**4.**

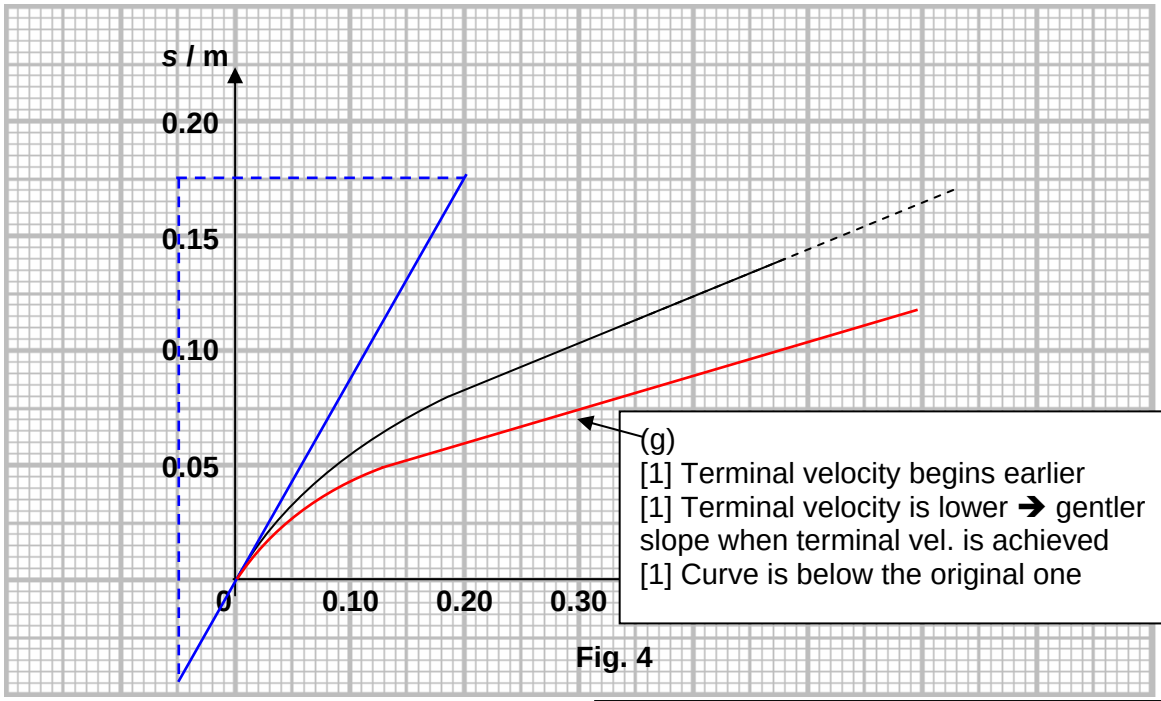



Fig. 4

(g)
[1] Terminal velocity begins earlier
[1] Terminal velocity is lower ➔ gentler slope when terminal vel. is achieved
[1] Curve is below the original one

**a)** Gradient (at $t$ = 0 s)
= [0.175 – (–0.045)]/[0.20 – (–0.05)]
= 0.88 m $s^{-1}$
(range: 0.79 to 0.97)

[1] Working & Substitution
[1] Answer (within 10% range) & units
Deduct [1] if the triangle is less than three big squares vertically.

**b)** Using
$v^2 = u^2 + 2as$
➔ $0.88^2 = 0 + (2)(9.8)\ s$
➔ $s$ = 0.0395 = 0.040 m

[1] Formula & Substitution (ecf)
[1] Answer & units

**c)** The magnitude of velocity decreases between $t$ = 0 s and $t$ = 0.2 s.
It reaches a constant value after $t$ = 0.2 s.

[1] Decreasing magnitude
[1] Constant velocity

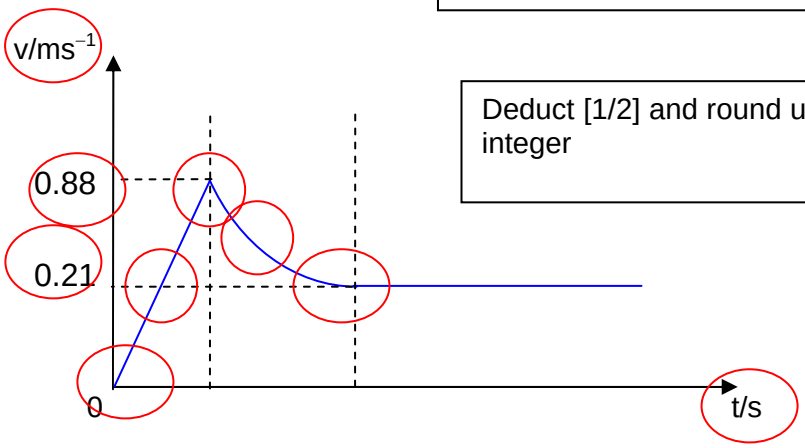
**d)** Gradient (after $t$ = 0.2 s) = [0.165 – 0.0825]/[0.60 – 0.20]
= 0.206 m $s^{-1}$

$a = (mg - kv)/m$
➔ $0 = (m\ (9.8) - (0.013)(0.206))/m$
➔ $m$ = 0.000274 kg

[1] Answer (within 10% range) & units

[1] Working & Substitution
[1] Answer & units

**e)**




Deduct [1/2] and round up to an integer

**f)** At $t$ = 0.4 s, s = 0.125 m and the ball bearing experiences terminal velocity

1.6 s later, the ball-bearing hits the floor:

Displacement (between $t$ = 0.4 s and $t$ = 2.0 s)

= 0.206 x 1.6 = 0.3296 m

Therefore, depth of liquid = 0.125 + 0.3296 = 0.455 m

[1] correct approach

[1] Working
[1] Answer

[1] Answer & units