Value based questions in Physics Class- XI

Class XI and XII students of Central Board of Secondary Education (CBSE) will be required to answer value based questions in their final examination from the academic session 2012-13.

The Central Board of Secondary Education (CBSE), whose educational process is inclusive of co-scholastic areas of life skills, attitude and values, sports and games as well as co-curricular activities, is aiming to strengthen its education system in the area of value education. For the same, the board will be introducing value-based questions in the papers of final examinations in all major subjects for classes XI and XII from the academic session 2012-13 .

The questions will be for 5 marks in a paper of 100 marks and 3-4 marks in a question paper of 70-90 marks. This will be effective from the forthcoming final examinations — classes XI and XII in 2014.

1. An old woman crossing the road was holding a money purse. She was not able to walk .A pick pocket snatches away her purse. A school student of class X having seen this incident tries to help that old lady. He informs the police Inspector who stands nearby. The Inspector collects the money purse from the pickpocket and hand it over to the old lady.

   (a)What values do you find in the school student?

   (b)Also the police inspector in a jeep is chasing the pickpocket on a straight road. The jeep is going at its maximum speed 'v'. The pickpocket rides on the motorcycle of a waiting friend when the jeep is at a distance'**d**'away. and the motorcycle starts with a constant acceleration 'a'. Show that the pickpocket will be caught if $v \geq \sqrt{2ad}$.

   Ans: (a) The student is sympathetic towards others, helping, and applies his presence
   of mind insolving the problems, knows how to use public services.

   (b) $s = \frac{1}{2} at^2$, the distance covered by the this time interval $= s + d = vt$

   $t = \frac{v \pm \sqrt{v^2 - 2ad}}{a}$

   The pick pocketter will be caught if t is real ad positive

   This will be possible if $v^2 \geq 2ad$ or, $v \geq 2ad$.

2. Sita a student of class XII was suffering from malaria. The area is full of mosquitoes. She was not having mosquito net. Her friend Geeta has an extra net. She gave it to Sita.Also she took Gita to a Doctor, got her medicines. After a week Sita became normal

(a) Comment upon the qualities of Sita.

(b) The mosquito net over a 7 m X 4mbed is 3m high. The net has a hole at one corner of the bed through which a mosquito enters the net. It flies and sits at the diagonally opposite upper corner of the net(i) Find the magnitude of the displacement of the mosquito (ii)Taking the hole as the origin, the length of the bed as the X-axis, its width as the Y-axis and vertically up as the Z-axis, with the components of the displacement vector.

Ans: (a) Sita has a caring attitude, and concern for others.

(b)(i)√ 74m i.e.,{ $(\sqrt{7^2+4^2+3^2})$ } (ii)The components of the vector are 7m,4m, and 3m

3. Krishna went for sight seeing to a nearby river along with his physics teacher. He noticed that the wind was blowing from the side and the sailboat still continued to move forward. He was surprised. He asked his physics teacher the explanation of this situation. The teacher having noticed his interest explained the concept through a small example. The physics of sailing is very interesting in that sailboats do not need the wind to push from behind in order to move. The wind can blow from the side and the sailboat can still move forward.

The answer lies in the well-known principle of aerodynamic lift. Imagine you are a passenger in a car as it's moving along, and you place your right hand out the window. If you tilt your hand in the clockwise sense your hand will be pushed backwards and up. This is due to the force of the air which has a sideways component and upwards component (therefore your hand is pushed backwards and up).

(a) What values could you find in Krishna?

(b) Also explain what Magnus effect is.

Ans: (a) Krishna is very interested in learning the subject; also he is interested in knowing how science helps in understanding the day to day experiences, observant, has courage to ask questions.

(b) Refer NCERT TEXT BOOK.

4. Having found his mother suffering from fever *Venkat took*her tothe doctor for treatment.While checking the status, the doctor used a thermometer to know the temperature of the body. He kept the thermometer in the mouth of the patient and noted the reading as 102° F. Doctor gave the necessary medicines. After coming home, Venkat asked his mother, who is a science teacher , why mercury is used in a thermometer when there are so many liquids. Then his mother explained the reason.

(a) Comment upon the values of the mother.

(b)A newly designed thermometer has its lower fixed point and upper fixed point marked at 5◦and 95◦ respectively. Compute the temperature on this scale corresponding to 50◦C

Ans: (a) Mother has interest in educating her son and explained that Mercury has got the following properties for being used in thermometers

(i) The expansion of Mercury is fairly regular and uniform.

