHYSICS 12

GENERAL INSTRUCTIONS

1. Insert the stickers with your Student I.D. Number (PEN) in the allotted spaces above and on the **back** cover of this booklet. **Under no circumstance is your name or identification, other than your Student I.D. Number, to appear on this booklet.**

2. Ensure that in addition to this examination booklet, you have an **Examination Response Form**. Follow the directions on the front of the Response Form.

3. **Disqualification** from the examination will result if you bring books, paper, notes or unauthorized electronic devices into the examination room.

4. All multiple-choice answers must be entered on the Response Form using an **HB pencil**. Multiple-choice answers entered in this examination booklet will **not** be marked.

5. For each of the written-response questions, write your answer in the space provided in this booklet.

6. When instructed to open this booklet, **check the numbering of the pages** to ensure that they are numbered in sequence from page one to the last page, which is identified by

    | END OF EXAMINATION |.

7. At the end of the examination, place your Response Form inside the front cover of this booklet and return the booklet and your Response Form to the supervisor.

Value: 60 marks (2 marks per question)   **Suggested Time: 60 minutes**

> **INSTRUCTIONS:** For each question, select the **best** answer and record your choice on the Response Form provided. Using an HB pencil, completely fill in the circle that has the letter corresponding to your answer.

1. Which of the following is true for projectile motion? (Ignore friction.)

|	HORIZONTAL COMPONENT	VERTICAL COMPONENT
A.	constant velocity	constant velocity
B.	constant velocity	changing velocity
C.	changing velocity	constant velocity
D.	changing velocity	changing velocity

2. A ball is thrown vertically upward at 20 m/s from a height of 30 m above the ground. What is its speed on impact with the ground below?

   A. 14 m/s
   B. 24 m/s
   C. 31 m/s
   D. 44 m/s

3. A car travelling north at 20 m/s is later travelling west at 30 m/s. What is the direction of the change in velocity?

A.

B.

C.

D.

OVER

- 1 -
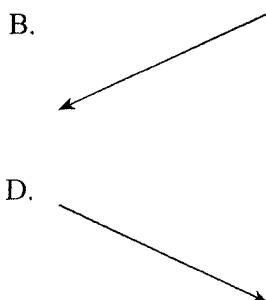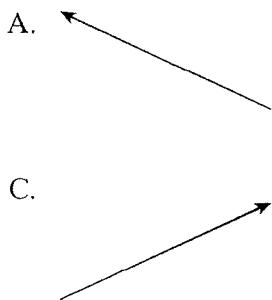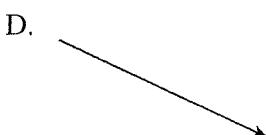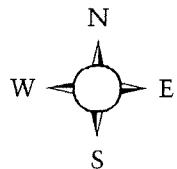
4. Which of the following graphs shows the relationship between acceleration and net force?

A. a

net F

B. a

net F

C. a

net F

D. a

net F
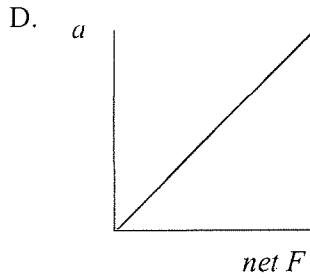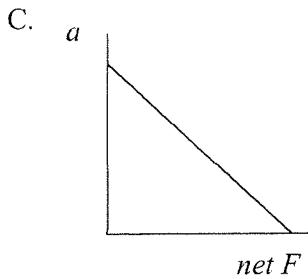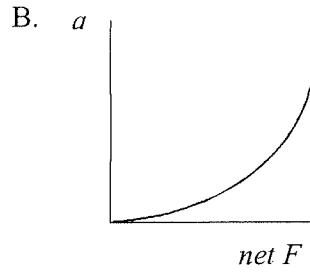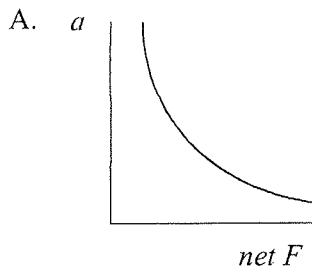
5. A 12 kg cart on a 23° frictionless incline is connected to a wall as shown.
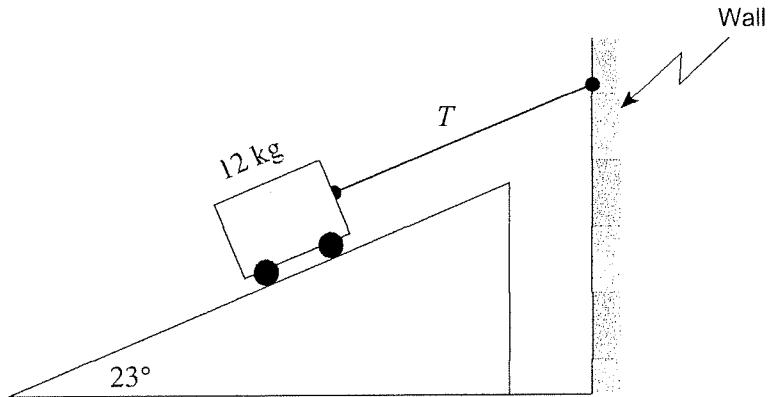
What is the tension T in the cord?

