

1/5

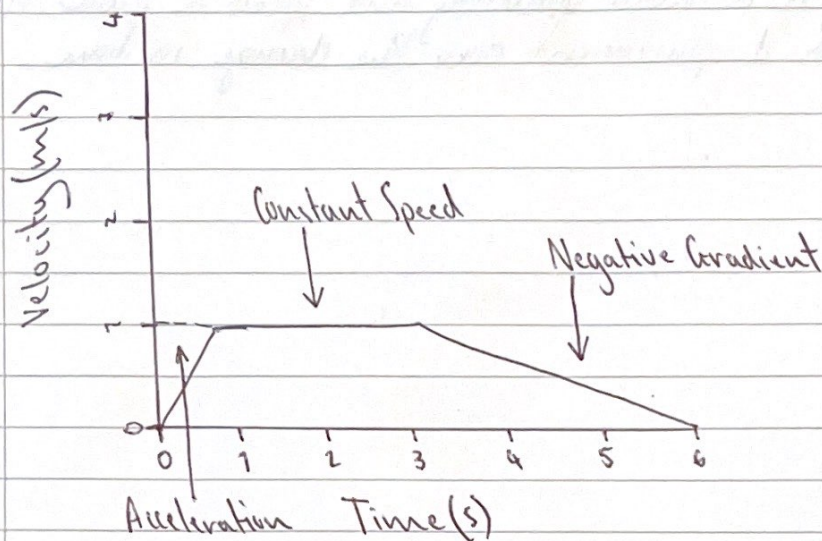
Kian Evans - 1801660

Dynamics Exam - 09/05/22, 9:30AM

ACMA5070

One

a)



b)

$$D = \frac{D}{s}$$

$$D = 275m$$

$$D/s = 41.29$$

41.29s considering the trolley
keep it's speed constant

$$S = 6.66$$

c) 24km/h $\rightarrow$ 27km/h

$$T = D/s \quad D = 275m \quad S = 27.5km/h \rightarrow m/s = 7.63ms$$

$$= \frac{275}{7.63} = 36.04s, \text{ no, it won't be more than } 40s.$$

$$d) \frac{41.29 - 36.04}{41.29} \times 100 = 12.71\%$$

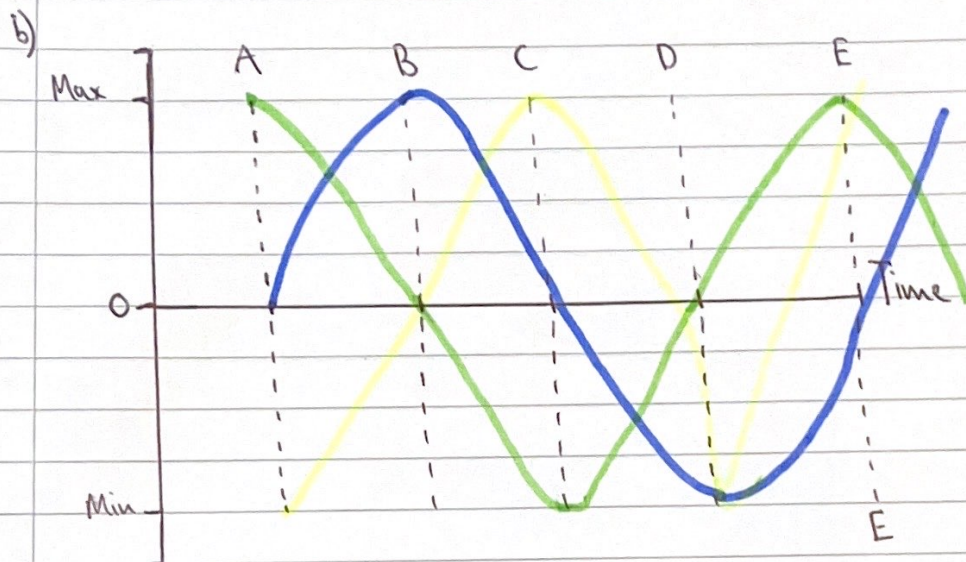
Change in Speed = 14.6%

Change in journey = 12.71%

Velocity is a vector quantity and Speed is scalar therefore measures displacement over the change in time.
 $\Delta s / \Delta t$

Two

- a) Simple harmonic motion is a special case of periodic motion where the restoring force on the moving object is directly proportional to the magnitude of the object's displacement and acts towards the object's equilibrium position.



Position —

Velocity —

Acceleration —

- c) To find amplitude, $v = \omega \sqrt{r^2 - x^2}$

(i)

~~$$v_1 = \omega \sqrt{r^2 - x_1^2}$$~~
~~$$3 = \omega \sqrt{r^2 - 0.08^2}$$~~
~~$$9 = \omega^2 (r^2 - 0.0064)$$~~
~~$$9 = \omega^2 r^2 - 0.04$$~~

~~$$v_2 = \omega \sqrt{r^2 - x_2^2}$$~~
~~$$15 = \omega \sqrt{r^2 - 0.16^2}$$~~
~~$$225 = \omega^2 (r^2 - 0.0256)$$~~
~~$$225 = \omega^2 r^2 - 0.04$$~~

$$v_1 = 15 \text{ m/s} \quad x_1 = 0.08 \text{ m}$$

$$v_2 = 3 \text{ m/s} \quad x_2 = 0.16 \text{ m/s}$$

amplitude = r value
 $r > 0.16 \text{ m}$

Three

(a) $\omega_m = 0$ at Accelerating torque: $T = I\alpha$
 $n_2 = 250$ $I = \frac{1}{2}mr^2 = 7800\text{kg} \times 225^2$
 $T = 40\text{s}$ $I = 1.974\text{kgm}^2$
 $\alpha = ?$

Knowing, $\omega_2 = \omega_1 + \alpha t$ and, $\omega_2 = \frac{2\pi \times 250}{60}$
 $\therefore = \frac{26.18}{40}$ $= 26.18$

$= 0.655\text{rad/s}^2$

So accelerating torque $= 1.974 \times 0.655$
 accelerating torque $T = 1.293\text{Nm}$

Fundamental Assumption is no resisting torque, for example it's a frictionless system.

b)

Four

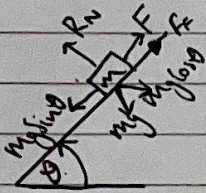
- (a) Cold-welding is a solid-state welding process that requires little or no heat or fusion to join two or more metals together. The energy used for creating a weld comes in the form of pressure.

(b)

(i) $F = \mu \cdot R_N \rightarrow N = F / \mu$ (F = applied force)

$N = \frac{1.15}{0.35} \therefore N = \frac{1.15}{0.35 \times 9.81} = \frac{2.150N}{3.50 \times 9.81} = 0.334$

(ii)



$$R_N = mg \cos \theta$$

Parallel to $\theta = F + F_f = mg \sin \theta$ where, $F_f = N \cdot \mu$

$\therefore F =$