Uganda Certificate of Education
PHYSICS MARKING GUIDE FOR SET 1
Topic: Machines

SECTION A

01. A ✓	02. B ✓	03. D ✓	04. D ✓	05. B ✓	06. D ✓	07. C ✓	08. B ✓
09. B ✓	10. B ✓	11. A ✓	12. C ✓	13. C ✓	14. C ✓	15. B ✓	16. A ✓
17. A ✓							

Working for the mathematical calculations:

Question 6:

$$\text{M.A} = \frac{L}{E} = \frac{210}{90} \quad , \qquad \text{V.R} = 3$$

$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\% = \frac{210}{90 \times 3} \times 100 = \left(\frac{210 \times 100}{90 \times 3}\right)\%$$

Question 8:

$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\% = \frac{3}{4} \times 100 = 75\%$$

Question 9:

$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\%$$

$$80 = \frac{\text{M.A}}{5} \times 100$$

$$\text{M.A} = \frac{80 \times 5}{100} = 4$$

$$\text{also,} \qquad \text{M.A} = \frac{L}{E}$$

$$4 = \frac{72}{E}$$

$$E = \frac{72}{4} = 18 \text{ N}$$

Question 12:

$$\text{V.R} = \frac{1}{\sin\theta} = \frac{1}{\sin 30°} = \frac{1}{0.5} = 2$$

Question 13:

$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\%$$
$$80 = \frac{\text{M.A}}{5} \times 100$$
$$\text{M.A} = \frac{80 \times 5}{100} = 4$$
$$\text{also,} \qquad \text{M.A} = \frac{L}{E}$$
$$4 = \frac{L}{10}$$
$$L = 4 \times 10 = 40 \text{ N}$$

Question 14:

$$\text{M.A} = \frac{L}{E} = \frac{100}{25} = 4 \ , \qquad \text{V.R} = 5$$
$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\% = \frac{4}{5} \times 100 = 80\%$$

Question 17:

$$\text{M.A} = \frac{L}{E} = \frac{18{,}000}{200} = 90 \ , \qquad \text{V.R} = 300$$
$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\% = \frac{90}{300} \times 100 = 30\%$$

SECTION B

Question 18:

(a). Mechanical Advantage of a machine is the ratio of load to effort. ✓ 01

(b). (i).

$$\text{Velocity ratio} = 2$$ ✓ 01

(ii).

$$\text{Weight of pulley} = mg$$
$$= 0.2 \times 10$$
$$= 2\ \text{N}$$
$$\text{Total load} = 2 + 10 = 12\ \text{N}$$ ✗

For a frictionless pulley,

$$\text{V.R} = \text{M.A}$$
$$2 = \frac{L}{E}$$ ✗
$$2 = \frac{12}{E}$$ ✗
$$2E = 12$$
$$E = 6\ \text{N}$$ ✗ 02

Question 19:

(a). Efficiency of a machine is the ratio of work done by the machine to the work done on the machine. ✓

Or: Efficiency is the ratio of work output to the work input expressed as a percentage. ✓

01 *Any one definition*

(b).

$$\text{V.R} = 4$$
$$\text{M.A} = \frac{L}{E} = \frac{640}{200} = 3.2$$ ✗ ✗
$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\% = \frac{3.2}{4} \times 100\% = 80\%$$ ✗ ✗ ✓ 03

Question 20:

(a).

$$\text{Work input} = \text{Work output} + \text{Work done against friction}$$
$$= (400 \times 15) + 1000$$ ✓
$$= 7000\ \text{J}$$ ✓ 01

(b).

$$\text{Efficiency} = \frac{\text{work output}}{\text{work input}} \times 100\% = \frac{3.2}{4} \times 100\% = 80\%$$ ✗ ✗ ✓ 01

Question 21:

(a). Velocity ratio is the ratio of distance moved by effort to the distance moved by the load in the same time interval. ✓ 01

(i).

$$\text{Velocity ratio} = \frac{\text{Radius of the wheel}}{\text{Radius of the axle}} = \frac{20}{2} = 10$$ ✓ ✓ 01

(ii).