A. 46 N
B. 50 N
C. 110 N
D. 120 N

6. Is power a scalar or vector quantity, and which are the correct units for measuring it?

	TYPE OF QUANTITY	UNITS
A.	Scalar	J/m
B.	Scalar	J/s
C.	Vector	J/m
D.	Vector	J/s

7. A climber's gravitational potential energy increases from 14 000 J to 21 000 J while climbing a cliff. She expends 18 000 J of energy during this activity. What is the efficiency of this process?

A. 3%
B. 39%
C. 61%
D. 97%

8. A 40 000 kg rail car travelling at 2.5 m/s collides with and locks to a stationary 30 000 kg car. Determine the speed of the locked cars and state whether the collision is elastic or inelastic.

	SPEED OF LOCKED CARS	TYPE OF COLLISION
A.	1.4 m/s	Elastic
B.	1.4 m/s	Inelastic
C.	1.9 m/s	Elastic
D.	1.9 m/s	Inelastic

9. The unit for torque is

A. J
B. N·m
C. N·s
D. kg·m/s

OVER

10. An 85 kg object is suspended from a ceiling and attached to a wall.
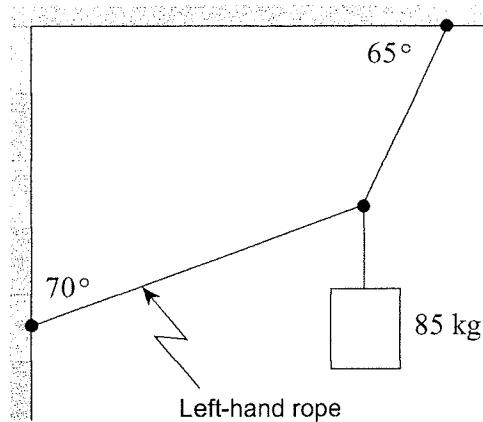
What is the tension in the left-hand rope?

A. 280 N
B. 350 N
C. 500 N
D. 1 100 N

11. A student stands on a uniform 25 kg beam. The scale on the right end reads 350 N.
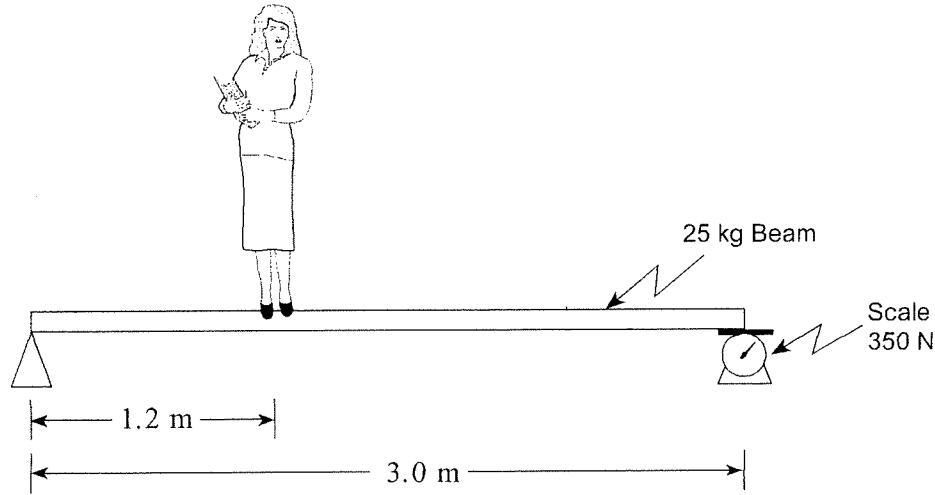
What is the mass of the student?

