ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

RESOURCES FOR

"HSC-I 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. **Name any 4 major branches of biology and define them.**

S.NO	CRQ	ANSWER	CL	DL
1.	**Define force with the help of Newton's first law of motion? Prove that Force is the rate of change of momentum?**	$F = m\,a$ $F = m\left[\frac{v_f - v_i}{t}\right]$ $a = \frac{V_f - V_i}{t}$ $P = m\,V$ $P_i = m\,V_i$ $P_f = m\,V_f$ $F = \frac{mv_f - mv_i}{t}$ $F = \frac{P_f - P_i}{t}$	**K/A**	**A**

2.	**A bullet having a mass of 0.005 kg is moving with a speed of 100 m/s. It penetrates into a bag of sand and is brought rest after moving 25cm into the bag. Find the decelerating force on the bullet. Also calculate the time in which it is brought to rest.**	100 N , 0.005 Sec	**K/A**	**A**
3.	**In an electron gun of a television set, an electron with an initial speed of 10^3 m/s enters a region where it is electrically accelerated. It emerges out of this region after 1 micro second with speed of 4 x 10^5 m/s. what is the maximum length of the electron gun? Calculate the acceleration.**	0.2 m, 3.99 x 10^{11} m/s^2	**K/A**	**B**
4.	**Two bodies A and B are attached to the ends of a string which passes over a pulley so that the two bodies hang vertically if the mass of the body A is 4.8 kg find the mass of body B which moves down with an acceleration of 0.2m/s^2.**	[5 kg]	**K/A**	**A**
5.	**Two bodies A and B are attached to the ends of**	9.79 Kg	**K/A**	**B**

	a string which passes over a friction less pulley. If the mass of the body B is 9.6 kg; find the mass of the body A which moves down with an acceleration of 0.1m/s^2.			
6.	**A cyclist is going up a slope of 3 0° with a speed of 3.5 m/s if he stops pedaling. How much distance will be move before coming to rest? (Assume the friction to be negligible)**	[1.25 m]	**K/A**	**A**
7.	**The engine of a motor car moving up 45 ° slope with a speed of 63 km / h stops working suddenly. How far will the car move before coming to rest (assume the friction to be negligible)**	[22.10 m]	**K/A**	**A**
8.	**Define friction. Write the cause and types of friction?**	Friction is the self-adjusting force which resists the motion of the body. Direction of friction is always opposite to the direction of motion. There are two types of friction. Contact Friction Fluid Friction Contact friction: Whenever a body 'B' slide on the surface of body 'A' then body 'A' will oppose the motion of body 'B'. This opposite force is called Contact Friction there are three types of contact friction i) Static friction ii) Limiting friction iii) Kinetic friction.	**K/R**	**A**

		Static Friction The friction in which the body remains at rest called static friction and denoted by f_s Limiting Friction The friction at which the body just starts moving is called limiting friction and is denoted by $(f_s)_{max}$ Limiting friction always greater than static and kinetic friction $(f_s)_{max} > f_s$, $(f_s)_{max} > f_k$ Kinetic FrictionThe friction at which the body remains in motion called Kinetic friction. Fluid friction: Whenever a solid body moves in a fluid, fluid will oppose the motion of a solid body this opposing force called fluid friction or viscous drag. According to Stokes law the value of fluid friction can be obtained by the formula. $F = 6\pi\eta r v$ Where, η = Coefficient of viscosity r = Radius of the spherical body v = Terminal velocity. Cause of friction: As we know that every surface having projection and depressions. When such surface of two objects are brought into physical contact the gross interlocking of projection and depression takes place. This interlocking opposes the relative motion of one surface on the other.		
9.	**A long-jumper leaves the ground at an angle of 20 ^{o} to the horizontal and at a speed of 11 m/s. How far does he jump? What is the maximum height reached?**	[7.94 m , 0.722 m]	**K/A**	**B**
10.	**Two possible angles to hit a target by a mortar shell fired with initial**	[490 m, 5.18 sec]	**K/A**	**B**

