25. Work done, $W = \frac{1}{2} m \left(v_2^2 - v_1^2\right)$

$= \frac{1}{2} \times 20 \ (50^2 - 40^2)$

$= 9000$ J **[ICSE 2013]**

26. Increase in gravitational potential energy
$= mg \ (h_2 - h_1)$
$= 35 \times 10 \ (12 - 4)$
$= 350 \times 8 = 2800$J **[ICSE 2013]**

*27.

28. (i) Man having a box on his head who climbs up a slope does more work against the force of gravity because he has more potential energy by virtue of his position i.e., height.
As, P.E. = W.D. = F × S
$= mg \times h$

(ii) The two forces each of 5 N form a couple.
∴ Moment of the couple = Either force × Perpendicular distance between the two forces
$= 5 \times 1$
$= 5$ Nm (anti-clockwise) **[ICSE 2014]**

29. Let a body of mass 'm' is moving with velocity 'v,' m/s. The initial kinetic energy is given by

$$\text{K.E}_i = \frac{1}{2} mv^2$$

Now, the velocity is reduced to $\frac{1}{3}$rd of the initial velocity. The final kinetic energy is given by

$$\text{K.E}_f = \frac{1}{2} m\left(\frac{v}{3}\right)^2$$

$$= \frac{1}{9}\left(\frac{1}{2} mv^2\right)$$

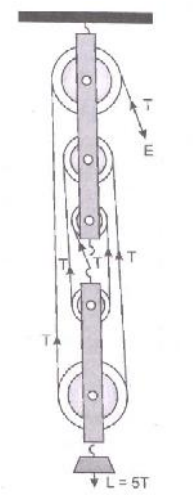
$$= \frac{1}{9} \text{ K.E}_i$$

So, K.E. becomes th of its initial K.E. **[ICSE 2014]**

30. Same as 33

31. Same as 34

32. (i)



(ii) Efficiency = 75%
V.R. = 5
Efficiency = M.A/V.R
Thus, 75/100 = M.A./5
Or, M.A. = 3.75
M.A. = Load/Effort
3.75 = Load/150
Load = 3.75 × 150 = 562.5 kgf. **[ICSE 2015]**

33. Power exerted = Force × Average speed
= 150 × 10
= 1500 W **[ICSE 2015]**

34. Given : Distance = 20 cm = 20/100 m = 0.2 m, Force = 2N
Moment of the force = Force × Distance = 2 × 0.2 Nm = 0.4 Nm
[ICSE 2015]

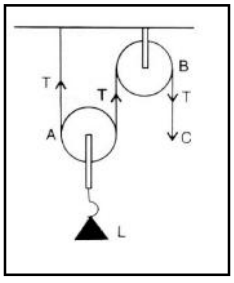
35. Given : weight of the boy W_1 = 40 kgf, weight of the girl W_2 = 30 kgf, height h = 30 × 20 cm = 600 cm = 6 m, time t_1 = 4 min, t_2 = 3 min

(i) $$\frac{\text{Work done by boy}}{\text{Work done by girl}} = \frac{W_1 h}{W_2 h} = \frac{W_1}{W_2} = \frac{40}{30} = 4 : 3$$

(ii) $$\frac{\text{Power developed by boy}}{\text{Power developed by girl}} = \frac{W_1 / t_1}{W_2 / t_2} = \frac{W_1}{W_2} \times \frac{t_2}{t_1} = \frac{4}{3} \times \frac{3}{4} = 1 : 1$$

[ICSE 2015]

36. (i) A — movable pulley
B — fixed pulley.
(ii) Purpose of pulley B — to change the direction of effort from upward to downward direction.
(iii) M.A. = 2; Effort required at C is E = $\frac{1}{2}L$



$= \frac{1}{2} \times 20 \text{ kgf} = 10 \text{ kgf}$ **[ICSE 2016]**

37. *(i) This arrangment of gear is used where gain in speed is required.
(ii) Given : number of pulleys = 3, L = 120 N, E = 50 N

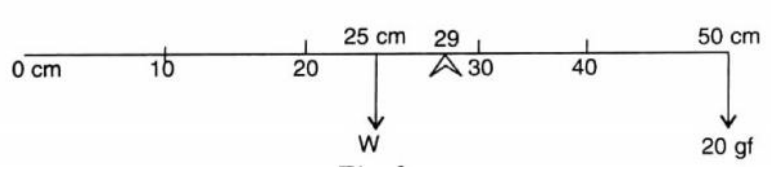
$$\text{Mechanical advantage} = \frac{L}{E} = \frac{120}{50} = 2.4$$

$$\text{Velocity ratio} = \text{number of pulleys} = 3$$

$$\text{Efficiency} = \frac{\text{mechanical advantage}}{\text{velocity ratio}} = \frac{2.4}{3} = 0.8 (\text{or } 80\%)$$

[ICSE 2016]

38.



(i) The arrangement is shown in diagram
(ii) If W gf is the weight of half metre rule,
by the principle of moments,

$$W \times (29 - 25) = 20 \times (50 - 29)$$

or $W \times 4 = 20 \times 21$ or $W = 105$ gf **[ICSE 2017]**

39. Given, power P = 100 kW = 100×10^3W, force F = 50,000 N
Power (P) = force (F) × speed (v)

$$\therefore \quad v = \frac{P}{F} = \frac{100 \times 10^3}{50{,}000} = 2 \text{ ms}^{-1}$$ **[ICSE 2017]**

40. Effort applied by the boy using movable pulley = 1
Reason : Mechanical advantage of a single movable pulley is 2 while that of a single fixed pulley is 1. **[ICSE 2017]**

41. Given, V.R. = 4, L = 175 kgf, d_L = 15 m, E = 50 kgf
(i) V.R. = d
$\therefore \quad d_E = d_L \times \text{V.R.} = 15 \times 4 = 60$ m
(ii) Work done by the effort = $E \times d_E = (50 \times 10 \text{ N}) \times 60 \text{ m} = 3 \times 10^4$J

(iii) $$\text{M.A.} = \frac{L}{E} = \frac{175 \text{ kgf}}{50 \text{ kgf}} = 3.5$$

(iv) $$\text{Efficiency } \eta = \frac{\text{M.A.}}{\text{V.R.}} = \frac{3.5}{4} = 0.875 \text{ or } 87.5\%$$

[ICSE 2017]

Note : * marked questions are not applicable as per new syllabus.

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