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9.4 Constant Acceleration formulae 2

1) $a=3$, $u=4$, $s=100$

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

$v^2=(4^2)+2(3)(100)$

$v^2=16+600$

$v^2=616$

$v=\sqrt{616}=24.8\,ms^{-1}$

2) $u=0$, $v=16$, $s=80$

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

$(16)^2=(0)^2+2(a)(80)$

$256=160a$

$a=1.6\,ms^{-2}$

3) $a=2.4$, $u=2$, $t=10$

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

$s=(2)(10)+\frac{1}{2}(2.4)(10)^2$

$s=140m$

4) $u=16$, $s=32$, $t=8$

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

$32=16(8)+\frac{1}{2}(a)(8)^2$

$32=128+32a$

$32a=-96 \rightarrow a=-3\,ms^{-2}$

$|a|=\sqrt{(-3)^2}=3\,ms^{-2}$

5) $a=-1.5$, $s=75$, $v=8$

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

$(8)^2=u^2+2(-1.5)(75)$

$65=u^2-225$

$u^2=289$

$u=\sqrt{289} \rightarrow 17\,ms^{-1}$

6) $a=3.5$, $u=6$, $s=160$

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

$160=(6)(t)+\frac{1}{2}(3.5)(t^2)$

$160=6t+1.75t^2$

$1.75t^2+6t-160=0$

$t=8$ $\quad t=-11.4$ (can't be negative)

$t=8$ seconds

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

$0=(12.5)^2+2(-1.5)(50)$

$u=\sqrt{312.5}$

$0=(12.5)^2+2(-1.5)(s)$

$s=\frac{(12.5)^2}{3}=52m$

The car will not stop before the stop sign as the stopping distance is more than 50m.

8) $v=10$, $u=15$, $a=-0.25$

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

$(10)^2=(15)^2+2(-0.25)(s)$

$0.5s=125$

$s=250m$

9) a) a) $v^2=u^2+2as$

$(30)^2=(0)^2+2a(500)$

$90=1000a$

$a=0.9\,m/s^2$

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

$v^2=(0)^2+2(0.9)(200)$

$v^2=360$

$v=\sqrt{360}=18.97 \rightarrow 19\,m/s$

b) The uniform acceleration assumption is incorrect. The car accelerating at a lower rate in the first 200m than the final 300m.

10) a) $a=\frac{\Delta v}{\Delta n}=\frac{18-u}{20}=\frac{18-27}{20}=-0.45$

$0.45\,ms^{-2}$

$450=20u+200\left(\frac{18-u}{20}\right)$

$450=20u+180-10u$

$450=10u+180$

$10u=27$

b) $u=27\,m/s$

11) $a=1.1$, $s=250$, $t=19$

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

$250=u(19)+\frac{1}{2}(1.1)(19)^2$

$250=19u+198.55$

$19u=51.45$

a) $u=2.7\,ms^{-1}$

b) $v=?$, $a=1.1$, $s=250$, $t=19$

$s=vt-\frac{1}{2}at^2$

$250=v(19)-\frac{1}{2}(1.1)(19)^2$

$250=19v-198.55$

$19v=448.55$

$v=23.6\,ms^{-1}$

12) $a=0.16$, $s=400m$, $v=18$, $t=?$

$s=vt-\frac{1}{2}at^2$

$400=(18)(t)-\frac{1}{2}(0.16)(t)^2$

$400=18t-0.08t^2$

$0.08t^2-18t+400=0$

$t=200$ $\quad t=25$

13) $t=20$, $u=3$, $v=28$, $s=?$, $a=?$

$v=u+at$

$28=3+20a$

$20a=25$

$a=1.25$

$s=\left(\frac{u+v}{2}\right)t$

$s=\left(\frac{3+28}{2}\right)20$

$s=\frac{310m}{2}=155m$

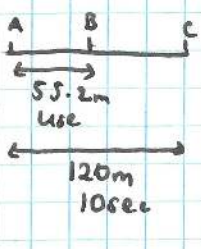
A → M = 155m, $t=?$, $u=3$, $a=1.25$

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

$155=3t+\frac{5}{8}t^2$

$\frac{5}{8}t^2+3t-155=0$

$t=13.5$ $\quad t=-18.3$ ✗

14) 

$\overrightarrow{AB}$

S 55.2
u u
v
A a
T 4

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

$8a + 4u = 55.2$

$\overrightarrow{AC}$

S 120
u u
v
A a
T 10

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

$50a + 10u = 120$

$40a + 20u = 276$
$100a + 20u = 240$ −

$-60a = 36$
$a = -3/5$

$8\left(-\frac{3}{5}\right) + 4u = 55.2$

$4u = 60$
$u = 15\,ms^{-1}$

b) Use

S
u = 15
v = 0
A = $-3/5$
T = ?

$v = u + at$
$0 = 15 + -\frac{3}{5}(T)$
$\frac{3}{5}T = 15$
$T = 25sec$