	velocity of 98 m/s are 15º and 75º. Calculate the range of projectile and the minimum time required to hit the target			
11.	**Define angular displacement, Angular Velocity and Angular Acceleration?**	Angular Displacement: If a body moves in a circular path from any point P_1 to P_2 as shown in figure, then angular displacement of a body can be defined as: $\theta = m \angle P_1 O P_2$ OR Angular displacement is the ratio of arc length of a circle to the radius of a circle mathematically it can be expressed as: $\theta = \frac{\widehat{S}}{r}$ Unit: In S.I. System unit of angular displacement is radian. One Radian: Angular displacement is said to be one radian if arc length of a circle is equal to the radius of a circle. One radian = 57.3° Angular Velocity: [2008 , 12] Angular velocity is the amount of angular displacement covered by a body in unit time mathematically it can be expressed as: $\omega = \frac{\Delta\theta}{\Delta t}$ This is the magnitude of angular velocity. Direction of angular velocity can be obtained by using right hand rule. "If our fingers of right hand curl towards direction of angular displacement then our thumb of right hand will indicate the direction of angular velocity" Unit: In S.I. System unit of angular velocity is radian/sec. Angular Acceleration: [2008] Angular acceleration is the amount of change of angular velocity in unit time mathematically it can be expressed as. $\alpha = \frac{\Delta\omega}{\Delta t}$	**K/R**	**A**

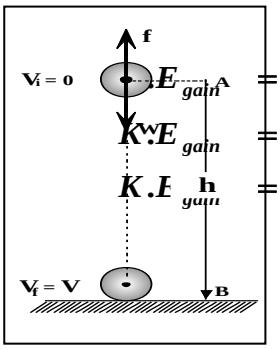
		This is the magnitude of angular acceleration. Direction of angular acceleration is always towards the direction of angular velocity, if angular velocity of a body will increases. Direction of angular acceleration always opposite to the direction of angular velocity if angular velocity of a body will decreases. Unit: In S.I. System unit of angular acceleration is radian/sec^2.		
12.	**Derive relation between linear and angular velocity?**	$\theta = \frac{\widehat{S}}{r}$ $\Delta\theta = \frac{\Delta S}{r}$ Dividing both the side by Δt $\frac{\Delta\theta}{\Delta t} = \frac{1}{r}\frac{\Delta S}{\Delta t}$ If Δt is very small then ΔS = d. we put in above $\frac{\Delta\theta}{\Delta t} = \frac{1}{r}\frac{d}{\Delta t}$ Since $\omega = \frac{\Delta\theta}{\Delta t}$ and $V = \frac{d}{\Delta t}$ $\omega = \frac{1}{r}V$ $\boxed{V = r\,\omega}$	**K/R**	**A**
13.	**Define centripetal force and centrifugal force.**	Centripetal Force: "Such a force which keeps a body in a circular path called centripetal force." If a body of mass 'm' move in a circular path of radius 'r' with uniform speed 'V' then body must possess centripetal force and according to Newton's second law of motion centripetal force can obtained by the formula $F_{cp} = m\,a_c$ Here $a_c = \frac{V^2}{r}$ we put in above	**K/R**	**A**

		$F_{cp} = \frac{mV^2}{r}$ This is the magnitude of centripetal force direction of centripetal force always towards the centre of a circle. Centrifugal Force: It is the reaction of centripetal force therefore magnitude of centrifugal force is equal to the magnitude of centripetal force but direction of centrifugal force always away from the centre of a circle mathematically it can be express as; $F_{cf} = -F_{cp}$ $F_{cf} = -ma_c$ $F_{cf} = -\frac{mv^2}{r}$		
14.	**Calculate centripetal acceleration and centripetal force on a man whose mass is 80 kg who is resting on the ground at the Equator, given that the radius of earth is 6.4 x10^6 m**	[0.0338 m/s ^{2} , 2.7N]	**K/A**	**A**
15.	**A ball mass 0.2 kg is tied to the end of a string and whirled in a horizontal circle of radius 0.4m. if the ball makes 10 complete revolutions in 4sec; determine the linear speed, centripetal acceleration and centripetal force.**	[6.28 m/s, 98.59 m/s^2, 19.72 N]	**K/A**	**B**
16.	**Define and explain torque or moment of**	"Torque or moment of force is the turning effect of the force which produces rotation in a body"	**K/R**	**B**

	force in the body.	EXPLANATION: If a force F acts on a body by making an angle θ with position vector then force of a body can be resolved into two rectangular component F cos θ and F sin θ. Where F cos θ can not produces torque in a body so torque in a body is given by $\tau = (F \sin \theta) r$ $\tau = r F \sin \theta$ $\tau = r \times F$ With the help of above equation torque can also be define as:"Torque is the cross product of position vector and force" QUANTITY:Torque is a vector quantity UNIT: In m k s system the unit of torque is N m.		→
17.	**Define equilibrium give condition of equilibrium**	EQUILIBRIUM A body is said to be in equilibrium if it is in rest or move with uniform speed. Or there is no change, either in it's translatory or rotatory motion.There are two type of equilibrium. i) STATIC EQUILIBRIUM ii) DYNAMIC EQUILIBRIUM STATIC EQUILIBRIUM Such an equilibrium in which a body is in the state of rest are called static equilibrium DYNAMIC EQUILIBRIUM Such an equilibrium in which a body move with uniform speed are called dynamic equilibrium CONDITION There are two condition of equilibrium i) FIRST CONDITION OF EQUILIBRIUM ii) SECOND CONDITION OF EQUILIBRIUM iii) FIRST CONDITION OF EQUILIBRIUM According to first condition of equilibrium or translatory equilibrium	**K/R**	**A**

