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GRADE 12: PAPER 1

PHYSICAL SCIENCES 2024

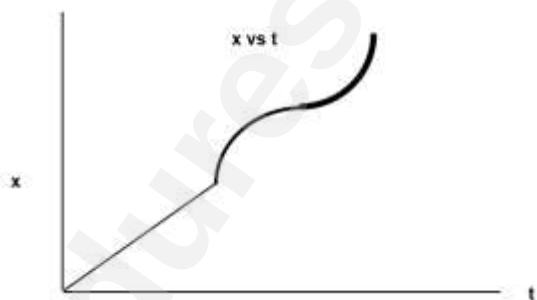
TOTAL: 200

QUESTION 1

- 1.1 A
- 1.2 B
- 1.3 C
- 1.4 C
- 1.5 A
- 1.6 D
- 1.7 B
- 1.8 D
- 1.9 A
- 1.10 D

QUESTION 2

- 2.1 Rate of change of velocity.
- 2.2 $-2,5 \text{ m.s}^{-2} / 2,5 \text{ m.s}^{-2}$ South $10 = 20 - 2,5t$ $t=4\text{s}$
- 2.3 A change in position.
- 2.4 $x = 10(8) + 0,5(2)(10) = 90 \text{ m North}$
- 2.5 Speeding up south or accelerates uniformly south.
- 2.6 $10 = 20 + at$ $-10 = -2,5t$ $t = 4\text{s}$



2.7

2.9

Rabbit	Car A
$8 = 0,5(0,5)t$ $t = 5,66 \text{ s}$	$v_f = v_i + at$ $0 = v_i + (-2,5)(14)$ $v_i = 35 \text{ m.s}^{-1}$ $60 = 35t + 0,5(0,8)t^2$ $t = 1,68 \text{ and not equal to } -89,18 \text{ s}$ Rabbit doesn't cross in time.

QUESTION 3

3.1 Elastic potential energy to kinetic energy.

$$3.2 \quad x = \frac{v_i + v_f}{2} t \quad 0,2 = \frac{v_f + 0}{2} (0,25) \quad v_f = 1,6 \text{ m.s}^{-1}$$

3.3 $E_k = 0 \text{ J}$ and $g = 9,8 \text{ m.s}^{-2}$ downwards

$$3.4 \quad v_f = v_i + 2ax \quad 0 = (1,6)^2 + 2(-9,8)x \quad x = 0,13 \text{ m}$$

$$h = 17,5 + 0,13 + 0,25 = 17,88 \text{ m}$$

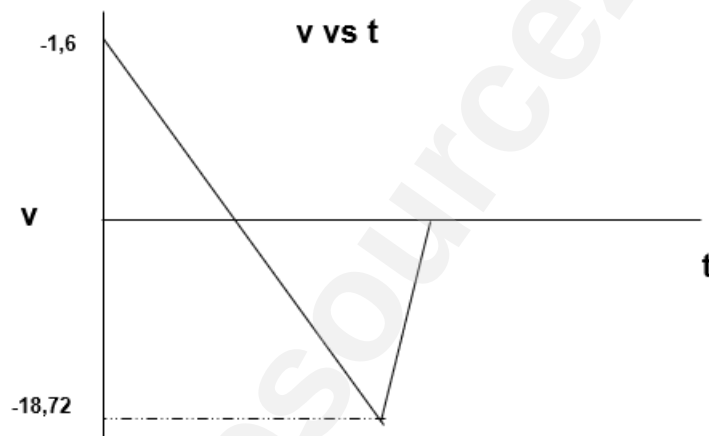
$$3.5 \quad v_f = \sqrt{(1,6)^2 + 2(9,8)(17,5 + 0,25)} = 18,72 \text{ m.s}^{-1}$$

$$3.6 \quad F_{net} = m \frac{(v_f - v_i)}{t} = \frac{2(0 - (-18,72))}{0,75} = 49,92 \text{ N}$$

$$J = F_{net} \times t = 49,92 (0,75) = 37,44 \text{ Ns upwards}$$

accept change in momentum calculation (-1 for no direction and -1 for kg.m.s^{-1}).

3.7

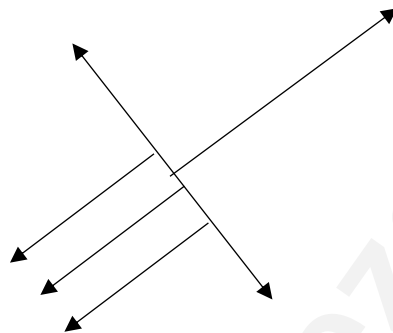


QUESTION 4

4.1 When a net force, F_{net} , is applied to an object of mass, m , the object accelerates in the direction of the net force. The acceleration is directly proportional to the net force and inversely proportional to the mass.

