ANSWER KEY. XI-PHYSICS.

① $n_1 = 100$ dyne

$n_2 = ?$

$F = [MLT^{-2}]$

Given System	New System
$M_1 = 1g$	$M_2 = 1kg$
$L_1 = 1cm$	$L_2 = 1m$
$T_1 = 1s$	$T_2 = 1min$

$$n_2 = n_1\left[\frac{M_1}{M_2}\right]^a\left[\frac{L_1}{L_2}\right]^b\left[\frac{T_1}{T_2}\right]^c$$

$$= 100 \times \left[\frac{1g}{1000g}\right]^1\left[\frac{1cm}{1m}\right]^1\left[\frac{1s}{60s}\right]^{-2}$$

$$= 100 \times \frac{1}{100} \times 60 \times 60$$

$$= 360$$

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② $v = [LT^{-1}] = 20 \longrightarrow ①$

$a = [LT^{-2}] = 40 \longrightarrow ②$

$F = [MLT^{-2}] = 30 \longrightarrow ③$

Divide ② by ①;

$$\frac{[LT^{-2}]}{[LT^{-1}]} = \frac{40}{20}$$

$$[T^{-1}] = 2$$

$$[T] = \frac{1}{2} = 0.5s$$

Put in eq ①;

$L \times 2 = 20$

$[L] = 10m$

Put in eq ③;

$$[M] \times 10 \times \frac{2}{2} \times \frac{2}{2} = 30$$

$$[M] = \frac{3}{4}g$$

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③ (a) LHS $= F = [MLT^{-2}]$

$$RHS = \frac{2GMm}{R+h} = \frac{[M^{-1}L^3T^{-2}][M^2]}{[L]+[L]} = [MLT^{-2}]$$

LHS = RHS ∴ relation is correct.

(b) $\frac{LHS}{RHS} = v = [LT^{-1}]$

$$\sqrt{\frac{4GM}{R+h}} = \sqrt{\frac{[M^{-1}L^3T^{-2}][M]}{[L]+[L]}} = \sqrt{LT^{-2}} = [L^{1/2}T^{-1}]$$

LHS ≠ RHS ∴ relation is wrong.

④ $T = k P^a d^b E^c$

$[M^0 L^0 T] = [ML^{-1}T^{-2}]^a [ML^{-3}]^b [ML^2T^{-2}]^c$

$[M^0 L^0 T] = [M^{a+b+c} \; L^{-a-3b+2c} \; T^{-2a-2c}]$

$a+b+c = 0 \implies 3a+3b+3c = 0 \longrightarrow (1)$

$-a-3b+2c = 0 \longrightarrow (2)$

$-2a-2c = 1 \longrightarrow (3)$

Add (1) & (2); $3a+3b+3c-a-3b+2c = 0$

$2a+5c = 0$

$-2a-2c = 1$

$3c = 1$

$\boxed{c = 1/3}$

$-2a - \frac{2}{3} = 1$

$-2a = 5/3$

$\boxed{a = -5/6}$

$-\frac{5}{6} + b + \frac{1}{3} = 0$

$b = \frac{5}{6} - \frac{1}{3} = \frac{5-2}{6} = \frac{1}{2}$.

$\therefore \boxed{T = k P^{-5/6} d^{1/2} E^{1/3}}$

⑤ $v = a + bt + c\sqrt{t}$

Dim. of a = Dim of v

$a = [LT^{-1}]$

Dim of bt = Dim of v

$b \cdot [T] = [LT^{-1}]$

$b = [LT^{-2}]$.

Dim of $c\sqrt{t}$ = Dim of v

$c \cdot [T]^{1/2} = [LT^{-1}]$

$c = \frac{[LT^{-1}]}{[T^{1/2}]} = [LT^{-3/2}]$