PHYSICAL SCIENCES GRADE 12

QUESTION 1

1.1 Power (1)

1.2 Emission (1)

1.3 faraday's law (1)

1.4 Slip ring (1)

1.5 Hydrogenation (1)

[5]

QUESTION 2

2.1	~~A~~	B	C	D
2.2	~~A~~	B	C	D
2.3	A	~~B~~	C	D
2.4	A	B	C	~~D~~
2.5	A	B	~~C~~	D

[5 X 2 = 10]

TOTAL SECTION A : 15 MARKS

QUESTION 3

3.1 Gradient of the graph is constant. ✓✓ [12.1.2] (2)

3.2 At t = 1 s ✓ and t = 3 s✓ [12.1.2] (2)

3.3 $V_{AB} = V_{AC} + V_{CB}$
$= -10 + (-10)$
$= -20\ m \cdot s^{-1}$
$= 20\ m \cdot s^{-1}$ ✓✓downwards ✓

OR

$V_{AB} = V_{AC} - V_{BC}$
$= -10 - 10$
$= -20\ m \cdot s^{-1}$
$= 20\ m \cdot s^{-1}$ ✓✓downwards ✓

OR

$V_{AB} = V_A - V_B$ (vector difference)
$= -10 - (10)$
$= -20\ m \cdot s^{-1}$
$= 20\ m \cdot s^{-1}$ ✓✓downwards ✓

[12.1.2] (3)

3.4

OPTION 1

$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓

= (0)(4) + ½ (10)(4)^2✓

= 80 m✓ (78,4 m if a = 9,8 m·s^{-2})

OPTION 2

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

(40)^2 = (0)^2 + 2(10)Δy✓

Δy = 80 m ✓ (81,63 m if a = 9,8 m·s^{-2})

OPTION 3

$\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓

$= \left(\frac{40 + 0)}{2}\right)(4)$ ✓

= 80 m✓

Accept:

s = ut + ½ at^2

v = u + at

v^2 = u^2 + 2as

$s = \left(\frac{v + u}{2}\right)t$

Accept formulae if *a* is replaced with *g*

[12.2.3] (3)

3.5 Displacement ✓✓ / Change in position

Accept: distance [12.2.1] (2)

3.6

(Accept: y / Δx / x for distance)

Distance covered by object B

$\Delta y = \frac{1}{2} bh + lb$ ✓

= ½ (1)(10) + (10)(1)✓

= 15 m

Distance covered by object A

$\Delta y = \frac{1}{2} bh$ ✓

= ½ (1)(-10) ✓ Accept: ½ (1)(10)

= - 5 m = 5 m

Distance between A and B = 15 – (-5) = 20 m ✓

Accept:

Distance between A and B = 15 + (5) = 20 m ✓

[12.1.3] (5)

QUESTION 4

4.1 The total linear momentum before a collsion is equal to the total linear momentum after a collsion in a closed system✓✓ (2)

4.2 $m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ ✓

(0,002 x v) ✓ + (0,498 x 0) ✓ = 0,5 x 0,48✓

0,002 v = 0,24

V_{1f} = 120 m·s^{-1}✓ (5)

4.3 Inelastic (2)

4.4 The work done by the net force on an object is equal to the change in its energy. ✓✓ (2)

4.5 $W_{net} = \Delta E_k + \Delta E_p$✓
$= (½ mV_f^2 - 0) + (mgh_f - 0)$
$= (½ \times 500 \times 4^2)$ ✓ + (500 x 9,8 x 40) ✓
$= 4\,000 + 196\,000$
$= 200\,000$ J✓
$P = W/t$✓
$= 200\,000/60$✓
$= 3333{,}33$ W✓ (7)
[14]

QUESTION 5

5.1 Doppler effect ✓✓ (2)
5.2 Away ✓✓ (2)
5.3

$$f_L = \left(\frac{v - v_L}{v + v_S}\right) f_S \quad ✓$$

$$0.8 f_S = \left(\frac{340 - 0}{340 + v_S}\right) f_S \quad ✓✓$$

$$0.8(340 + v_S) = 340$$
$$272 + 0.8 v_S = 340$$
$$0.8 v_S = 68$$
$$v_S = 85 m.s^{-1} \quad ✓✓$$

(5)
[9]

QUESTION 6

6.1 Diffraction ✓✓ (2)
6.2 Constructive interference ✓✓ (2)

6.3.1 $\tan\theta = \frac{0.05}{9}$ ✓✓

$\theta = \tan^{-1}\left(\frac{0.05}{9}\right) = 0.32^O$ ✓

$\sin\theta = \frac{m\lambda}{a}$ ✓ $\sin(0.32) = \frac{(1)(\lambda)}{0.0972 \times 10^{-3}}$ ✓

