ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

RESOURCES FOR

"HSC-II PHYSICS"

ZUEB EXAMINATIONS 2021

PREFACE:

The ZUEB examination board acknowledges the serious problems encountered by the schools and colleges in smooth execution of the teaching and learning processes due to sudden and prolonged school closures during the covid-19 spread. The board also recognizes the health, psychological and financial issues encountered by students due to the spread of covid-19.

Considering all these problems and issues the ZUEB Board has developed these resources based on the condensed syllabus 2021 to facilitate students in learning the content through quality resource materials.

The schools and students could download these materials from www.zueb.pk to prepare their students for the high quality and standardized ZUEB examinations 2021.

The materials consist of examination syllabus with specific students learning outcomes per topic, Multiple Choice Questions (MCQs) to assess different thinking levels, Constructed Response Questions (CRQs) with possible answers, Extended Response Questions (ERQs) with possible answers and learning materials.

ACADEMIC UNIT ZUEB:

2. Constructed Response Questions (CRQs)

HOW TO ATTEMPT CRQs:

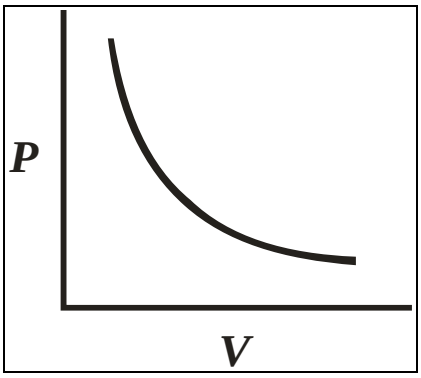
- Write the answer to each Constructed Response Question/ERQs in the space given below it.
- Use black pen/pencil to write the responses. Do not use glue or pin on the paper.

SECTION B (SHORT ANSWER QUESTIONS)

1. **State and explain ideal gas law.**

S.NO	CRQ	ANSWER	CL	DL
		CHAPTER 11		
1.	**State and explain ideal gas law.** **[2006, 00, 1996 (supp), 91, 83]**	There are two ideal gas laws. Boyle's law and Charles law **B O Y L E ' S L A W** **I n t r o d u c t i o n:** In **1660, Robert Boyle** studied the relation between the volumes and pressure at constant temperature and he stat that **S t a t e m e n t:** "At constant temperature and for fix no of molecule volume is inversely proportional to the pressure." **E x p l a n a t i o n:** If **P** represents pressure and **V** represents volume of a gas then	**K/R**	**E**

mathematically Boyle's law can be expressed as:



$$V \propto \frac{1}{P}$$

$$V = \frac{K}{P}$$

$$P\ V = K$$

This is the equation of Boyle's law and with the help of above equation Boyle's law can also be stated as:

"At constant temperature and for fix no. of molecule the product of pressure and volume remain constant."

GRAPHICAL REPRESENTATION:

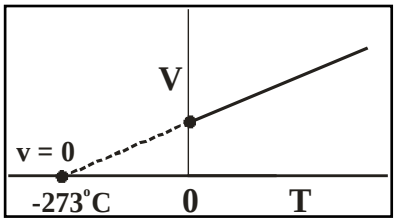
If we plot graph between pressure and volume then for Boyle's law we obtain a **'Hyperbola'**

CHARLES LAW

I n t r o d u c t i o n: In **1787, Jacques Charles** studied the relation between the volume and temperature at constant pressure.

S t a t e m e n t: **"**At constant pressure and for fix no. of molecule volume is directly proportional to the absolute temperature."

E x p l a n a t i o n: If 'V' represent volume of the gas and 'T' represent temperature of a gas then Charles