(ii) It is opaque and shining, hence can be easily seen through the glass tube.

(iii) Mercury is a good conductor of heat ad has low thermal capacity,

(iv) Mercury does not wet the sides of the glass tube in which it is filled.

(b) Let Θ be the temperature on the scale corresponding to 50◦C, then

(Θ -5)/(95-5) =(C- 0)/(100-0) =C/100 or Θ = 50◦

Thus, the required temperature on the scale of the designed thermometer is 50◦.

5. Having seen a big stone falling from the top of a tower Ravi pulled his friend Kiran away. The stone hit Ravi slightly and he got hurt. But he was saved from a major accident.
(a)What made Ravi act in such a way.

(b)From the top of a tower 100 m in height, a ball is dropped and at the same time another ball is projected vertically upwards from the ground with a velocity of 25 m/s.Find when and where the two balls meet. Take g = 9.8 m/sec2.

Ans: (a) More observation, presence of mind& Concern (ii) In the first case $h = \frac{1}{2}gt^2$

(b) For the second case $100-h = 25\,t - \frac{1}{2}gt^2$ where h is the height at which the two stones meet.

i.e., 100-h = 25t- h; 25t = 100; or t= 100/25 = 4 sec. ; h=78.4m

6. A monkey is sitting on a tree.Rahim seeing the Monkey brought some fruits and gave them to the Monkey, and ran into the house immediately. On hearing the sound produced when Rahim was running the monkey was scared and climbed the

nearby tree.

(a) What values of Rahim inspired you?

(b)A monkey of mass 40 Kg climbs on a rope which can stand a maximum tension of 600 N .

In which of the following cases will the rope will break. The monkey

(I) Climbs up with an acceleration of 6 m/s^2
(II) Climbs down with an acceleration of 4 m/s^2
(III) Climbs up with a uniform speed of 5 m/s
(IV) Falls down the rope nearly under gravity?
(Take g= 10 m/s^2) (Ignore the mass of the rope)

(a) Ans: (a1) Rahim loves animals and feeds them, don't frighten animals with

(b)(I) The tension developed in the string when the monkey climbs up with an acceleration of 6 m/s2 is given by T = m(g + a) = 40 (10 + 6) =640 N

(II) The tension developed when the monkey climbs down with an acceleration of 4m/s2

Is given by T = m (g-a) = 40(10-4) = 40 x 6 = 240 N

(III)When the monkey climbs with a uniform speed of 5m/s acceleration is zero and

the tension in the string is T = mg 40 x 10 = 400 N

(IV)As the monkey falls down the rope nearly under gravity, the tension in the

string is given by, T = m(g-a) = m(g-g) 0

Since the string can withstand a maximum tension of 600 N, hence the rope will

break only in the first case (I)

7. Radha found the wheel getting detached from her uncle's car . She took it to workshop and got it repaired. She informed her uncle, who is a mechanical engineer, about this matter.

(a) What according to you the values displayed by Radha?

(b)A thin wheel can stay up-right on its rim for a considerable length of time when rolled with a considerable velocity, while it falls from its upright position at the

slightest disturbance, when stationery. Explain.

Ans: (a) Radha takes care of things and has concern for others.Practical in finding the solutions to problems.

(b)When the wheel is rolling, the angular momentum is conserved. However, due to frictional force, it continues to decrease. Thus, the wheel can stay upright on its rim only for a certain interval of time. In the stationary position, the wheel falls due to unstable equilibrium.

8. Suresh noticed a big Granite Rock in his locality. He thought that if they worked upon it they couldearn money. He took permission from theGovernment, completed all the formalities .He brokethe Rock using a bomb. The rock was made into slices .They established a Granite industry. Many of the people in the surroundings started to earn and live comfortably.

(a) What values of Suresh impress you?

(b)A bomb is thrown in a horizontal direction with a velocity of 50 m/s. It explodes into two parts of masses 6 Kg and 3 Kg. the heavier fragment continues to move in the horizontal direction with a velocity of 80 m/s .Calculate the velocity of the lighter fragment.

Ans: (a) Suresh knows how to utilize the natural resources, has got concern forothers. Also he knows how to complete all legal formalities before taking up any work.