A. 45 kg
B. 54 kg
C. 58 kg
D. 89 kg

16. Which of the following illustrates the work required to move an object in a gravitational field?

A.

B.

C.

D.
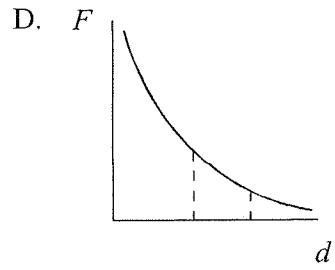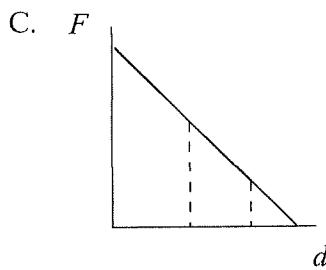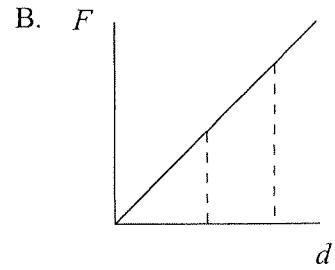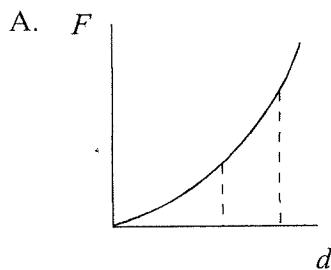
17. A 1 500 kg satellite orbits the earth at 2 500 m/s. What is the satellite's centripetal acceleration?

   A. 0.098 m/s^2
   B. 0.98 m/s^2
   C. 9.8 m/s^2
   D. $1.5 \times 10^2 \text{ m/s}^2$

18. Which diagram shows the electric field near a negative point charge?

   A.

   B.

   C.

   D.
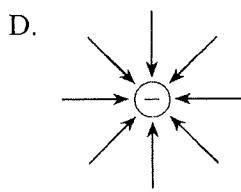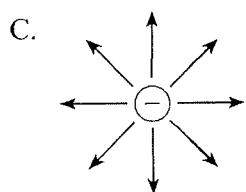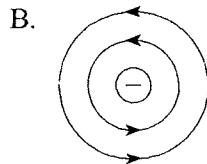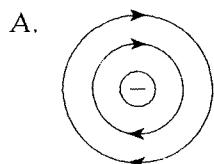
19. Which pair of values will cause the greatest deflection of an electron beam in a cathode ray tube?

	ACCELERATING VOLTAGE	DEFLECTION (PLATE) VOLTAGE
A.	400 V	20 V
B.	400 V	40 V
C.	800 V	20 V
D.	800 V	40 V

20. The magnitude of the net electric field at P in the diagram below is 5.0×10^3 N/C.

$Q_1 = 4.0 \times 10^{-6}$ C

Q_2

3.0 m

3.0 m

P
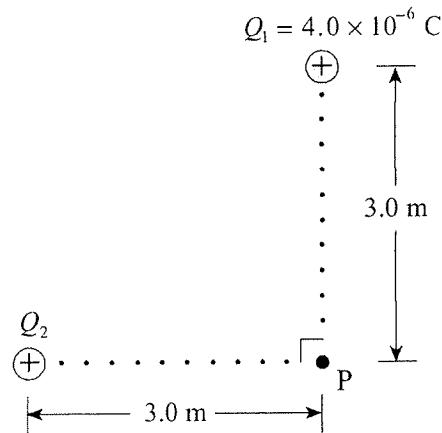
Find the magnitude of charge Q_2.