		law can be expressed as  $V \propto T$ $V = KT$ $\frac{V}{T} = K$ This is the equation of Charles law and with the help of above equation Charles law can also be stated as: "At constant pressure and for fix no. of molecule the ratio of volume to the absolute temperature remain constant" **GRAPHICAL REPRESENTATION:** If we plot graph between temperature and volume then for Charles law we obtain a 'Straight line'. If we extend graph between volume and temperature then we notice that volume of gas become zero at **-273°C**. This temperature is called **Zero Kelvin or Absolute Zero.**		
2.	**Prove Boyle's and Charles' law with the help of kinetic theory?** **[2008, 07, 02 (P.E), 00 1998, 87]**	**P r o o f:** According to the Kinetic theory of a gas: $P = \rho \frac{\overline{V^2}}{3}$ Here $\rho = \frac{m N_o}{V}$ we put in above $P = \frac{mN_o}{V} \frac{\overline{V^2}}{3}$ $V = \frac{N_o}{P} \frac{m\overline{V^2}}{3}$ ….. Eq. (i) Since $\overline{K.E.} = \frac{3}{2} K T$ $\frac{1}{2} m \overline{V^2} = \frac{3}{2} KT$	**K/R**	**E**

		$\frac{m\overline{V^2}}{3} = KT$ We put in Eq. (i) $V = \frac{N_o}{P} KT$ $V = \frac{N_o KT}{P}$ ..... Eq. (ii) **Boyle's Law:** If 'N_o' and 'T' of a gas remains unchanged then Eq. (ii) becomes: $V = \frac{Constant}{P}$ $V \propto \frac{1}{P}$ ..... **Proved** **Charles Law:** If 'N_o' and 'P' of a gas remains unchanged then Eq. (ii) becomes: **V = Constant T** **V ∝ T** ..... **Proved**		
3.	**Define Co-efficient of linear and co-efficient of cubical expansion? [2003 (P.M, P.E), 1997, 95, 89]**	Co-Efficient Of Linear Expansion "Co-efficient of linear expansion is the fractional change in length per degree change of temperature." Explanation: As we know that change in length 'ΔL' is directly proportional to the initial length of a body 'L_i' and change in temperature 'ΔT' mathematically it can be expressed as: $\Delta L \propto L_i$ $\Delta L \propto \Delta T$ comparing both we get $\Delta L \propto L_i \Delta T$ $\Delta L = \alpha L_i$ ΔT $\frac{\Delta L}{L_i \Delta T} = \alpha$ $\alpha = \frac{\Delta L}{L_i \Delta T}$ The value of co-efficient of linear expansion doesn't depend upon length, mass, size and temperature it only depend on the nature of a material UNIT: In S.I. system its unit is $(°C)^{-1}$. or K^{-1}.	**K/R**	**M**

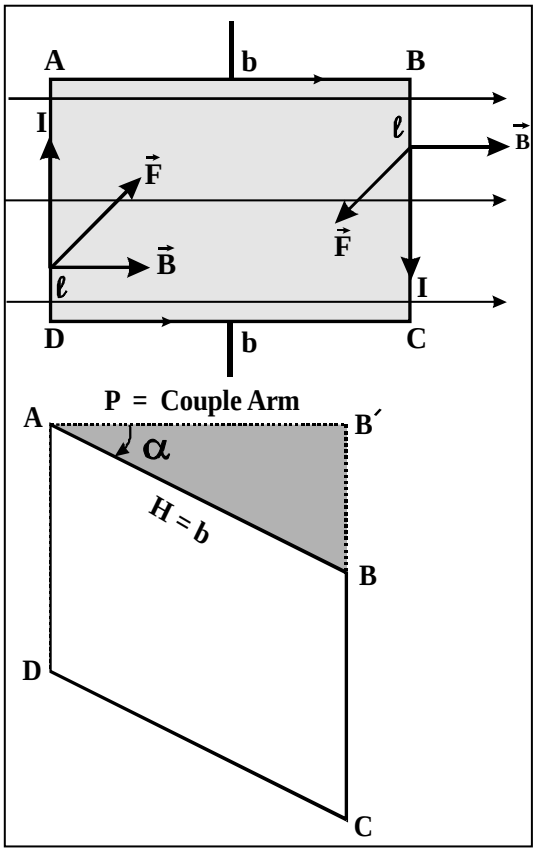
		Co-Efficient Of Cubical Expansion [2003(P.E),97,95,89] "Co-efficient of cubical expansion is the fractional change in volume per degree change of temperature." E x p l a n a t i o n: As we know that change in volume 'ΔV' is directly proportional to the initial volume of a body 'V_i' and change in temperature 'ΔT' mathematically it can be express as: $\Delta V \propto V_i$ $\Delta V \propto \Delta T$ Comparing both we get $\Delta V \propto V_i \Delta T$ $\Delta V = \beta V_i$ ΔT $\frac{\Delta V}{V_i \Delta T} = \beta$ $\beta = \frac{\Delta V}{V_i \Delta T}$ The value of co-efficient of cubical expansion doesn't depend upon length, mass, size and temperature it only depend on the nature of a material. UNIT: In S.I. system its unit is $(°C)^{-1}$. or K^{-1}.		
4.	A steel rod has a length of exactly **0.2** cm at **30°C**. What will be its length at **60°C**? **$\alpha = 1.1 \times 10^{-5}\ {}^0C^{-1}$**	**[0.200066 cm]**	**K/A**	**M**
5.	A steel bar is **10 m** in length at **- 2.5°C**. What will be the change in its length when it is at **25°C**? [β for steel = **$3.3 \times 10^{-5}\ k^{-1}$**]	**[3.025×10^{-3} m]**	**K/A**	**D**
6.	Find the change in volume of an aluminum sphere of **0.4m** radius when it is heated from **0^oC** to **100°C**. **$\alpha = 2.4 \times 10^{-5}\ {}^0C^{-1}$**	**[$4.5 \times 10^{-4}\ m^3$]**	**K/A**	**M**