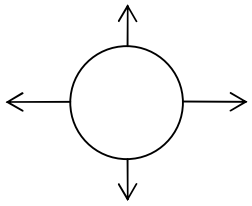
$\lambda = 5.39 \times 10^{-7} m$ or $\lambda = 540 nm$ ✓ (6)

6.3.2 $c = f \times \lambda$ ✓
$3 \times 10^8 = 5.39 \times 10^{-7} f$ ✓
$f = 5.55 \times 10^{14} Hz$ ✓ (green) ✓ (4)

6.4 INCREASE ✓✓ (2)
[16]

QUESTION 7

7.1



✓ ⊥ leaving the sphere (no bending)

✓ arrows

(2)

7.2 $n_{electrons} = \frac{Q}{q_e} = \frac{4\times10^{-9}}{1{,}6\times10^{-19}} = 2{,}5\times10^{10}(electrons)$ ✓ (2)

7.3 $F = \frac{kQ_1Q_2}{r^2} = \frac{(9\times10^9)(4\times10^9)(2\times10^9)}{(1\times10^{-2})^2} = 7{,}2\times10^{-4}\,N$ to the right ✓ direction and magnitude

(Or repulsion or Away from P)

(4)

7.4 New charge = $\frac{4\times10^{-9} + 2\times10^{-9}}{2} = 3\times10^{-9}\,C$ ✓

$U = \frac{kQ_1Q_2}{r} = \frac{(9\times10^9)(3\times10^{-9})^2}{1\times10^{-2}} = 8{,}1\times10^{-6}\,J$ ✓ (6)

[14]

QUESTION 8

8.1 R_{tot} = 3,6 + 6 = 9,6 Ω (3)

8.2 $emf = I(R+r)$ ✓ (4)

$12 = 1(9{,}6+r)$ ✓✓

$r = 2{,}4\Omega$ ✓

8.3 $W = I^2 R\,t$ ✓

= $(1)^2(3{,}6)(3x60)$ ✓

= 648 J ✓ (3)

8.4.1 decrease ✓ (1)

8.4.2 increase ✓ (1)

8.5 Increases. ✓

R_{ext} decreases (a lot) ✓

I through the battery increases✓

W= I^2rt increases significantly (work done by the battery) ✓ (4)

[16]

QUESTION 9

9.1 AC: slip rings ✓

DC: (split ring) commutator ✓ (2)

9.2 $I_{rms} = I_{max} / \sqrt{2}$✓ = 6,43/$\sqrt{2}$✓ = 4,55 A✓ (3)

9.3 $V_{max} = I_{max} \times R$✓ **OR** $V_{rms} = I_{rms} \times R$✓

= 6,43 x 50✓✓ = 4,55 x 50✓

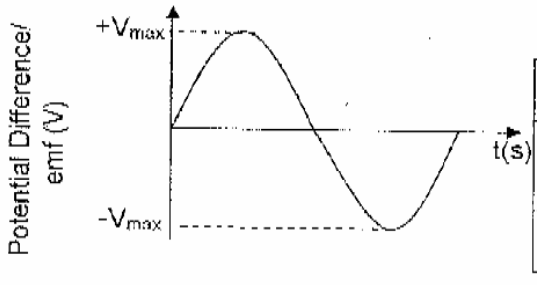
= 321,50 V ✓✓ =227,5 V✓

$V_{max} = V_{rms} \times \sqrt{2}$✓

= 227,5 x $\sqrt{2}$

= 321,73 V✓ (5)

9.4



Checklist Criteria for Graph	Marks
V_{max} correctly shown : $-V_{max}$ and $+V_{max}$ = -321,73 V and = 321,73 V	✓
Correct shape for at least one complete cycle.	✓

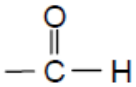
(2)

9.5 Less carbon dioxide into atmosphere ✓ (1)

[13]

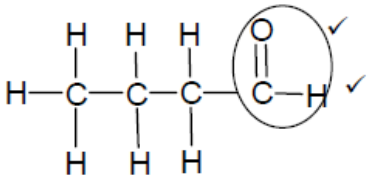
QUESTION 10

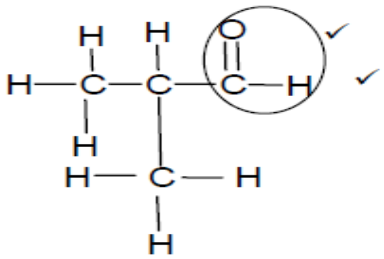
10.1



✓ (1)

10.2





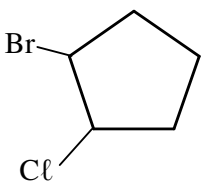
(2)

10.3 2-methyl-1-pentene ✓✓ (2)