(b) According to law of conservation of momentum

Total momentum of fragments = Momentum of the Bob

$m_1v_1 + m_2v_2 = MV$

$6X80 + 3X\ v_2 = 9\ X\ 50;\ v_2 = -10$ m/s

9. Rakesh withthe intention to win in the interschool sports practiced high jump every day for about a month. He participated and won I position in the interschool sports.

(a) Comment upon the values Rakesh possesses.

(b) Whydoes anathlete run some steps before taking a jump?

Ans: (a) Rakesh has determination, he Plans and executes his plan accordingly.

(b) An Athlete runs some steps before taking a jump to gain some initial momentum, which helps him to jump more?

10. A sports teacher was training the children for march-past. On their way they come across a bridge .Then the physical education teacher stopped the children from marching on the bridge.

(a) Comment upon the values of sports teacher.

b) Also explain what is meant by Resonance.

Ans: (a) The sports teacher is responsible, cares not only for public property but also children.

(b) When the frequency of marching coincides with the natural frequency of oscillation of the bridge then the bridge oscillates with maximum amplitude to such an extent that the bridge may even collapse. This condition is called "Resonance".

11. Suraj went to Big Bazaar to purchase certain goods .There he has noticed an old lady struggling with her shopping. Immediately he showed herthelift and explainedto her how it carries the load from one floor to the next. Even then the Old lady was not convinced.. Then suraj took her in the lift and showed her how to operate it.. That old lady was very happy.

(a)What values doesSuraj possess?

(b)An elevator can carry a maximum load of 1800 kg is moving up with a constant speed of 2 m/s , The frictional force opposing the motion is 4000 N. Determine the minimum power delivered by the motor to the elevator in watts as well as in horse power.

Ans: (a) Suraj issympathetic and also has the attitudeof helpingothers. He has patience

(b)The downward force on the elevator is F= mg + Ff = (1800 X 10) + 4000 = 22000N

The motor must supply enough power to balance this force.

Hence P = F.V = 22000 X 2 = 44000W = 59 hp

12. Jagat and Ram are working in the same company.Jagat has noticed that Ram is suffering from Cancer. Ram is not aware of this.When Jagat asks him to go for a checkup, Ram refuses .He gets convinced how even when he realizes it is very important to get checkup done once a year.

(a) What according to you, are the values displayed by Jagat in helping Ram

(b) A hospital uses an ultrasonic scanner to locate tumors in a tissue. What is the wavelength of sound in the tissue in which the speed of sound in the tissue in which the speed of sound is 1.7 km/s? The operating frequency of the scanner is 4.2 MHz

(Ans: (a,) his concern for his friend, also he has the knowledge of medical facilities available

(b) $\lambda = V/v$; = 1700/4.2 x 10^6m; thatis $\lambda = 4.05 \times 10^{-4}$ m)

13. Preeti a student of class XI was reading the newspaper, The Headlines in the News paper were about the earth quake thathad taken place in Assam on the previous day. She was very depressed seeing the loss to life and property.. She approached her physics teacher and got the information about how earth quake occurs.

(a) What can you say about the inquisitiveness of Preeti?

(b)Earth quake generates sound waves inside the earth. Unlike a gas, the earth can experience both transverse(S) and longitudinal (P) sound waves. Typically the speed of S wave is about 4 km/s, and that of P wave is 8km/s. A seismograph records P and S waves from an earthquake. The first P wave arrives 4 min before the fires S wave. Assuming the waves travel in straight line, how far away does the earthquake occur?

(a)She has concern for society and is sympathetic towards others

b)($Vs = d/t_s$; $v_p = d/t_p$; $v_s t_s = v_p t_p$; $4t_s = 8t_p$; $t_s = 2t_p$;

$t_s - t_p$ = 4min = 240sec; t_p=240s; t_s=480s;d = 1920km)

14. Agroup of students went to a place on excursion. While boating on sea water, the students identified a submerged Torpedo shaped structure. The boys debated among themselves on what they saw. A student by name Sharath considering it as a threat informed the police. Thepolice took necessary steps to protect the country from the enemy submarine.Sharath was rewarded.

(a) What can you say about the qualities exhibited by Sharath?

(b) A SONAR system fixed in a submarine operates at a frequency 40 kHz. An enemy submarine moves towards the SONAR with a speed of 360 km/hr. What is the frequency of sound reflected by the submarine? Take the speed of sound in water to be 1450m/s.