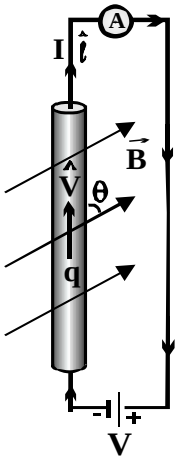
7.	Find the Efficiency of a Carnot Engine Working between **100°C and 50°C**.	**[13.4 %]**	**K/A**	**E**
8.	A heat engine operates between two reservoirs at temperatures of **25°C** and **300°C**. What is the maximum efficiency for this engine?	**[48%]**	**K/A**	**E**
9.	The efficiency of a heat engine is **50%**. If the temperature of the cold reservoir is **300° k** find the temperature of the hot reservoir	**[600 K]**	**K/A**	**M**

S.NO	**CRQ**	**ANSWER**	**CL**	**DL**
		CHAPTER 13		
10.	**Define electric current and write down its unit.**	**DEFINITION:** "Electric current is the rate of flow of electric charge through the cross-section of a conductor". **EXPLANATION:** If **"q"** amount of charge is flowing in time **"t"** then magnitude of electric current **"I"** is given by $\mathbf{I} = \frac{q}{t}$ **UNIT:** In S.I system unit of electric current is Ampere. **ONE AMPERE:** Current is said to be one ampere, if one coulomb of charge can flow through a conductor in one second . **TYPES OF CURRENT** There are two main types of electric current. **Electronic Current** Electronic current is caused by the flow of electrons from the negative terminal to the positive terminal or form the lower potential to higher potential. **Conventional Current** Conventional current is caused by the flow of electron from the positive terminal to the negative terminal or from the higher potential to the	**K/R**	**E**

		lower potential.		
11.	Certain battery is rated at 80 ampere hour. How many coulomb of charge can this battery supply	**[2 . 8 8 x 10 ^{5} C]**	**K/A**	**E**
12.	A wire carries a current of 1A. How many electrons pass a point in the wire an each second	**[6.3 x 10^{18} electrons]**	**K/A**	**E**
13.	A 1 2 Ω resistor is connected in series with a parallel combination of 10 resistors, each of 2 0 0 Ω. What is the net resistance of the circuit?	**[3 2 Ω]**	**K/A**	**M**
14.	Three equal resistors each of 1 2 Ω can be connected in four different ways. What is equivalent resistance of each combination?	**[4 Ω, 8 Ω, 18 Ω, 36 Ω]**	**K/A**	**D**
15.	Three resistors each of 50Ω can be connected in four different ways. Find the equivalent resistance for each combination.	**[16.33 Ω, 150 Ω, 75 Ω, 33.33 Ω]**	**K/A**	**M**