A. 1.0×10^{-6} C

B. 3.0×10^{-6} C

C. 6.4×10^{-6} C

D. 1.0×10^{-5} C

21. Electricity is transmitted at high potential to

A. operate heavy equipment.
B. maximize current in the transmission lines.
C. minimize the energy lost as heat in the transmission lines.
D. produce alternating currents because they always require high voltages.

22. Find the current flowing through resistor R_2 in the circuit shown below.

$$V = 21\text{ V}$$

$I = 5.0$ A

$R_1 = 14\ \Omega$

R_2
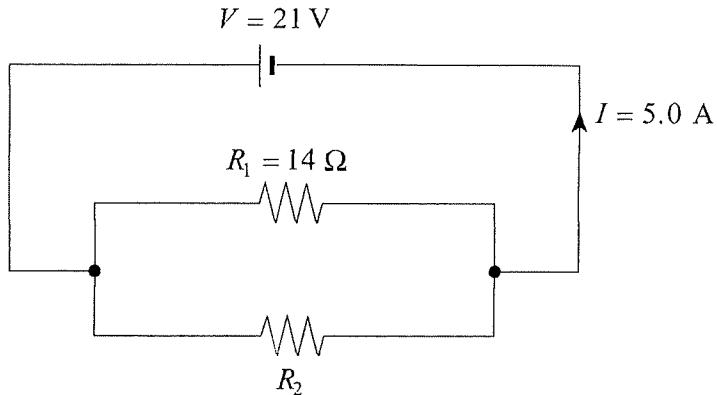
A. 1.5 A
B. 2.5 A
C. 3.5 A
D. 5.0 A

23. A cell has an internal resistance of $0.50\ \Omega$. It has a terminal voltage of 1.4 V when connected to a $5.0\ \Omega$ external resistance. What will its terminal voltage be if the $5.0\ \Omega$ resistor is replaced by a $10.0\ \Omega$ resistor?

A. 0.70 V
B. 1.4 V
C. 1.5 V
D. 2.8 V

24. An electric current flows through a solenoid as shown below.

I
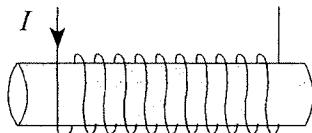
What is the direction of the magnetic field inside the solenoid?

A. → $\vec{B}$

B. ← $\vec{B}$

C. ↑ $\vec{B}$

D. ↓ $\vec{B}$

25. A long conductor is placed in a 0.65 T magnetic field as shown below.
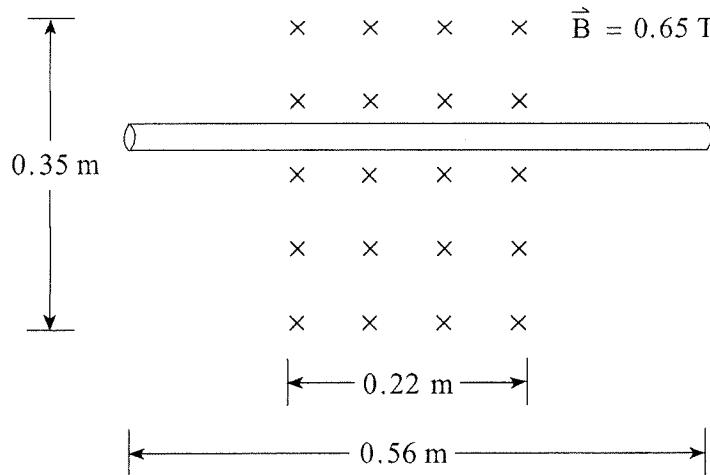
What are the magnitude and direction of the current that produces a 1.6 N force on the wire directed up the page?

	MAGNITUDE OF CURRENT	DIRECTION OF CURRENT
A.	4.4 A	Right
B.	4.4 A	Left
C.	11 A	Right
D.	11 A	Left

26. A proton has a speed of 5.0×10^6 m/s while travelling perpendicular to a 0.14 T magnetic field. What is the magnetic force on the proton?

