

Centrifugal acceleration affect on gravitational force engineering essay

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Ans1 Gravity of earth which is denoted by 'g' is the acceleration that is imparted by earth on or near its surface to objects. The value of this acceleration is approximately 9.81 m/s^2 . Gravitational force is that force which is mainly responsible for the life on earth and due to this force only we can stand on the surface of earth. If a ball is thrown upward then it comes back to the ground, this is due to gravitational force. The net force exerted on an object by the Earth is known as apparent gravity that we experience at different locations on earth. This gravity is affected due to the presence of other forces like the centrifugal acceleration. Centrifugal force is the type of force which is produced outward by the earth's surface and centrifugal force at the latitudes near the equator is much stronger than at polar latitudes. This is the only reason that apparent gravity is 0.3% less than actual gravity at equators. When the centrifugal acceleration increases in such proportions at the equator where the rotational speed is largest such that the Earth's gravity is not able to match it, then the objects present there would appear to float whereas at poles due to gravity the objects would not float. The second major affect of centrifugal acceleration on the apparent gravity is related to the forces experienced by objects. Centrifugal force causes the objects present at equator to be farther from the center of planet than the objects at the pole. As the force due to gravitational attraction occurring between the two bodies changes inversely with the square of the distance between them. Due to this the objects at the equator experiences a gravitational force which is weaker than the objects present at the poles. So these are the affects of centripetal acceleration on the apparent gravity present on earth.

Question 2- How is centripetal force different from the coriolis force?

Ans2. Centripetal force is a force which makes the body to follow a curved path; the direction is always orthogonal to the velocity of body and it is towards the centre of curvature of the path. Whereas coriolis force is the force which comes because of the motion on the sphere's surface which is rotating and that is the earth. If an object is standing relative to the earth's surface then also it is moving because earth is moving. Centripetal force makes objects to move in orthogonal direction whereas coriolis force makes the object to move towards the right of direction of motion in northern hemisphere and to the left direction in southern hemisphere. Centripetal force impelles or draws the body towards the point at center which is not done by coriolis force. The magnitude of centripetal force on object of mass M and speed V is $F = M a_c = M V^2 / R$ In terms of angular velocity that is ω it is written as $F = M R \omega^2$ whereas horizontal component of inertial force is called coriolis. $F_h = 2m \omega u \sin(\theta)$

Question 3- How does coriolis force affects the movement of Foucault pendulum?

Ans3 There is large number of Foucault pendulums around the world and at the main places like at universities, science museums and planetarium. Coriolis force near the poles is greatest and it is zero near the equators but the centripetal force is not zero near the equators. Foucault pendulum consists of a vibrating spring which is placed on top of a disk for making a fixed angle with a disk and the spring oscillates in a plane. The terms like Coriolis force and Foucault pendulum are related matters as the Coriolis

force effects the movement of this pendulum. This is explained with an example that both a rotating universe around a fixed earth and the reverse that is rotating earth around a fixed universe are equal systems. If a heavy shell of meter is accelerated by one then mass enclosed by shell also experiences an accelerative force. The main reason behind the movement affect by Coriolis force is that when the shell is rotated relative to the fixed stars about an axis passing through its center, a force arises in the interior of the shell and this force is Coriolis force and the plane of the Foucault pendulum is dragged out. Due to this the movement of the Foucault pendulum is affected by Coriolis force.

Question 4- The Earth is said to radiate like a " blackbody" that has a temperature of -18 deg Celsius. What is a blackbody and how and why is the Earth's blackbody temperature is different from its true average temperature?