S.NO	**CRQ**	**ANSWER**	**CL**	**DL**
		CHAPTER 14		
16.	**Derive an expression for torque in a current carrying coil in a magnetic field. [09, 05, 03pm]**	If a coil of length **"l"** breadth **"b"** place in a magnetic field **"B"** and carrying current **"I"** then couple will act on a coil and the torque produced by the couple is given by: τ = F x Couple Arm Eq (i) ***CALCULATION OF "F"*** $F = I\, l\, B \sin\theta$ *Here* $\theta = 90°$ $\therefore \quad F = I\, l\, B \sin 90$ $F = I\, l\, B$ ***Couple Arm*** *In* $\Delta BAB'$	**K/R**	**E**

		$Cos\ \alpha = \frac{B}{H} = \frac{Couple\ Arm}{b}$ $b\ Cos\ \alpha = Couple\ Arm$ $Couple\ Arm = b\ Cos\ \alpha$ Putting the value of F and couple arm in eq (i) $\tau = I\ l\ B\ b\ Cos\ \alpha$ $\tau = I\ B\ l\ b\ Cos\ \alpha$ Here l b = A (Area of a coil) we put in above $\tau = I\ B\ A\ Cos\ \alpha$ This is the torque in a coil due to single turn. Torque due to "N" number of turns is given by: τ $N\ I\ B\ A\ Cos\ \alpha$  		
17.	**Derive an expression for magnetic force when a current carrying wire placed in a magnetic field**	If a wire of length "**l**" carrying current **"I"** placed in a magnetic field **"B"** then wire will experience a magnetic force. "If **"q"** is the total amount of charge, **"v"** is the velocity of charge and **"B"** is the magnetic field	**K/R**	**E**

	[2017, 2015, 2013, 11, 08, 06]	of induction then magnetic force experience by a current carrying wire can be expressed as: $\vec{F} = q(\vec{v} \times \vec{B})$ Here **q = I t** $\vec{F} = \vec{I}t(\vec{v} \times \vec{B})$ $\vec{F} = \vec{I}(t\vec{v} \times \vec{B})$ Here **t v = l** **F = I (l x B)** This is the required expression of magnetic force. 		
18.	**State and prove ampere circuital law. [2011, 10 , 09, 07, 03p.e, 02p.m, p.e,00, 98, 96]**	**INTRODUCTION:** In 1825, French scientist Andre Marie Ampere state that **STATEMENT:** "Algebraic sum of the dot product of magnetic field of induction and small length of closed loop is equal to μ_o times the current enclosed in a closed loop". **PROOF: HANS OERSTED IDEA** In 1820 Hans Oersted give the idea of magnetic field produce by a current carrying conductor. **BIOT- SAVART LAW07** In Oct 1820 French engineer Jean Biot and Felix Savart state that: "When current passes through the conductor then a circular magnetic field produced around the wire the magnitude of magnetic field is directly proportional to the twice of current passes through the wire	**K/R**	**E**

and inversely proportional to the distance form the wire".

Mathematically it can be expressed as:

$$B \alpha \frac{2I}{r}$$

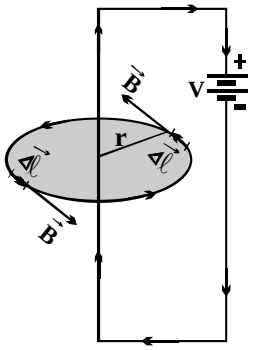
$$B = \frac{\mu_o}{4\pi} \frac{2I}{\gamma}$$

$$B = \frac{\mu_o I}{2\pi\gamma}$$

Where μ_o is the permeability of free space and its value is $4\pi \times 10^{-7} \frac{\text{weber}}{\text{m Amp}}$.

AMPERES LAW

If we want to prove amperes law then we take a closed loop in the form of circle of radius "r" and split it into small length **"ΔL"** then we can write:



$$\Sigma \vec{B} \cdot \vec{\Delta l} = \Sigma B \Delta l \cos 0$$

$$\Sigma \vec{B} \cdot \vec{\Delta l} = \Sigma B \Delta l \quad (1)$$

$$\Sigma \vec{B} \cdot \vec{\Delta l} = B \Sigma \Delta l$$

Here $B = \frac{\mu_o I}{2\pi r}$

And $\Sigma \Delta l = 2\pi r$ **We put in above**

$$\Sigma \vec{B} \cdot \vec{\Delta l} = \frac{\mu_o I}{2\pi r} 2\pi r$$

$$\Sigma \vec{B} \cdot \vec{\Delta l} = \mu_o I$$

$$\Sigma \vec{B} \cdot \vec{\Delta l} = \mu_o \times \text{Current enclosed}$$

19.	A long solenoid is wound with 35 turns in 10cm, and caries a current of 10A.Find the magnetic field in it.	**[4.39 x 10^{-3} Weber / m^2]**	**K/A**	**M**
20.	A long solenoid is wound with 10 turns per cm and carries a current of 10 amperes; find the magnetic flux density within it	**[1.25 x 10^{-2} Weber / m^2]**	**K/A**	**M**
21.	A solenoid 20cm long has three layers of windings of 300 turns each. If a current of 3 A is passed through it, find the value of the magnetic field of induction B**.**	**[1.69 x10^{-2} weber / m^2]**	**K/A**	**M**
22.	A transformer has 1000 turns in the primary coil. If the input voltage of the transformer is 200volts. What should be the number of turns of the secondary coil to obtain an output of 6.0volts?[30 turns]	[30 turns]	**K/A**	**M**
23.	A step-down transformer having 4000 turns in primary is used to convert 4400volts to 220volts. The efficiency of the transformer is 90% and 9.k Watt. Output is required. Determine the input power, the number of turns in the secondary coil and the current in the primary and secondary coils.	[P_p = 10Kw; N_s = 200 turns ; I_p = 2.272 A; I_s= 40.91A]	**K/A**	**M**

S.NO	**CRQ**	**ANSWER**	**CL**	**DL**
		CHAPTER 15		
24.	A galvanometer whose resistance is 50Ω deflects full-scale for a potential difference 100mV across its terminals. How can it be converted into a voltmeter of 50V range?	**[24950 Ω]**	**K/A**	**E**

25.	A galvanometer has a resistance of **50Ω** and it deflected full-scale when a current of **10mA** How can it be converted into an ammeter of range **10A?**	**[By connecting a shunt of 0.05 Ω]**	**K/A**	**E**
26.	A galvanometer whose resistance is **40 Ω** deflects full-scale for a p.d of **100 mV**. How can it be converted into an ammeter of **5A** range?	**[By connecting a shunt of 0.02 Ω]**	**K/A**	**E**
27.	The coil of a galvanometer of a resistance of **50Ω** and a current of **500 μA** produces a full-scale deflection in it. (i)The shunt required to convert it into an ammeter of **5A** range. (ii)The series resistance required to convert it into a voltmeter of **300 volt** range.	**[0.005 Ω, 599950Ω]**	**K/A**	**E**

S.NO	**CRQ**	**ANSWER**	**CL**	**DL**
		CHAPTER 17		
28.	What will be the length of a bar in the stationary frame if its length along the x'-direction is **1m** and the motion is with a velocity **0.75C** with respect to the observer at rest.	**[0.66 m]**	**K/A**	**D**
29.	A **5 0 m** trailer is moving with relativistic speed. It passes over a bridge of length **4 0 m.** To an observer at rest with respect to the bridge at one instant the trailer seems to overlap the bridge find the speed of the trailer	**[3 C / 5]**	**K/A**	**D**
30.	Find the speed at which the mass of a particle will be doubled	**[$\sqrt{3}$ C / 2]**	**K/A**	**E**