A. 1.6×10^{-26} N

B. 8.4×10^{-21} N

C. 2.2×10^{-20} N

D. 1.1×10^{-13} N

27. The flux through a circular coil with a radius of 0.075 m is 0.013 Wb when placed perpendicular to a magnetic field. What is the strength of the magnetic field?

A. 0 T

B. 0.17 T

C. 0.74 T

D. 2.3 T

28. The diagram below shows an aluminum ring and the current induced in it by the nearby magnet that is free to move along its central axis.

Aluminum ring

I

S   N   — — Central axis
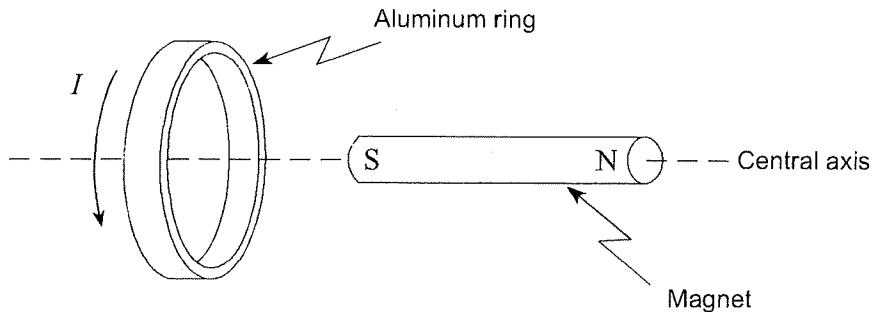
Magnet

The magnet must be

A. stationary.
B. moving to the left.
C. moving to the right.
D. spinning about its central axis.

29. A computer adapter contains a transformer that converts 120 V ac across its primary windings to 24 V ac across its secondary windings. The primary current is 1.2 A. What is the secondary current and what is the type of transformer?

	MAGNITUDE OF CURRENT	DIRECTION OF CURRENT
A.	0.24 A	Step-up
B.	0.24 A	Step-down
C.	6.0 A	Step-up
D.	6.0 A	Step-down

30. A loop of wire of area 0.32 m^2 is placed in a 0.75 T magnetic field as shown. The magnetic field is changed to 0.35 T in the opposite direction in 0.45 s.
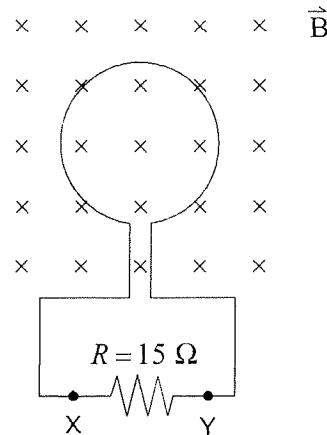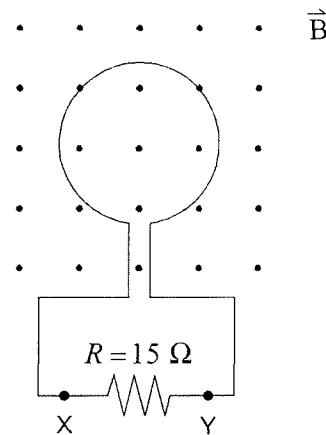
Before   After

What are the magnitude and direction of the current through the 15Ω resistor?

	MAGNITUDE OF CURRENT	DIRECTION OF CURRENT
A.	0.019 A	X to Y
B.	0.019 A	Y to X
C.	0.052 A	X to Y
D.	0.052 A	Y to X

This is the end of the multiple-choice section.
Answer the remaining questions directly in this examination booklet.

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1. An 18 kg cart is connected to a 12 kg hanging block as shown. (Ignore friction.)