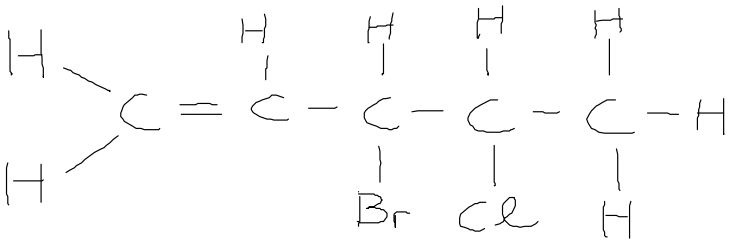
10.4 E ✓ (1)

10.5 Unsaturated✓ (1)

10.6



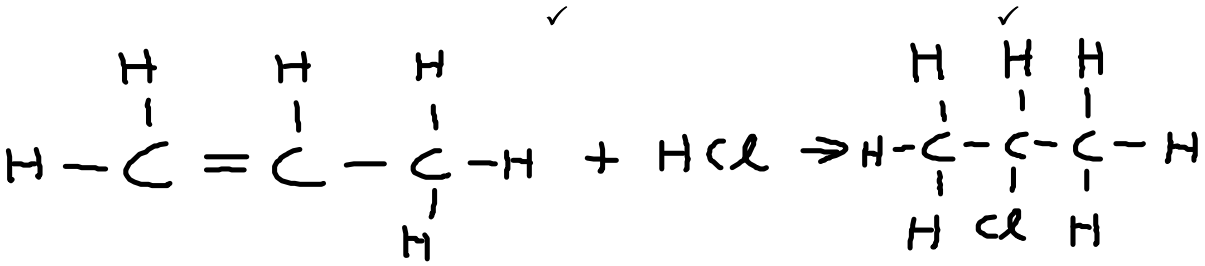
✓✓ **OR**



✓✓

(2)

10.7 Addition ✓



✓ ✓

(3)

10.8 Alkylhalide or haloalkane ✓ (1)

[13]

QUESTION 11

11.1 The temperature ✓at which the vapour pressure of a liquid is equal to the external (atmospheric) pressure. ✓ (2)

11.2 B - Pentane ✓ (1)

11.3 Butane✓✓ (2)

11.4.1 Compounds with the same molecular formula✓, but different structural formulae. ✓ (2)

11.4.2

Compound C / 2-methylbutane is more branched/more compact/more spherical/has a shorter chain/has a smaller surface area.✓
Weaker intermolecular forces/ Van der Waals forces/dispersion forces/London forces.✓
Less energy needed to overcome intermolecular forces. ✓

OR

Compound B / Pentane is less branched/has a longer chain/less compact/less spherical/has a larger surface area. ✓
Stronger intermolecular forces / Van der Waals forces. ✓
More energy needed to overcome intermolecular forces. ✓

(3)

11.5 The Van der Waals forces in B (pentane) ✓ are weaker✓ than the hydrogen bonds in D (pentan-1-ol) ✓ and requires less energy✓ to break. (4)

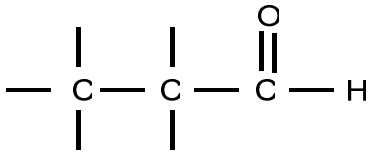
11.6 Cooking / in gas bottles. ✓ (1)
[15]

QUESTION 12

12.1 Oxidation✓ of a primary alcohol✓ or fermentation✓✓ (2)

12.2 **X** – propanol ✓ **Z**- propanoic acid ✓ (2)

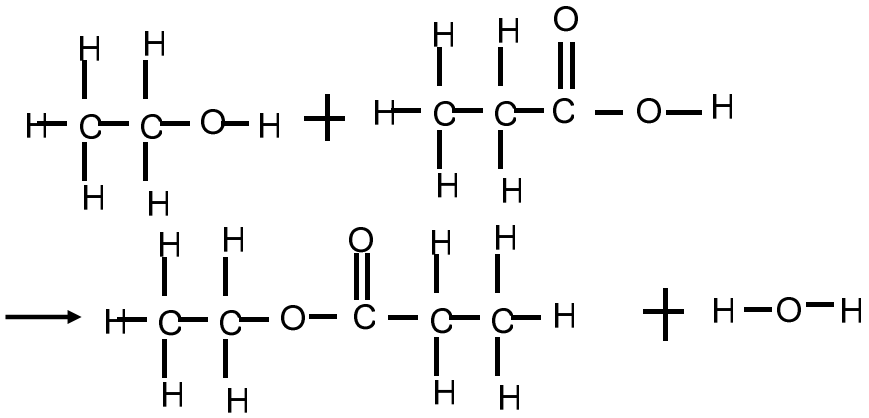
12.3 Propanal✓



✓✓ (3)

12.4 $KMnO_4$ **or** $K_2Cr_2O_7$ ✓ (Potassium Permanganate or Potassium Dichromate) (1)

12.5 Ethanol ✓ propanoic acid ✓✓



Ethylpropanoate ✓✓ Water✓ **(Marks for structural formulae)**
(6)

12.6 Perfumes / flavourants / solvents / adhesives ✓ (1)
[15]

TOTAL: 160 MARKS