		"Algebraic sum of all the force acting on the body is equal to zero". EXPLANATION: If $\vec{F_1}, \vec{F_2}, \vec{F_3}, \ldots \vec{F_n}$ be the number of force acting on a body then according to the first condition of equilibrium. $\vec{F_1} + \vec{F_2} + \vec{F_3} + \ldots + \vec{F_n} = 0$ $\Sigma \vec{F} = 0$ $\Sigma [F_x i + F_y j + F_z k] = 0i + 0j + 0k$ $\Sigma F_x i + \Sigma F_y j + \Sigma F_z k = 0i + 0j + 0k$ By comparing i , j and k the side $\Sigma F_x = 0$ $\Sigma F_y = 0$ $\Sigma F_z = 0$ So first condition of equilibrium can also be state as: Algebraic sum of all the force acting along x-axis is equal to zero. Algebraic sum of all the force acting along y-axis is equal to zero. Algebraic sum of all the force acting along z-axis is equal to zero. SECOND CONDITION OF EQUILIBRIUM: According to second condition of equilibrium or rotatory equilibrium Algebraic sum of all the torque acting on the body is equal to zero. EXPLANATION: If $\vec{\tau}_1, \vec{\tau}_2, \vec{\tau}_3, \ldots \vec{\tau}_n$ be the number of torque acting on a body then according to the second condition of equilibrium. $\tau_1 + \tau_2 + \tau_3 + \ldots + \tau_n = 0$ $\Sigma \tau = 0$ Second condition of equilibrium can also be state as: "Clockwise torque is equal to anticlockwise torque".		

18.	**Derive an expression for the mass of earth**	If a body of mass m but of very small radius as compare to the radius of earth placed on the earth surface then force with which earth attracts a body is given by: $F = \frac{G m M_e}{R_e^2}$ …. Eq. (i) The force with which earth attracts a body towards its centre is equal to the weight of the body. Mathematically it can be expressed as: $F = mg$ ….. Eq. (ii) Comparing Eq. (i) and Eq. (ii) we get: $\frac{G m M_e}{R_e^2} = mg$ $M_e = \frac{m g R_e^2}{m G}$ $M_e = \frac{g R_e^2}{G}$ Here $G = 6.67 \times 10^{-11}\ Nm^2/Kg^2$ $R_e = 6.4 \times 10^6\ m$ $g = 9.8\ m/s^2$ We put in above $M_e = \frac{(9.8)(6.4 \times 10^6)^2}{6.67 \times 10^{-11}}$ $M_e = 6 \times 10^{24}\ Kg$	**K/R**	**C**
19.	**Compute the gravitational attraction between two college students of mass 80 kg and 50 kg respectively, 2m apart from each other. Is this force worth worrying about?**	[6.67 * 10^{-8} N, Not at all]	**K/A**	**A**
20.	**The mass of the planet Jupiter is 1.9 x 10^{27} kg and that of the sun is 2 x 10^{30} kg. if the average distance between them is 7.8 x 10^{11} m. find the gravitational force of the sun on Jupiter.**	[4.16 x 10^{23} N]	**K/A**	**A**

21.	**At what depth from the surface of the earth is the value of acceleration due to gravity one- fourth the value at the earth's surface?**	[3/4 R_e]	**K/A**	**C**
22.	**Establish work energy equation.**	STATEMENT:Work energy equation consists of two statements: "In free falling body gain in kinetic energy must equal to the loss in potential energy." "In a fluid medium gain in kinetic energy is equal to the difference of loss in potential energy and work done against friction." PROOFIf a body of mass m, weight mg drops from a height h in a fluid of friction f then its kinetic energy will go on increasing because the velocity of the body is increasing and gain in kinetic energy must equal to the amount of work done by a body in a fluid. Mathematically it can be expressed as:  $K.E_{gain} = Work$ $K.E_{gain} = \vec{F} \cdot \vec{d}$ $K.E_{gain} = F\ d\ Cos\theta$ *Here* $F = mg - f$ $d = h$ We put in $\theta = 0$ above $K.E_{gain} = (mg - f)\ h\ Cos0$ $K.E._{gain} = (mg - f)\ h\ (1)$ $K.E._{gain} = mgh - f\ h$ $K.E_{gain} = P.E_{Loss} - Work\ done\ against\ friction$	**K/R**	**C**

