Physics 12

June 1999 Provincial Examination

ANSWER KEY / SCORING GUIDE

CURRICULUM:

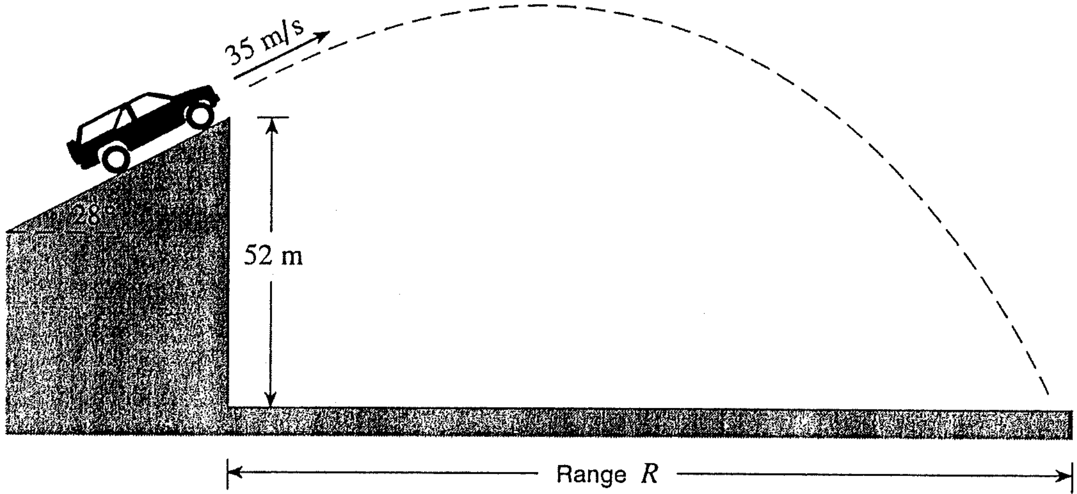
	Organizers	**Sub-Organizers**
1.	Vector Kinematics in Two Dimensions	A, B
	and	
	Dynamics *and* Vector Dynamics	C, D
2.	Work, Energy and Power	E
	and	
	Momentum	F, G
3.	Equilibrium	H
4.	Circular Motion	I
	and	
	Gravitation	J
5.	Electrostatics	K, L
6.	Electric Circuits	M, N
7.	Electromagnetism	O, P

PART A: Multiple Choice (each question worth TWO marks)

Q	K	C	CO	PLO	Q	K	C	CO	PLO
1.	C	K	1	C6	16.	A	H	4	I4, A10
2.	A	U	1	C7, 8, D5	17.	D	K	4	J10
3.	B	U	1	C4, 7, D3	18.	C	U	4	J8, I4
4.	C	U	1	C3, 7, D1, 5	19.	D	K	5	L7
5.	B	U	1	C4, 8, D3, 6	20.	C	U	5	L6
6.	B	U	2	E1	21.	B	H	5	K2, I4
7.	A	K	2	F2	22.	C	K	6	M9
8.	D	U	2	E7, F7	23.	D	U	6	N2
9.	C	U	2	G3	24.	C	H	6	M7, 5, N2
10.	C	K	3	H9	25.	A	K	7	O3
11.	B	U	3	H2, 3	26.	C	U	7	O6
12.	D	U	3	H11	27.	A	U	7	O8, P1
13.	B	K	4	I3	28.	D	U	7	P4
14.	C	U	4	I4	29.	C	U	7	P9
15.	C	U	4	I4, J2	30.	D	U	7	P11

Multiple Choice = 60 marks

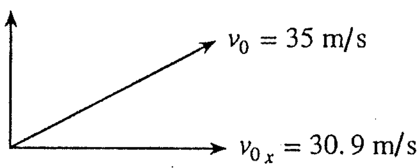
1. A stunt vehicle leaves an incline with a speed of 35 m/s at a height of 52 m above level ground. Air resistance is negligible.



a) What are the vehicle's vertical and horizontal velocity components as it leaves the incline?