4.2 50 kg trolley on 20 kg box = Action
20 kg box on 50 kg trolley = Reaction

4.3



F_A : Force Applied
 F_N : Normal force
 $F_{g\text{perp}}$: perp comp of F_g
 $F_{g//}$: // comp pf F_g
 F_T : Tension
 F_{fk} : Kinetic friction

4.4

50 kg Trolley	20 kg Box
$1500 - F_T - (50)(9,8) \sin 20 - 8 = 50 a$ $F_T = 1324,41... - 50 a$ Equate $1324,41... - 50a = 20 a + 72,04$ $a = 17,89 \text{ m.s}^{-2}$	$F_T - (20)(9,8) \sin 20 - 5 = 20 a$ $F_T = 20a + 72,03...$

4.5 $F_T = 20 (17,89) + 72,04 = 421,91 \text{ N}$

4.6 The total linear momentum of an isolated system remains constant.

4.7 $\sum p_i = \sum p_f$ $(20)(6) + 0 = 25 v_f$ $v_f = 4,8 \text{ m.s}^{-1}$ to the left

QUESTION 5

5.1 The work done by a net force on an object is equal to the change in the \ kinetic energy of the object.

5.2 $E_{kB} = (0,4)(1470) = 588 \text{ J}$

$$W_{\text{net}} = \Delta E_k$$

$$F_f (8) = 0 - 588$$

$$F_f = -73,5 \text{ N} = 73,5 \text{ N Backwards}$$

5.3 Rate at which work is done.

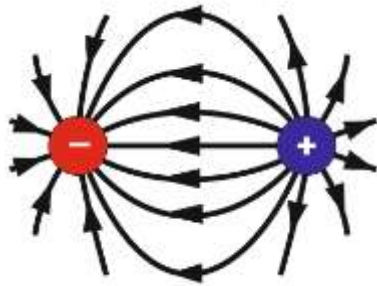
5.4 $F = (50+50)9,8 = 980 \text{ N}$

$$P = Fv = 980(1,15) = 1127 \text{ W}$$

5.5 $\frac{1127}{1200} \times 100 = 93,92 \%$

QUESTION 6

6.1 More field lines on B.



6.2 The force per unit positive charge.

$$6.3 \quad EA_{onP} = \frac{kQ}{r^2} = \frac{(9 \times 10^9)(2 \times 10^{-9})}{0,4^2} = 112,5 \text{ NC}^{-1} \text{ Left}$$

$$EB_{onP} = \frac{(9 \times 10^9)(4 \times 10^{-9})}{(0,7-0,4)^2} = 400 \text{ NC}^{-1} \text{ Left}$$

$$E_{net} = 112,5 + 400 = 512,5 \text{ NC}^{-1} \text{ towards A or Left}$$

$$6.4 \quad F = Eq = (512,5)(1,5 \times 10^{-6}) = 7,69 \times 10^{-4} \text{ N Left}$$