23.	**Define simple harmonic motion; give characteristic, condition and example of simple harmonic motion?**	Definition "Vibratory motion of single frequency and fixed amplitude is called Simple Harmonic Motion." ConditionS:There are three condition of simple harmonic motion. The motion of the body should be vibratory. The acceleration "a" of the body should be proportional to its displacement "x". The acceleration of a body should be directed towards mean position mathematically $a \propto -x$ Characteristics:There are three characteristics of S.H.M i)The frequency of vibration remains unchanged. The amplitude of vibration remains unchanged. Every S.H.M has an initial phase angle. ***Examples*** i)Motion of the mass attached to a spring. ii)Motion of a simple pendulum. iii)Motion of the prongs of tuning fork. Motion of the membrane of a drum	**K/R**	**C**
24.	**Calculate the length of second's pendulum on the surface of moon where the acceleration due to gravity is 0.167 times that on the earth's surface.**	[0. 1 6 m]	**K/A**	**C**
25.	**Find the speed of sound in air at the temperature of 2 7 ^{O}C γ = 1 . 4 2, R = 8 . 3 1 3 J / mole k, molecular mass = 2 8 . 8 x 1 0 $^{-3}$ kg / mole**	[3 5 0 . 6 6 m / s]	**K/A**	
26.	**The speed of sound in air at 0 ^{O}C is 3 3 2 m/ s. what will be its speed at 2 5 ^{O}C.**	[3 4 6 . 8 m / s]	**K/A**	
27.	**Find the speed of sound at 50˚C and 10˚C(Take speed of sound 332m/s at 0˚C in air)**		**K/A**	
28.	**An ambulance travels down a highway at a**	[477 Hz, 337 Hz]	**K/A**	

	speed of 75mil/h. its siren emits sound at a frequency of 400Hz. What is the frequency heard by a person in a car traveling at 55mil/h in the opposite direction as the car approaches the ambulance and as the car moves away from the ambulance.			
29.	**Two cars are moving straight to each other from opposite directions with same speed. The horn of one is blowing with the frequency of 3000 Hz and is heard by the people in the car with the frequency of 3400 Hz; find the speed of the cars (v = 3 4 0 m/s.)**	[21.2 m/s]	**K/A**	**C**
30.	**A car has a siren sounding a 200CPS tone. What frequency will be heard by a stationary listener as the car moves away from him at 100 ft/sec? (v = 1100 ft/sec.)**	[183.3 C.P.S]	**K/A**	**C**
31.	**Define Position vector, Free vector, equal vector, negative vector and null vector**	POSITION VECTOR: A vector which starts from the origin of any frame of reference called position vector it cannot displace parallel to itself Free Vector: A vector which does not starts from origin of any frame of reference called free vector itcan displace parallel to itself form figure all vectors are free vector except position vector Equal Vector: Two vectors are said to equal if they are equal in magnitude and same in direction. Negative Vector:	**K/R**	

		Two vectors are said to be negative to each other if they are equal in magnitude but opposite in direction. Unit Vector: A vector of magnitude unity (equal to one unit) and used to represent the direction of any vector is called unit vector. It is normally represented by a small letter with a hat over it. $\hat{a} = \frac{\vec{A}}{\lvert\vec{A}\rvert}$ $\hat{i}$, $\hat{j}$ and $\hat{k}$ are the set of three rectangular unit vectors along x, y and z axis respectively Null Vector: A vector of magnitude zero and has no certain direction is known as nullvector"Its symbol is 'O' and graphically it is represented by a dot (●)It can be obtained by the following techniques: By adding two vectors of equal magnitudes and opposite direction. By the subtraction of two equal vectors. By adding several vectors in such a way that the starting and terminating points are same. By the multiplication of a vector with a zero.		
32.	**Is it possible that the magnitude of the resultant of two equal vectors be equal to the magnitude of either vector?**	Yes, it is possible if the angle between two given vectors is 120^o Since $F = \sqrt{F_1^2 + F_2^2 + 2F_1F_2Cos\theta}$ Here $F = F_1 = F_2$ $F = \sqrt{F^2 + F^2 + 2FFCos\theta}$ $F = \sqrt{2F^2 + 2F^2Cos\theta}$ $F^2 = 2F^2 + 2F^2Cos\theta$ $F^2 - 2F^2 = 2F^2Cos\theta$ $-F^2 = 2F^2Cos\theta$	**K/R**	**A**