(1 mark)

Components: $v_{0_y} = 16.4$ m/s



b) What is the vehicle's time of flight? **(4 marks)**

$$d = v_0 t + \frac{1}{2}at^2$$

$$-52 = 16.4t + \frac{1}{2}(-9.8)t^2$$

$$t = 5.3\text{ s}$$ ← **4 marks**

c) What is the vehicle's range, R ? **(2 marks)**

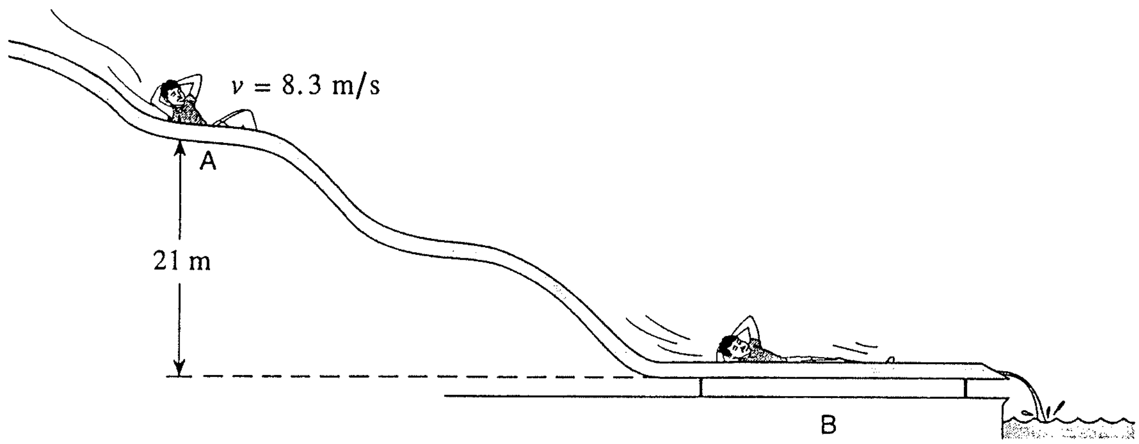
$$R = v_x t$$

$$R = 30.9(5.3)$$

$$R = 165\text{ m}$$

$$R = 1.6 \times 10^2\text{ m}$$ ← **2 marks**

2. A 45 kg child on a water slide passes point A at 8.3 m/s.



As the child descends from A to B, 3 600 J of heat energy is created because of friction. What is his speed at B? **(7 marks)**

$$E = E'$$ ← **1 mark**

$$E_k + E_p + E_H = E_k' + E_p' + E_H'$$ ← **2 marks**

$$\tfrac{1}{2}mv^2 + mgh = \tfrac{1}{2}m(v')^2 + E_H'$$ ← **1 mark**

$$\tfrac{1}{2}(45)(8.3)^2 + 45(9.8)(21) = \tfrac{1}{2}(45)(v')^2 + 3\,600$$ ← **1 mark**

$$1\,550 + 9\,260 = 22.5(v')^2 + 3\,600$$ ← **1 mark**

$$v' = 18 \text{ m/s}$$ ← **1 mark**

OR

$$E = E'$$
$$E_k + E_p + E_H = E_k' + E_p' + E_H'$$
} ← **2 marks**

$$E_k = \tfrac{1}{2}mv^2 = 1\,550 \text{ J}$$ ← **1 mark**

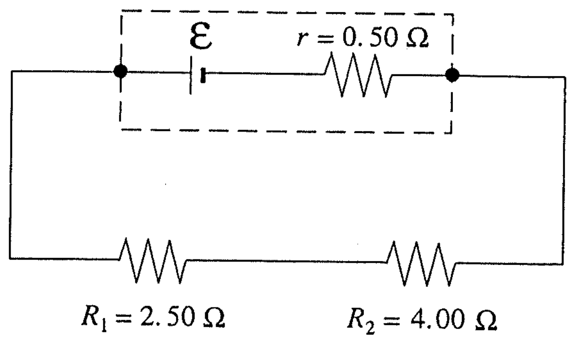
$$E_p = mgh = 9\,260 \text{ J}$$ ← **1 mark**

$$E_k' = \tfrac{1}{2}mv^2 = \tfrac{1}{2}(45)(v')^2$$ ← **1 mark**

$$E_H' = 3\,600 \text{ J}$$ ← **1 mark**

$$v' = 18 \text{ m/s}$$ ← **1 mark**

6. The cell shown in the diagram supplies a $1.80\ \text{A}$ current to the resistors R_1 and R_2.



a) What is the terminal voltage of the cell? **(3 marks)**

$V_T = IR$ $\leftarrow \frac{1}{2}$ **mark**

$= 1.80(2.50 + 4.00)$ $\leftarrow$ **2 marks**

$= 11.7\ \text{V}$ $\leftarrow \frac{1}{2}$ **mark**

b) What is the emf of the cell? **(4 marks)**

$V_T = \varepsilon - Ir$ $\leftarrow$ **1 mark**

$11.7 = \varepsilon - 1.80(0.50)$ $\leftarrow$ **2 marks**

$\varepsilon = 12.6\ \text{V}$ $\leftarrow$ **1 mark**

7. A rectangular coil of wire containing 250 loops is placed in a magnetic field. Each loop measures 0.075 m by 0.28 m. The magnetic field changes over a time interval of 0.36 s producing an average emf of 1.3 V. What is the change in the magnetic field strength?