18 kg cart

35°

12 kg block
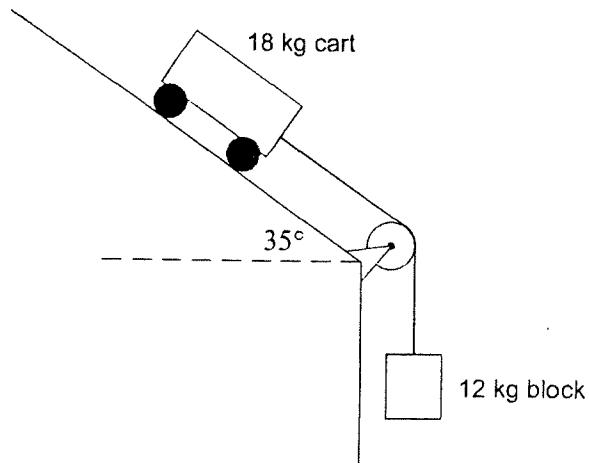
a) Draw and label a free body diagram for the 18 kg cart. **(2 marks)**

b) What is the magnitude of the acceleration of the cart? **(5 marks)**

ANSWER:

b) acceleration: _____

2. A 0.25 kg cart travelling at 3.0 m/s collides with and sticks to an identical stationary cart on a level track. (Ignore friction.)

$v = 3.0$ m/s $\longrightarrow$

$m = 0.25$ kg

h
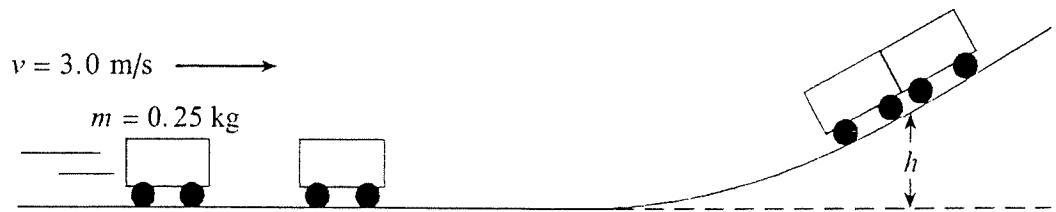
To what height h do the combined carts travel up the hill?   **(7 marks)**

ANSWER:

height: _____

3. A 6.0 m uniform beam of mass 32 kg is suspended horizontally by a hinged end and a cable. A 93 kg object is connected to one end of the beam.

Cable

48°

F_h →

Hinge

4.0 m

6.0 m beam, 32 kg

93 kg object
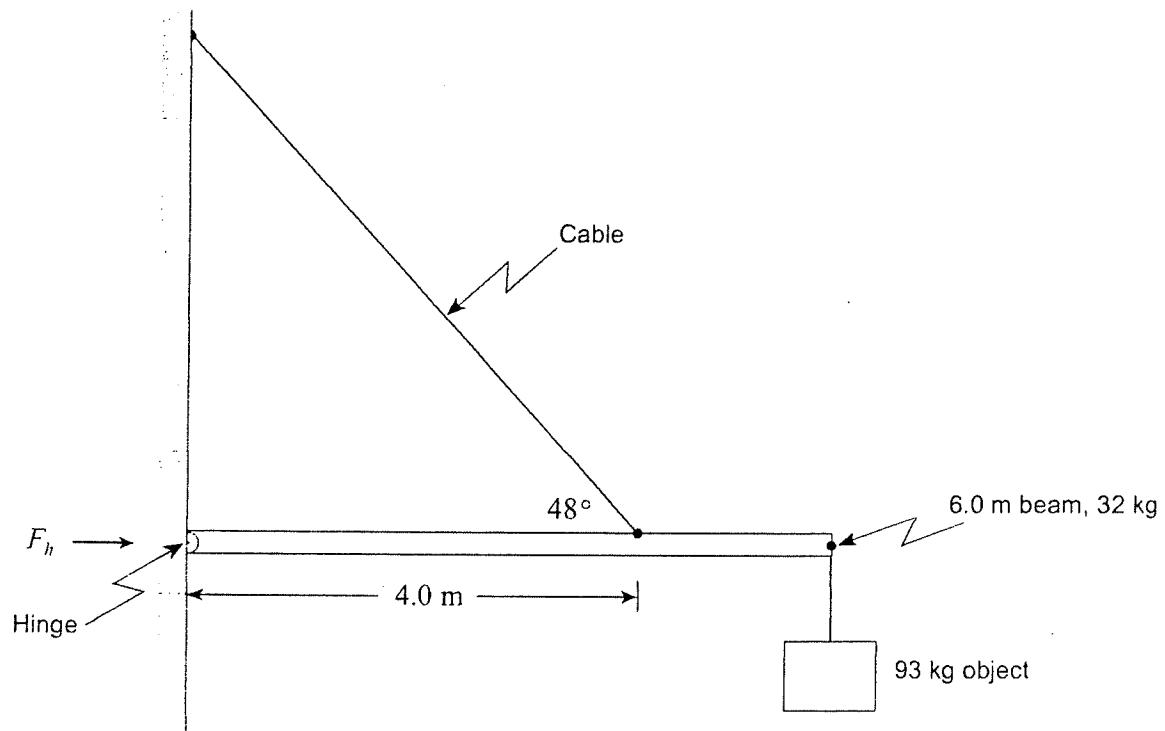
What is the magnitude of the horizontal force F_h that the hinge exerts on the beam? **(7 marks)**