		$-\frac{F^2}{2F^2} = Cos\theta$ $-0.5 = Cos\theta$ $\theta = Cos^{-1}(-0.5)$ $\theta = 120^0$		
33.	**Prove that** $\vec{A} \times \vec{B} \neq \vec{B} \times \vec{A}$ **OR** $\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$	Proof: If we have two vectors $\vec{A}$ **and** $\vec{B}$ which make an angle θ with respect to each other than cross product of vector $\vec{A}$ **and** $\vec{B}$ can be expressed as: $\vec{A} \times \vec{B} = \lvert\vec{A}\rvert \lvert\vec{B}\rvert Sin\theta$ ……Eq. (i) $\vec{B} \times \vec{A} = \lvert\vec{B}\rvert \lvert\vec{A}\rvert Sin(-\theta)$ ..Eq. (ii) Since $\lvert\vec{B}\rvert\lvert\vec{A}\rvert = \lvert\vec{A}\rvert\lvert\vec{B}\rvert$ $Sin(-\theta) = -Sin\theta$ We put in Eq. (ii) $\vec{B} \times \vec{A} = \lvert\vec{A}\rvert \lvert\vec{B}\rvert (-Sin\theta)$ $\vec{B} \times \vec{A} = -\lvert\vec{A}\rvert \lvert\vec{B}\rvert Sin\theta$ $-\vec{B} \times \vec{A} = \lvert\vec{A}\rvert \lvert\vec{B}\rvert Sin\theta$ Eq. (iii) By Comparing Eq. (i) and (iii) we get $\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$ OR $\vec{A} \times \vec{B} \neq \vec{B} \times \vec{A}$ So we say that vector does not contain commutative property with respect to cross product.	**K/R**	**C**
34.	**In a double slit experiment, the separation of slits is 1.9 mm and the fringe spacing is 0.31mm at a**	[5.89×10^{-7} m]	**A**	**A**

	distance of 1 meter from the slits. Find the wavelength of light?				
35.	**In a Young's double slit arrangement the slits are 0.9 mm apart and a light of $5890A°$ is used. What is the separation of fringes obtained on a screen 180 cm away from the slits?**	[1.17 mm]		**K/A**	**C**
36.	**Give difference between Interference and diffraction of light.**	Interference	Diffraction		
		Interference is the result of interaction of light coming from two different wave fronts originating from the same source.	Diffraction is due to interaction of light coming from different parts of the same wave front.	**K/R**	**C**
		In interference fringes are of the same width	In diffraction fringes are not of the same width.		
		In interference all bright fringes are of the same intensity.	In diffraction all bright fringes are not of the same intensity.		
		In interference all points of minimum intensity are perfectly dark.	In diffraction all points of minimum intensity is not perfectly dark.		
		In interference the fringe spacing is uniform.	In diffraction the fringe spacing is not uniform.		

37.	**What are the defects in lenses and how are they remove**	There is two main aberration (errors) or defects in image formation by lenses. i) Spherical aberration. ii) Chromatic aberration. Spherical Aberration Definition: "Such an error of lens in which two or more images of an object are formed closed to each other is called Spherical Aberration". Reason: The surface of the lens at the edges has more apertures than central portion and the angle of refraction at the edges in greater than central portion. Therefore, focal length of rays near the middle of the lens has longer focal length than rays at the edges. Correction: Spherical aberration can be corrected in two ways: i)By using only the central portion of a lens. ii)By using a lens made by combining lenses of different shapes. Chromatic Aberration Definition: "Such an error of lens in which an image of different colors of a white object is formed is called Chromatic Defect." Reason: In thick lenses small portion of a lens behaves as a prism. When white light passes through such portions of lens it disperse into component colour as a result the images of various colours are formed overlapping each other. Correction: Chromatic aberration can be corrected by using a combination of a convex lens and a concave lens because the dispersion produced by	**K/R**	**C**

		concave lens is exactly equal, and opposite to the convex lens.		
38.	**A converging lens of focal length 20 cm is placed infront of a converging lens of focal length 4 cm. What is the distance between the lenses if parallel rays entering the first lens leave the second lens as parallel?**	[24 cm]	**K/A**	**C**
39.	**The convex lenses of power 2 dioptres and 10 dioptres are used as an objective and an eye-piece of a telescope: find the magnifying power and the length of the telescope when focused for infinity.**	[5, 0.6 m]	**K/A**	**C**
40.	**What is the magnifying power of an astronomical telescope having1dioptres objective and a 20 dioptres eye-piece? Also find the length of the telescope.**	[20, 1.05 m]	**K/A**	**C**