$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\%$$ ✓

$$45 = \frac{\text{M.A}}{10} \times 100$$ ✓ ✓ 02

$$\text{M.A} = \frac{45 \times 10}{100} = 4.5$$ ✓

Question 22:

(i).

$$L = 2T$$ ✓

$$600 = 2T$$ ✓ 02

$$T = 300\ \text{N}$$ ✓

(ii).

$$\text{M.A} = \frac{L}{E}$$ ✓

$$3 = \frac{600}{E}$$ ✓ 02

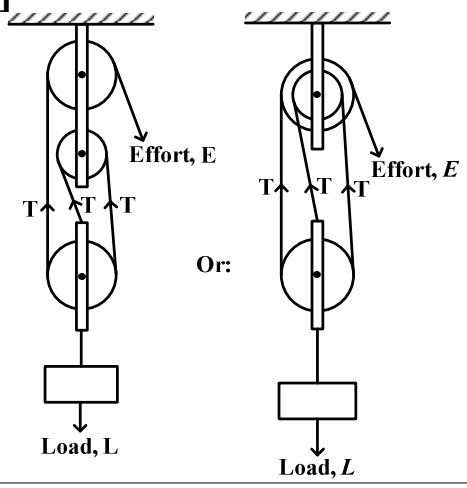
$$3E = 600$$

$$E = 200\ \text{N}$$ ✓

Question 23:

(a). [See Qn. 19 a]

(b).



✓ -2 pulleys in upper part, 1 pulley in lower part

✓ -3 strings

✓ -direction of tension in the strings

✓ -direction of load & effort

02

(c).

This is because:

- **Some energy is wasted in overcoming the frictional forces between the surfaces of the moving parts.** ✓
- **Some energy is wasted in lifting weights (useless loads) of moving parts of the machine like threads and moveable pulley blocks.** ✓

01 *Any one reason*

Question 24:

(i).

$$\text{Velocity ratio} = \frac{\text{Number of teeth on the driven gear}}{\text{Number of teeth on the driving gear}} = \frac{80}{20} = 4$$ ✓ ✓ 02

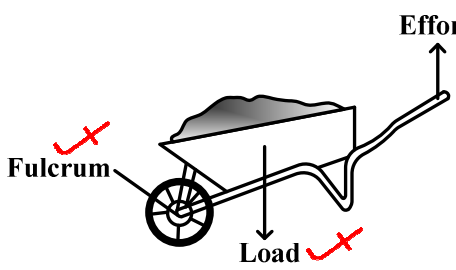
(ii).

$$\text{Mechanical Advantage} = \frac{\text{Weight on the driven gear}}{\text{Weight on the driving gear}} = \frac{450}{150} = 3$$ ✓ ✓

$$\eta = \frac{\text{M.}A}{\text{V.}R} \times 100\% = \frac{3}{4} \times 100 = 75\%$$ ✓ ✓ ✓ 02

Question 25:

(a).



✓ ✓ *-Direction of effort and load* 02

(b). (i). Along OA, the fraction of the effort used in doing useful work increases with increase in the load and they are nearly directly proportional to each other. ✓ 01

(ii).

As the load is increased to a greater value, the value of the work output approaches the value of the work input but never becomes the same because part of the work input is wasted in overcoming friction and lifting the lower load of the pulley. This makes efficiency less than 100%. 02

Question 26:

(i).

$$\text{V.R} = \frac{R}{r} = \frac{40}{10} = 4$$ 02

(ii).

$$\text{M.A} = \frac{L}{E} = \frac{900}{300} = 3$$

$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\% = \frac{3}{4} \times 100\% = 75\%$$ 03

Question 27:

(a). First class lever is a lever system where the pivot (or fulcrum) is between the load and the effort. 01

(b).

- **See-saws.**
- **Pair of scissors.**
- **Pair of pliers.**
- **Weighing scale.**
- **Claw Hummer.**

01 *Any two*

(c). (i).

$$\text{M.A} = \frac{L}{E} = \frac{200}{50} = 4$$ 01

(ii).

$$\text{M.A} = \frac{dE}{dL} = \frac{16}{3}$$

$$\eta = \frac{\text{M.A}}{\text{V.R}} \times 100\% = \frac{4 \times 3}{16} \times 100\% = 75\%$$ 02

END

Recommended Books Include:
Mastering A-level
-Physics Paper 1
-Physics Paper 2
-Subsidiary Math Paper 1
-Mathematics Paper 1
-Mathematics Paper 2
(Statistics, Probability & Numerical Methods)
-Mathematics Paper 2 (Mechanics)

-Mastering O-level Physics (Vol. 1 of 2)
-Mastering O-level Physics (Vol. 2 of 2)

Topical Questions with Answers for
-U.C.E Mathematics Paper 1 & 2
-U.A.C.E Mathematics Paper 1 & 2
-U.A.C.E Physics Paper 1 & 2
For orders of any of the these books, you can contact: WALUGADA RONALD (0704989851/ 0785609713).

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