Ans: (a) Navigator is a responsible citizen, he is duty minded, having presence of mind

(b)Apparent frequency received by an enemy submarine,v' = {(v + v0)/v}v=

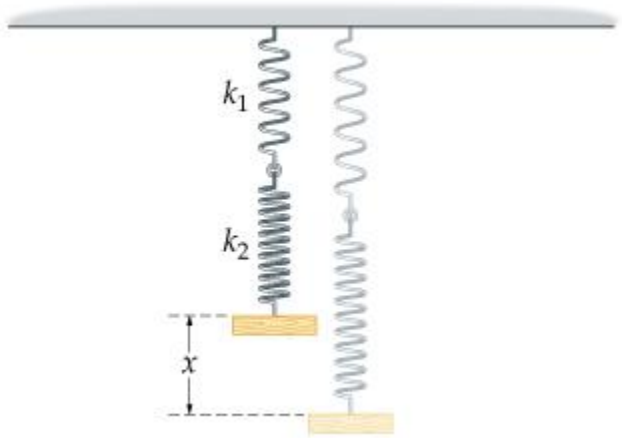
= {(1450 + 100)/1450} x 40 x 10^3Hz = 4,276 x 10^4Hz. This frequency is reflected by the enemy submarine (source) and is observed by SONAR (now observer)

In this case Apparentfrequency v'' = {v/ (v-vs.)} X v = [1450/(1450-100)]X 4.276 X 10^4Hz = 45.9 kHz.

15.) The Physics Teacher of class XI has assigned the work of finding the resultant spring constant when two springs of spring constant s k_1, k_2 are joined in series. Two students Sabita and Shirin. Sabita made a theoretical study aswellas verified experimentally. Whereas Shirin could not complete the work. When the teacher enquiredthe next day Sabita could give the answer. Whereas Shirin couldnot.

(a)Comment upon the qualities of Sabita.

(b) Two springs are joined in series and connected to a mass m as shown in fig. If spring constants are k_1 and k_2, calculate the period of oscillation of mass m.



Ans: (a) Sabita is Sincere and hard working and having scientific temper

(b)[k = k1k2/(k1+k2)]; T = $2\pi\sqrt{m(k_1+k_2)/k_1k_2}$

16. Adarsh a student of class XI has found the factors on which the time period of oscillation of a pendulum depends and arrived at the expression T = (constant) X $(l/g)^{y2}$. He wants to

know how the length of the pendulum gets affected on the surface of the moon for the same pendulum and arrived at the conclusion that it is l/6.(a) What values does Adarshpossesses?.

(b)The length of a seconds' pendulum on the surface of the earth is 1m What will be the length on the surface of the moon?

(a) Adarsh is hardworking, thinks logically,having scientific temper , able to find solutions with patience. (b) Since'**l**`is proportional to'**g** ` the length of the pendulum on the surface of the moon will be 1/6m

17.(a)Ravi has to attend to an interview . He was not well. He took the help of his friend Raghavan. On the way office Ravi felt giddy, He vomited on his dress. Raghavan washed his shirt. He made Ravi to drink enough amount of water. In spite of doing ,a foul smell was coming from the shirt. Then Raghavan purchased a scent bottle from the nearby cosmetics shop and applied on Ravi. Ravi attended the interview, Performed well .Finally he was selected.

(a)What values do you find in Raghavan?

(b)The velocity of air molecules is nearly 500m/s. But the smell of scent spreads very slowly, Why?

Ans: (a) He has presence of mind, serves others in need.

(b) This is because the air molecules can travel only along a zigzag path due to frequent collisions. Consequently, the displacement per unit time is considerably small.

18(a). Ratan noticed that his grandfather to be suffering from fever. He took him to the doctor The doctor gave him some pills .When the pills were used he sweated much, after some time became normal.Rahim enquired the Doctor about how his grandfather became normal.

(a)According to you what values are possessed by Ratan?

(b)A child running a temperature of 101°Fis given an Antipyriawhich causes an increase in the rte of evaporation of the body. If the fever is brought down to 98°F in 20 mts, what is the amount of heat lost by the body? . The mass of the child is 30 kg.

Ans: (a) Ratan is responsible and he has concern for others, inquisitiveness in gaining the knowledge

(b) Heat lost by the body = mst = 30kg X 1000cal/kg/°C X 1.67 °C = 50100cal [(where loss in tem = (101-98)°C =3 x 5/9 °F = 1.67°C.]