QUESTION 7

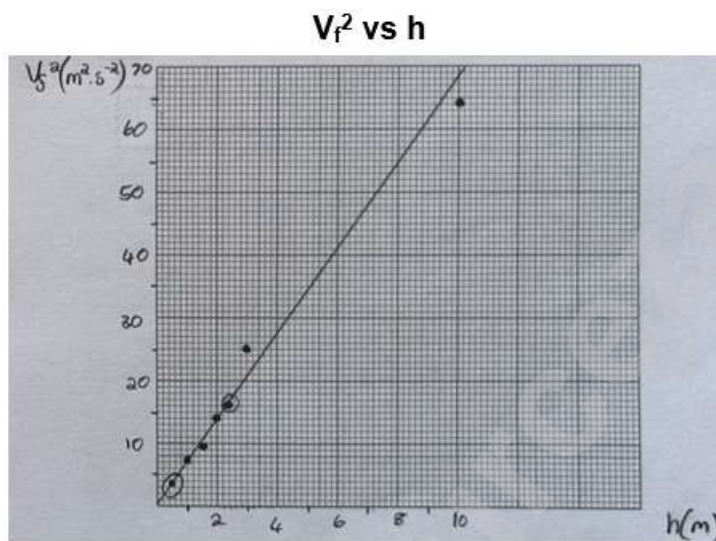
7.1 height

7.2 Final/impact velocity

7.3 The mass of the object and mass and radius or any relevant

7.4 Gravitational force per unit mass.

7.5



7.6 $(3,8)^2 = 14,44$

7.7 $m^2.s^{-2}$

7.8 $Gradient = \frac{16-3,6}{2,5-0,5} = 6,2$ Acceptable range: 6 to 6,9

7.9 $v_f^2 = 2gh$ gradient = $2g$ $2g = 6,2$ $g = 3,1 m.s^{-2}$

7.10 $g = \frac{GM}{r^2}$ $3,1 = \frac{(6,7 \times 10^{-11})(6,4 \times 10^{23})}{r^2}$ $r = 3719174,38 m$

7.11 The gravitational field is height dependent. It varies with altitude.

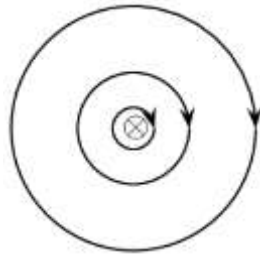
QUESTION 8

- 8.1 Diode, only allows current to flow in one direction.
- 8.2 No its isn't, A battery delivers DC which only flows in one direction.
- 8.3 0 V
- 8.4 6 A
- 8.5 $R = \frac{V}{I} = \frac{80}{6} = 13,33 \Omega$ $V_{\text{bulb}} = 40 \text{ V}$ $V_R = 80 \text{ V}$
- 8.6 $\varepsilon = IR + Ir$ $150 = 6(13,33 + 6,67) + 6r$ $r = 5 \Omega$
- 8.7 $Q = It = 4 \times 24 \times 3600 = 345600 \text{ C}$
- 8.8 $\text{Cost} = \frac{4^2(10)}{1000} \times 24 \times 2,6 = R9,98$
- 8.9.1 Decrease
- 8.9.2 Decrease
- 8.9.3 Increase
- 8.10 Total current decreases, V_{int} decreases, V_{load} increases, $V_{\text{load}} = -rI + \varepsilon$

QUESTION 9

9.1.1 There is an interaction between the magnetic field around the current carrying conductor and the magnetic field of the permanent magnetic field.

9.1.2



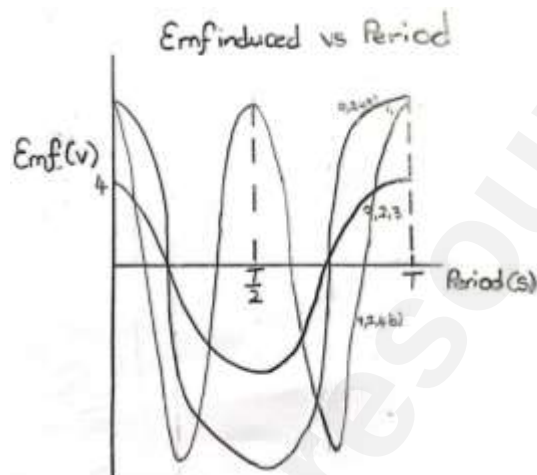
9.1.3 UP

9.1.4 Split-ring commutator

9.2.1 The induced emf is directly proportional to the rate of change of magnetic flux.

9.2.2 s_1 to s_2

9.2.3 and 9.2.4 a and b



9.3.1 Product of the number of turns on the coil and the flux through the coil.

9.3.2 MUTUAL (ELECTROMAGNETIC)

$$9.3.3 \quad \frac{N_s}{N_p} = \frac{V_s}{V_p} \quad \frac{3}{5} = \frac{V_s}{4} \quad v_s = 2,4 \text{ V}$$

9.3.4 Step-down transformers are designed to reduce the primary voltage to a lower secondary voltage. This is done so that the electrical equipment can safely use the power without experiencing any damage.

9.3.5 D_4 and D_3

QUESTION 10

10.1 the process that occurs when light shines on a metal and electrons are ejected.

10.2 ii

10.3 Green and Yellow

10.4 $W_o = 2,14(1,6 \times 10^{-19}) = 3,424 \times 10^{-19} J$

$$E = hf = (6,6 \times 10^{-34})(7,5 \times 10^{15}) = 4,95 \times 10^{-18} J$$

$$Ek_{max} = 3,424 \times 10^{-19} - 4,95 \times 10^{-18} = 4,6076 \times 10^{-18} J$$

$$v_{max} = \sqrt{\frac{2(4,6076 \times 10^{-18})}{9,1 \times 10^{-31}}} = 3182230.89 \text{ m.s}^{-1}$$