(7 marks)

$$\mathcal{E} = \frac{-N\Delta\Phi}{t} \qquad \Delta\Phi = \Delta BA$$

$$\Delta B = \frac{\mathcal{E} \cdot t}{N \cdot A} \qquad \leftarrow \textbf{3 marks}$$

$$= \frac{1.3\text{ V} \times 0.36}{250(0.075 \times 0.28)} \qquad \leftarrow \textbf{3 marks}$$

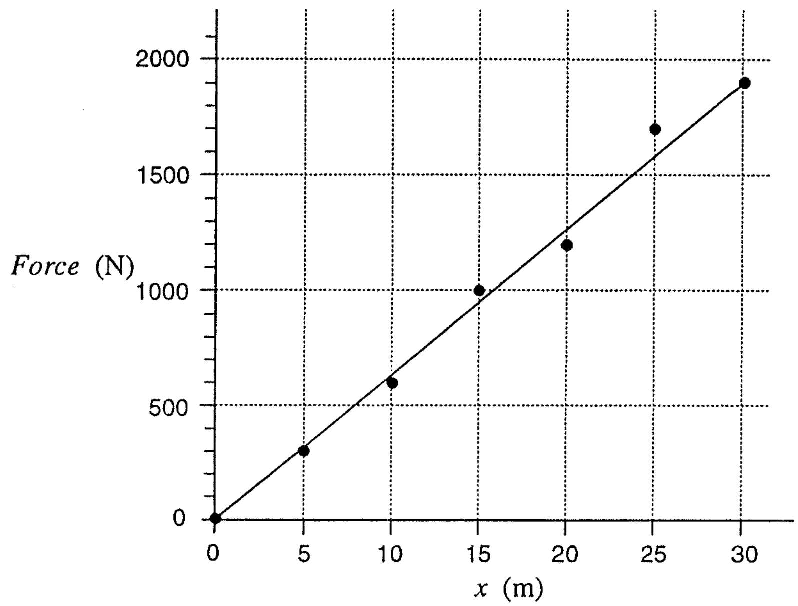
$$\Delta B = 0.089\text{ T} \qquad \leftarrow \textbf{1 mark}$$

(Accept + or − answers)

8. A daredevil is attached by his ankles to a bungee cord and drops from the top of a bridge. The force exerted on the daredevil by the bungee cord is measured against the change in length, x, of the cord as the cord is stretched, slowing the daredevil's fall.

Force (N)	0	300	600	1 000	1 200	1 700	1 900
x (m)	0	5	10	15	20	25	30

a) Plot a graph of force vs. change in length on the graph below. **(2 marks)**

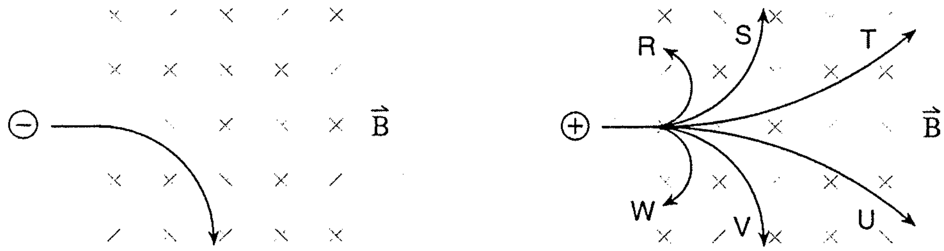


b) Use the graph to determine the work done by the bungee cord during its stretch. **(3 marks)**

$$Area = \frac{1\,900 \cdot 30}{2} = 28\,500 \text{ J}$$

$$= 2.9 \times 10^4 \text{ J}$$ $\leftarrow$ **3 marks**

9. An electron travelling at a high speed enters a magnetic field as shown. A proton travelling at the same speed then enters the magnetic field.



a) Which of the six possible paths shown does the proton follow? **(1 mark)**

Path T

b) Using principles of physics, explain why the proton takes the path selected in a). **(3 marks)**

Since a proton has a positive charge it will travel in the opposite direction as the electron. The proton is also more massive than the electron, therefore the F_B will cause a smaller a_C and hence a larger radius for its path.

END OF KEY