19. Vineet saw his uncle planting seeds in the land. His uncle does not know methods of growing plants. Then he decided to make his uncle aware of this. He explained the importance of ploughing the land before planting the seeds. Uncle is convinced with his ideas. He planted accordingly. Theplants grownsuccessfully.

(a) What can you say about Vineet?

(b) What is the utility of ploughing a field? Does it help the soil to retain moisture?

Ans: (a) Vineet has good knowledge of agriculture. He is very much interested in putting his ideas into practice, uses his knowledge to convince his uncle.

(b) When the field is ploughed, the capillaries are broken. So water cannot rise to the surface and the soil is able to retain its moisture.

20. Padma's little sister was crying. Then she took a piece of camphor and put it in water. By seeing the camphor piece dancing on the surface of water, the little one stopped crying.

(a) What can you say about the qualities of Padma?

(b)Why do small pieces of camphor dance on the surface of water?

Ans (a) Padma is responsible, helps her mother in looking after her younger sister.

(b) When camphor is dissolved in water, the surface tension of water is reduced. Since camphor has irregular shape therefore it may dissolve more at one end than at the other end. This produces an unbalanced force due to which it moves .When it reaches a different region, the same process is repeated.

21.A physics teacher explained about conservation of Angular momentum in the class .After the completion of her explanation she want to test how far how far the students are able to understand the topic. In the process she selected two students by name Babita and Ram. Both could explain the topic with examples..

(a) What qualitiesof them impress you?

(b) A physics teacher sits on a stool that is free to rotate nearly without friction about a vertical axis .Her outstretched hands each hold a large mass so that the rotational inertia is 12kgm^2.By pulling her arms close to her body she is able to reduce her rotational inertia to 6 kg m^2. If her student starts spinning at 0.5 rad/s, what is her speed after she draws her arms in?

Ans: (a) Both were doing group study, discussing together they have given answers.

(b) In the absence of external torque, her angular momentum stays constant so that $I\omega = I'\omega'$

i.e.′ = Iω/I′ =(12 x 0.5)/6 =1 rad/s; When her rotational inertia halves, her angular velocity doubles.

22. Suresh was struggling to understand the Kepler's second law of planetary motion. Then his friend Raman who came to him explained how the planet moves around the sun obeying Kepler's law of planetary motion.

(a) Comment upon the values of Raman.

(b) State and the Keplers 'laws of planetary motion.

(Ans: (a) Raman shares his knowledge with his friends and wants to improve his knowledge in the subject, has concern towards his friends.

(b) Refer NCERT Text book)

23.(a) Savita was surprised to see oil spreading on to the surface of water and asked her mother to explain why oil spreads on to the surface of water. Her mother explained her daughter the reason behind it. By going through the explanation she thought oflearning more about the other scientific phenomenon also. What qualities do you can find in Savita?

(b) Oil spreads over the surface of water whereas water does not spread over the surface of oil. Why?

(Ans: (a) she has inquisitiveness;she wants know the scientific reason behind the phenomena.

(b)The surface tension of the water is more than that of oil, therefore when oil is poured over water, the greater value of surface tension of water, pulls the oil in all directions. On the other hand, when water is poured over oil, it does not spread over it because surface tension of oil is less than that of water.

24.) Ram and his friend Ramesh while going to the school on a motorcycle noticed that a bidge hadcollapsed. Immediately they went to their physics teacher and enquired about the reasons for falling of the bridge. After knowing the reasons that very interesting they have decided to pursue their career as civil engineers and vowed to construct 100 % quality dams and bridges.

(a) Comment upon the values possessed by them.

(b) Name the property that helps in constructing bridges. Also define the property.

(Ans :(a) Sympathy, determination, and concern for society, honesty and integrity (b) Elasticityand for definition refer NCERT Text Book)

25.(a) A small hair piece has fallen into the eye of Suresh. It caused itching sensation in the eye of Sureshseeingthat Hari, who is a friend of Suresh, took him to the eye specialist. The Doctor removed it. Suresh expressed his gratitude to Hari.Comment upon the values of Hari.

(b) A student measure the thickness of a human hair by looking at it through a microscope of magnification 100.He makes 20 observations and finds that the average width of the hair in the field of view of the microscope is 3.5mm. What is the estimate on the thickness of hair?

(Ans: (a) Hari has presence of mind, acaring attitude towards his friend, & Concern towards others. (b) the estimated thickness of hair = 3.5/100 = 0.035mm)