Ans 4. An object which is idealized and that absorbs all the electromagnetic radiations falling on it is known as 'blackbody'. Generally the blackbodies absorb and re-emit radiations in a spectrum which is continuous and characteristic. The emissions from a blackbody are known as blackbody radiations and these bodies' infrared radiations at room temperature. The color of the object which is hotter is closer to blue end of spectrum and the color of the object which is cooler is closer to the red. As these bodies emit radiations which are distributed thermally so they could test the properties of thermal equilibrium. Earth's blackbody temperature is different from its true average temperature which can be seen from the values. The temperature of earth is approximately 254. 356 or -18. 8 deg Celsius and the average

temperature is totally different. If earth radiates almost as a perfect black body in the infrared then -18 deg Celsius is the temperature of the earth. The earth's black body temperature is different from its true average temperature because the earth behaves or radiates almost as a perfect body and because of this the temperature raises a few degrees above the average temperature. This is the main reason of increase of temperature of the black bodies of earth in comparison to the true average temperature.

Question 5- Who originally derived the mathematical expressions that describe emission and absorption of radiation by blackbodies?

Ans 5. The person who originally derived the mathematical formula for the link of emission to absorption was by Kirchhoff in 1860. According to Prevost's law a body which emits much also absorbs much but it doesn't tell how much. For solving this problem, laws were taken out by Kirchhoff and Stefan-Boltzmann. (112 Absorption and emission) According to his first law the two powers which are emission power E_1 and absorption power A_1 are proportional to each other for which the conditions like wavelength and temperature remains the same, that is $E_1 = C \cdot A_1$. According to its second law the constant C is equal for all the substances. In the third law he tells something about a body which is perfectly dark and the body which absorbs completely all the rays which meet it. Thus, he related the emission power and the absorption power of all the bodies to one body and that is black body.

Question 6- What is the greenhouse effect?

Ans6 : Greenhouse effect is the effect by which the energies which are radioactive leaving a planetary surface are absorbed by the gases which are atmospheric and these gases are known as greenhouse gases. The energy is re-radiated in all the directions which includes back down towards the surface because they transfer energy to the other components of the atmosphere. This whole energy from all the directions transfer their energies to the surface and lower atmosphere and because of this the temperature there is higher than it would be if direct heating by solar radiations were the only source of warming the surface. (Green Gloassary, 2010) This mechanism is different from that of actual greenhouse from the fundamental points of view as greenhouse works by spreading or storing warm air inside a structure so that heat which is inside is not lost by the process of convection. The discoverer of greenhouse effect was Joseph Fourier in 1824 and the first result of the performance was given by Svante Arrhenius in 1896. If a blackbody which is an ideal thermally conductive was at the same distance as the distance of earth then it would have an expected temperature of 5.3 deg Celsius. The planets actual temperature of the blackbody is around -18 or -19 deg Celsius, about 33 deg Celsius below the actual surface temperature as the earth reflects about 30% of the incoming sunlight. Greenhouse effect is the process that produces this difference between the blackbody temperature and the actual temperature due to atmosphere. Global warming is the result of excess of greenhouse effect. When excess of greenhouse gases like carbon dioxide, methane etc are used then earth's atmosphere get so warm due to absorption. Due to this increased

temperature of earth's atmosphere, the ice caps melts and because of which the level of water increases so much which leads to the flood in the low lying areas. Due to global warming there is a great loss in life and property in the low laying areas.

Question 7- What gases in the atmosphere primarily responsible for absorbing infrared radiations from the earth?

Ans: Infrared radiations are the radiations which are mainly produced or emitted by the hot body. The common example is sun and various other household things which are hot and produces infrared radiations. These infrared radiations after a limit are very harmful for all living organisms and there are some gases which absorb these infrared radiations which in turn is very harmful. The gases which absorb infrared radiations are known as greenhouse gases which are present in the earth's atmosphere. Carbon dioxide, methane, and nitrogen oxides are the greenhouse gases which absorbs the infrared radiations in the earth's atmosphere. The percentage of these major gases on earth is carbon dioxide 36-70%, methane- 4-9%, nitrogen oxide 3-7%. Due to their length of time they remain resident in the atmosphere and because of this these gases are of particular concern. Carbon dioxide which is responsible for the absorption of infrared radiations are produced by the emissions of coal-fired power plants and combustion engine automobiles and this carbon dioxide prevents excess heats form escaping through the atmosphere and due to this temperature of earth raises. Clouds also absorb and emit infrared radiation and thus have a great effect on the radioactive properties of the atmosphere. In U. S more than

80% of the greenhouse gases are carbon dioxide emissions from the sources which are related to energy. Therefore these are the gases which are responsible for the absorption of infrared radiations.