ANSWER:

horizontal force: _____

4. A 1 500 kg satellite travels around the earth in a stable orbit with a radius of 1.3×10^7 m.

   a) What is the speed of the satellite in this orbit?   (5 marks)

   b) The satellite is then moved to a new orbit with twice the radius of the first orbit. The speed in this orbit is

   ☐ the same as
   ☐ less than
   ☐ more than

   the speed in the first orbit. (Check one response.)   (1 mark)

   c) Using principles of physics, explain your answer to b).   (3 marks)

   _____

   _____

   _____

   _____

   _____

   _____

   ANSWER:

   a) speed: _____

5. a)   Find the electric potential at point A and at point B. (Note: $1.0\ \mu C$ is $1.0 \times 10^{-6}\ C$)

(3 marks)

$Q = -15.0\ \mu C$

$\ominus$

A

B

|← 3.0 m →|

|← 5.0 m →|
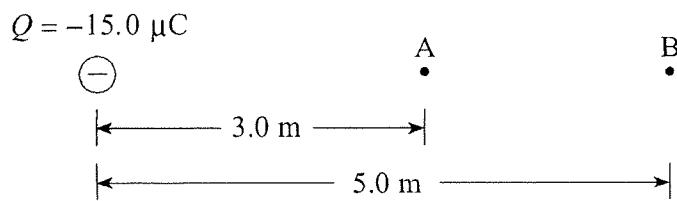
ANSWER:

a) potential at A: _____

   potential at B: _____

b) What is the potential difference between A and B? **(1 mark)**

```
ANSWER:

b) potential difference: _____
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c) 0.036 J of work must be done to move a charge q from A to B. Find the magnitude and polarity of this charge. **(3 marks)**

$$Q = -15.0 \ \mu C$$

q q
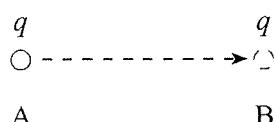
A   B

```
ANSWER:

c) charge: _____

   polarity: _____
```

OVER

6. a) Find the value of resistor R_2. **(5 marks)**

V

$R_3 = 5.0\ \Omega$

$R_4 = 10.0\ \Omega$

$I = 2.40$ A

$R_1 = 6.0\ \Omega$

R_2

$I_1 = 0.60$ A
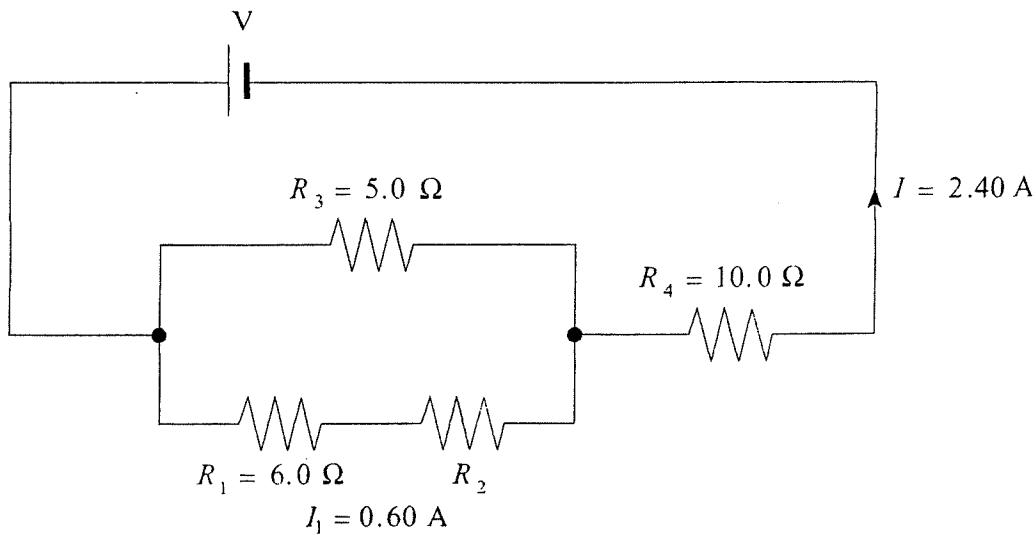
b) Find the potential difference of the power supply V. **(2 marks)**

ANSWER:

a) resistor R_2: _____

ANSWER:

b) potential difference: _____

7. An automobile starter motor, connected to a 12.0 V battery, produces a back emf of 9.7 V when operating at normal speed. A malfunction prevents the starter motor from turning and the current increases to 180 A. What current does the starter motor draw when operating normally? **(7 marks)**

- 26 -

ANSWER:

current: _____

8. An electric motor is connected to a 9.0 V power supply. The data table below shows how the back emf of the motor, V_{back}, varies with the current through the armature, I, as the mechanical load changes.

Back emf V_{back} (V)	7.5	6.0	4.5	3.0	1.5	0
Current I (A)	1.0	2.0	3.0	4.0	5.0	6.0

a) Plot this data on the graph below.   **(2 marks)**

V_b (V)

0

0

I (A)
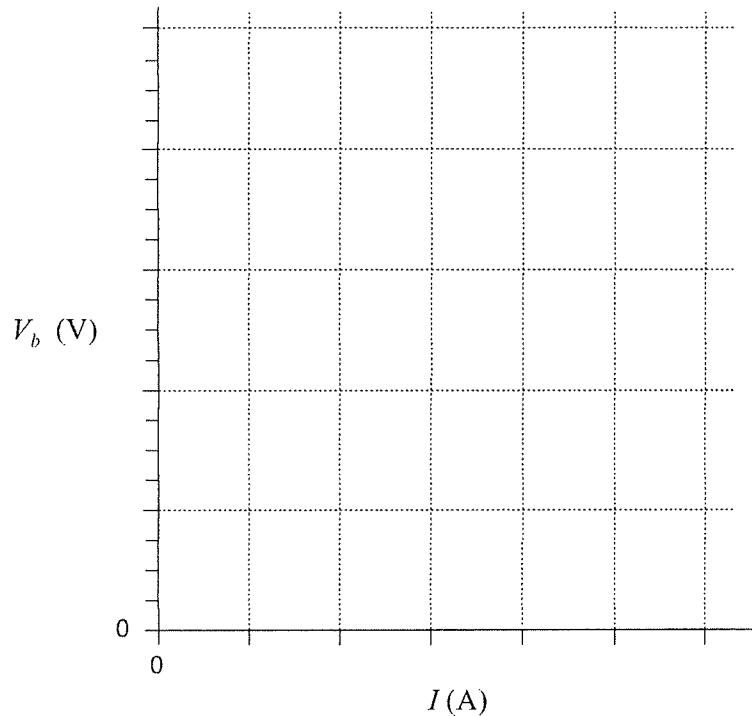
b) Determine the slope of this graph. **(2 marks)**

c) What property of the motor does the slope of this graph represent? **(1 mark)**

ANSWER:

b) slope: _____

OVER

9. A cyclist must do 1 000 J of work to speed up from 0 m/s to 5.0 m/s. The same cyclist must do 3 000 J of work to speed up from 5.0 m/s to 10.0 m/s. (In both instances friction has been ignored.) Using principles of physics, explain why more work must be done to speed up from 5.0 m/s to 10.0 m/s than from 0 m/s to 5.0 m/s. (Remember, friction plays no role in this problem.) **(4 marks)**

_____

_____

_____

_____

_____

_____

_____

_____

END OF EXAMINATION