

Topic Test - Linear Motion (1.5)

A PHYSICS

Explain the Physics; show all working + all units.

* Take $g = 10 \text{ N/kg}$ (or m/s^2)

Ignore air resistance unless otherwise instructed.

1 Write the 4 equations of motion - explain what each symbol means + give the units. (9)

2 This question is about the motion of a car on a journey.

The car (mass 1200 kg) accelerates steadily from rest on level ground to a speed of 20 m/s in a time of 15 seconds .

(a) What is the forward engine force needed? (3)

The car travels at a speed of 20 m/s for 30 seconds and then decelerates steadily to rest.

(b) Sketch the velocity / time graph - include the data you have been given. (4)

(c) If the total distance travelled is 1000 m , at what time after the start did the car stop? (3)

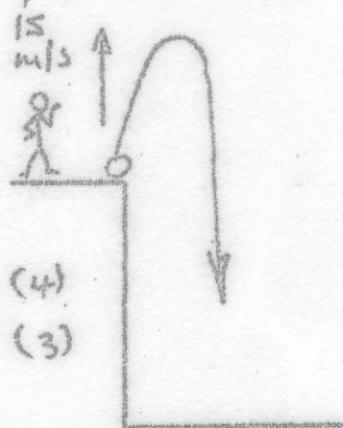
3. A person standing on a cliff throws a stone up with an initial velocity of 15 m/s .

(a) How high above the cliff edge does the stone go? (4)

(b) How long does it take to return to the cliff top? (3)

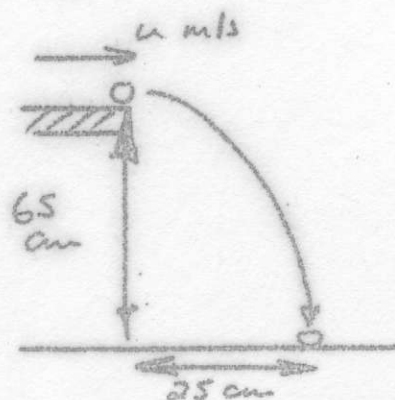
(c) How high above the cliff edge is the stone, 0.5 sec after being thrown? (2)

(d) The stone carries on falling below the cliff edge. What is its velocity when it is 10 m below the cliff edge? (3)



4 A bored student in a Physics lesson watches a marble roll off a table, and hit the ground 25 cm from its edge.

If the table is 65 cm high, what was the marble's speed just before it fell off? (4)



Test - Linear Motion (1.5) - ANSWERS

A-Physics

1. $s = vt$

explain...

$s = ut + \frac{1}{2}at^2$

u, v, a, s, t

eqs 1 each

Symbols $\frac{1}{2}$ each

units $\frac{1}{2}$ each

$v = u + at$

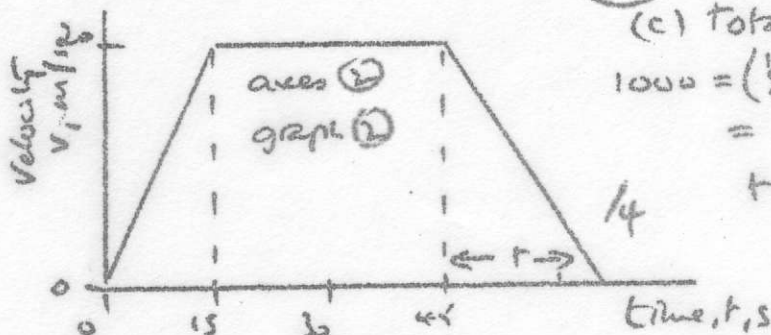
$v^2 = u^2 + 2as$

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2(a) $F_{\text{engine}} = ma = 1200 \times \frac{20}{15} = 1600 \text{ N}$

1/3

(b)



(c) Total dist. = area

$1000 = (\frac{1}{2} \times 15 \times 20) + (30 \times 20) + (\frac{1}{2} \times t \times 20)$

$= 150 + 600 + 10t$

$t = 25 \text{ s}$

Car stops at 70 s.

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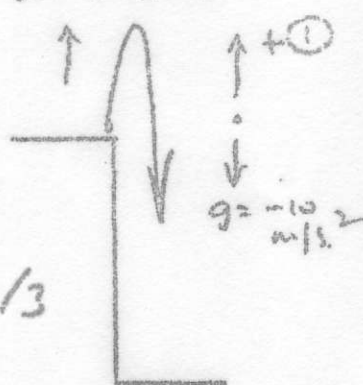
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3(a) $v^2 = u^2 + 2as$ at top of throw $v = 0$

max height $s = \frac{v^2 - u^2}{2a} = 11.25 \text{ m}$

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$u = +15 \text{ m/s}$



(b) Time to top $v = u + at$

$t = \frac{v - u}{a} = \frac{0 - 15}{-10} = +1.5 \text{ s}$

Time for stone to return to cliff top = 3 s

1/3

(c) at $t = 0.5 \text{ s}$ height $s = ut + \frac{1}{2}at^2 = 7.5 - 1.25$

$= 6.25 \text{ m}$

1/2

(d) at 10 m below cliff edge

$v^2 = u^2 + 2as = 15^2 + 2(-10)(-10) = 425$

so $v = 20.6 \text{ m/s}$ down

1/3

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4 Physics? How far does the marble move horizontally in the time it takes to hit the floor?

Time to hit floor - consider vertical velocity.

$s = ut + \frac{1}{2}at^2$ $u = 0$ so... $s = \frac{1}{2}at^2 \Rightarrow t = 0.36 \text{ s}$

Consider horizontal velocity

Short. = $v_{\text{horiz.}} \times t$

so $v_{\text{horiz.}} = s/t = 0.25/0.36 = 0.69 \text{ m/s}$

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1.97