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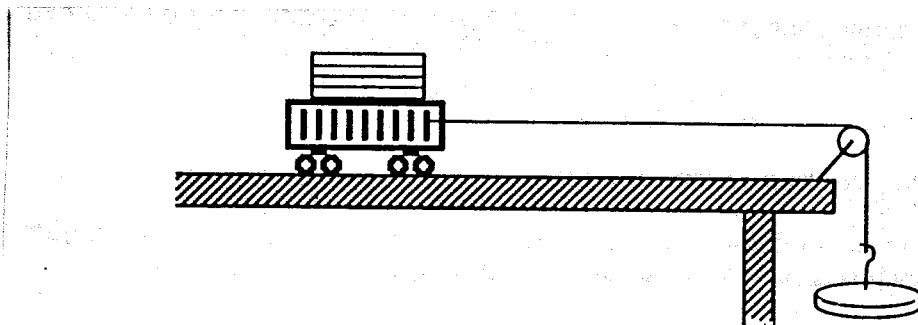
SAMPLE PRACTICAL TEST QUESTION

A trolley loaded with four 50 g masses and attached to a 50 g mass carrier by means of a string, as shown, is set up in an experiment to investigate the relationship between force, mass and acceleration.

The trolley is released and after several runs, the mean acceleration is calculated.

The experiment is repeated 4 times, with one mass from the trolley being transferred to the mass carrier each time. This varies the force acting on the system while keeping the total mass of the system constant. Note that the term "system" refers to the trolley + masses on trolley + hanging masses.

The results are shown in the table below.

Hanging Mass (g)	Force on system (N)	Mean Acceleration of system (ms^{-2})
50.0	0.49	0.25
100.0	0.98	0.55
150.0	1.47	0.90
200.0	1.96	1.19
250.0	2.45	1.51

(a) On the graph paper provided, plot the force on the system versus the mean acceleration. Draw a straight line of best fit.

(b) Calculate the slope of your graph.

$$Slope = \frac{Vertical\ rise}{horizontal\ run} = \frac{(2.5 - 0.1)}{(1.55 - 0)} = 1.55\ N(ms^{-2})^{-1}$$

$$= 1.55\ kg$$

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

(c) What does the slope of your graph represent?

The mass of the whole system. $M = \dfrac{F}{a}$

(d) Use your graph to determine the mass of the unloaded trolley.

For whole system mass = 1.55 kg

Total mass of (4 × 50g masses) + (1 × 50g mass carrier)

= 0.25 kg

∴ Mass of unloaded trolley = 1.55 - 0.25 = 1.30 kg.

(e) Explain why your graph does not pass through the origin.

Some of the applied force is needed to overcome friction between trolley + bench. So no acceleration occurs until this friction force has been exceeded. For graph to pass through origin there would have to be no friction present.

(f) Does the "Force on System" shown in the table represent the applied force or the net force acting on the system? Explain.

Applied force — if it was net force then graph would pass through origin and the instant the net force was non-zero, acceleration would also be non-zero.

(g) Determine the size (if any) of the frictional resistance between the trolley and the bench.

0.1 N = frictional resistance (= intercept on force axis)

(a) Force on System v's Mean Acceleration

2 millimetre Grid

Force on system (N) — vertical axis: 2.5, 2.0, 1.5, 1.0, 0.5, 0.1

Acceleration (ms⁻²) — horizontal axis: 0, 0.25, 0.50, 0.75, 1.00, 1.25, 1.50, 1.55