31.	What will be the work function of a substance for a threshold frequency of **43.9×10^{13} Hz**	**[1.82 eV]**	**K/A**	**E**
32.	Sodium surface is shined with the light of wavelength **3×10^{-7} m.** If the work functions of Na **2.46eV,** find the kinetic energy of the photo-electrons and also the cut of wavelength.	**[1.68eV, 5.05×10^{-7}m]**	**K/A**	**M**
33.	When the light of the wavelength **4000^{o}A** falls on a metal surface stopping potential is **0.6volt;** find the value of the work function of the metal	**[2.5 eV]**	**K/A**	**M**
34.	In a Compton scattering process, the fractional change in wavelength of x-ray photons is **1%** at an angle **$\theta = 120^{o}$**, find the wavelength of x-ray used in the experiment	**[3.63×10^{-10}m]**	**K/A**	**M**
35.	X-ray of was length λ_o are scattered from a carbon block at an angle of **45^{o}** with respect to the incident beam. Find the shift in wave length.	**[7.11×10^{-13}m]**	**K/A**	**M**
36.	X-ray are scattered from a target material. The scattered radiation is viewed at an angle of **90^{0}** with respect to the incident beam. Find the Compton shift in wave length.	**[2.42×10^{-12}m]**	**K/A**	**E**
37.	**Define Pair Production and Annihilation.** **[2009 86, 96(Sup)]**	**INTRODUCTION:** In 1932 C.D. Anderson study the conversion of energy into mass by stopping a photon with the help of heavy electrical field of nucleus **STATEMENT:** "If we may to stop a photon with the help of heavy electrical field of nucleus then it destroy and produce an electron positron pair this phenomena in which a photon produce two particle electron and positron called pair production or materialization of energy".	**K/R**	**E**

CONDITION: For pair production energy of photon must be grater than or equal to $2m_0c^2$.

$$E \geq 2m_0c^2$$

Here $m_0 = 9.1\times10^{-31}$ **kg** (Rest mass of electron or positron).

And $c = 3\times10^8$ **m/sec** (Speed of light)

We put in above.

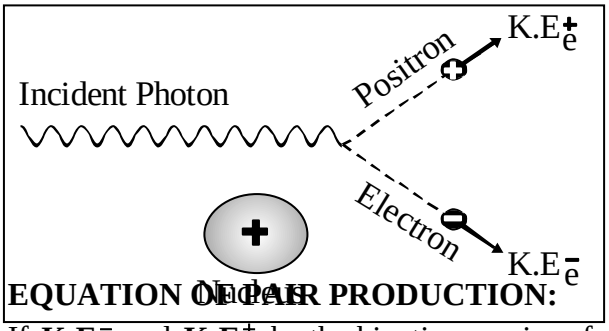
$$E \geq 2\times9.1\times10^{-31}\left(3\times10^8\right)^2$$

$$E \geq 1.638\times10^{-13} \text{ Joule}$$

$$E \geq \frac{1.638\times10^{-13}}{1.6\times10^{-19}} \text{ ev}$$

$$E \geq 1.02\times10^6 \text{ ev}$$

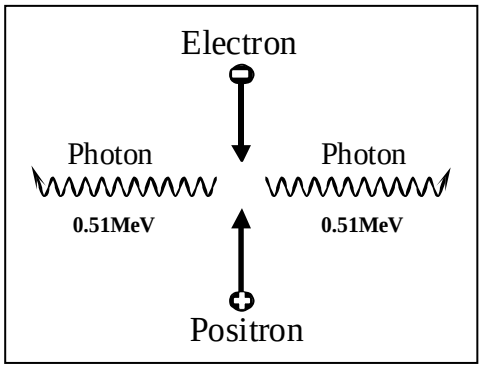
$$\boxed{E \geq 1.02 \text{ Mev}}$$



EQUATION OF PAIR PRODUCTION:

If $\mathbf{K.E_e^-}$ and $\mathbf{K.E_e^+}$ be the kinetic energies of electron and positron respectively then energy of photon in **Mev** is given by:

$$E = K.E_e^- + K.E_e^+ + 1.02\,Mev$$



ANNIHILATION:

When an electron and positron combine with each other then they destroyed and produce two photons of **0.51 Mev** each.

M

S.NO	CRQ	ANSWER	CL	DL
		CHAPTER 18		
38.	What is the wavelength of the radiation that is emitted when a hydrogen atom undergoes a transition form the state **n = 3 to n = 1.**	**[103 nm]**	**K/A**	**M**
39.	What is the wavelength of the radiation that is emitted when hydrogen atom under goes a transition from the state **n = 3 to n = 2.**	**[656.3 nm]**	**K/A**	**E**
40.	An electron in the hydrogen atom makes a transition from the **n = 2** energy state to the ground state**;** find the wavelength in the ultraviolet region	**[121.5 nm]**	**K/A**	**E**
41.	Find the wavelength of the first three lines of the Lyman series of hydrogen	**[121.5nm, 102.5nm, 97.2nm]**	**K/A**	**M**