Question 8- Describe the circulations that occur in hurricanes. Why do we normally encounter hurricanes in the northern hemisphere but not in the southern hemisphere?

Ans8 The circulation that occurs in hurricanes is the forced secondary circulation by the vertical shear of horizontal winds is isolated from the heating which is latent and the forced secondary circulation which is linked with a model stimulated hurricane vortex. By the use of potential vorticity inversion which is newly developed and by the quasi-balanced vertical motion equations system, the work of latent heating forces is to updraft in the eye wall which is very intense and slow subsidies in the eye whereas the friction forced secondary circulation occurs near the top of the boundary layer present in the eye. An anticlockwise forced secondary circulation appears across the inner core region when an environmental westerly shear is superposed with an ax symmetric balanced vortex. This results in the reduction of influence of the vertical shear by the horizontal flow and it thus opposing the roles of the vertical shear which are very destructive. Normally we encounter hurricanes in the northern hemisphere but not in the southern hemisphere because in southern hemisphere they are known as cyclones and these spin in a clockwise direction in the southern hemisphere which is opposite to hurricanes in the northern hemisphere. Another reason of more hurricanes in northern reason is that the hurricanes occurs in southern

hemisphere lasts through the northern hemisphere's colder months and the colder months are very less in northern hemisphere therefore hurricanes occurs more in northern hemisphere and not in the southern hemisphere.

Question 9- How do Meteorologists identify " cold fronts" and " warm fronts" and what is the significance of these phenomena for latent heat movement in the atmosphere?

Ans9: Meteorologists identifies cold fronts and warm fronts according to their features and with the time and place of their occurrence. The location of the cold fronts is at the leading edge of the temperature drop off and it normally lies within a sharp surface trough. One of the feature that helps Meteorologists to identify warm and cold fronts is that cold fronts can move twice fast than the warm fronts and which produces sharper changes in weather. On the weather maps which are prepared by meteorologists, the surface position of the cold fronts is marked with the symbol of a blue line of the shape of triangle which is pointing in the direction of travel and usually a warm front moves slowly than the cold front. On the other hand the surface location of a warm front is marked with a red line of semicircle which is pointing in the direction of travel on the maps by meteorologists. This phenomenon has significance for latent heat movement in the atmosphere like the formation of warm fronts over a cold air mass leads to the formation of Stratiform clouds and the steady rain occurs in a wide area. On the other hand when the cold fronts are pushed beneath the warm air produces sharp showers and formation of cumuliform clouds. Latent heat is the heat required to change a substance present in one state to the other state and it basically consists of three states. Due to the cold fronts and warm fronts the

processes like evaporation, sublimation, condensation takes place which further helps in many processes These fronts also produces the energy which is known as latent heat of evaporation and this energy is used to change liquid to vapors. These are the significance of these phenomena for the latent heat movement.

Question 10- How is latent heat and sensible heat fluxes from the Earth's surface affected by seasonal changes in temperature?

Ans10: Seasonal changes in temperature affects the latent heat and sensible heat fluxes from the Earth's surface a lot. When the temperature is low means in winter season the latent heat flux changes as the soil water at depths freezes because of low temperature. The change in latent heat and the sensible heat fluxes is dependent on the amount of solar radiations and these radiations vary with the seasonal change. For example in temperate coniferous rainforest the vaporation changed with the weather. In 1998 winters the evaporation was 432 mm and in 1999 it raised to 439 mm. The changes in the surface conductance to water vapour transfer are linked with the seasonal variation in both magnitude and direction of the sensible heat fluxes. The differences in the maximum evaporation rates timing and fux patterns resulted in great change within the seasons and there is great change found in winter and summer seasonsBy these ways latent heat and sensible heat fluxes from earth surface are affected by seasonal changes in temperature.