

Aga Khan University Examination Board
Notes from E-Marking Centre on SSC-I Physics Examination May 2018

Introduction

This document has been produced for the teachers and candidates of Secondary School Certificate (SSC) Part I Physics. It contains comments on candidates' responses to the 2018 SSC Examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E-Marking Notes

This includes overall comments on candidates' performance on every question and *some* specific examples of candidates' responses which support the mentioned comments. Please note that the descriptive comments represent an overall perception of the better and weaker responses as gathered from the e-marking session. However, the candidates' responses shared in this document represent some specific example(s) of the mentioned comments.

Teachers and candidates should be aware that examiners may ask questions that address the Student Learning Outcomes (SLOs) in a manner that requires candidates to respond by integrating knowledge, understanding and application skills they have developed during the course of study. Candidates are advised to read and comprehend each question carefully before writing the response to fulfil the demand of the question.

Candidates need to be aware that the marks allocated to the questions are related to the answer space provided on the examination paper as a guide to the length of the required response. A longer response will not in itself lead to higher marks. Candidates need to be familiar with the command words in the SLOs which contain terms commonly used in examination questions. However, candidates should also be aware that not all questions will start with or contain one of the command words. Words such as 'how', 'why' or 'what' may also be used.

General Observations

This year candidates performed well on questions related to the role of physics in science, technology and society, uniform circular motion, equations of motion, major sources of energy, pressure in liquids, differentiate between boiling and evaporation. Whereas low-scoring candidates did not perform well in questions based on graphical interpretations, understanding and analysing, position of gravity, differences between the orbit of a comet and a planet, efficiency, pressure in liquids, safety features by using the idea of momentum, process of radiation, word problems based on pressure and thermal conductivity and also had problem in articulating their answers on reasoning and discussion type questions.

Detailed Comments

Constructed Response Questions (CRQs)

Question 1:

‘Physics helps in the development of our society.’ In light of the given statement, describe any THREE important roles of physics for the development of society.

Better responses correctly described three important roles of physics for the development of society. High-scoring candidates wrote about advancement in telecommunications, modern means of transportation, discovery of electricity and other man-made modern technologies such as television, mobile phones, computers etc. They also wrote about other disciplines of science, such as chemistry, agriculture and environmental and biological sciences and made integration among them.

Example:

Physics has helped us develop our society by providing us Communication, Transportation and Electricity facilities.

- 1) Communication: is made very easier by the production of cell phones, we can talk to our relative living abroad.
- 2) Transportation: New roads, rail ways are made according to the teaching of Physics. Cars invention is based on physics.
- 3) Electricity: It is the most important discovery of physics which has developed the society.

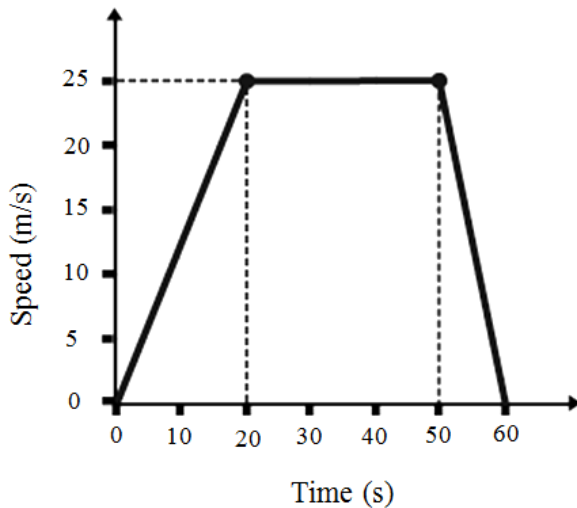
Weaker responses failed to write all three important roles of physics for the development of society. Few low-scoring candidates wrote only one correct contribution. They either wrote communication, mode of transportation or discovery of electricity. Some of the candidates wrote about the basic principles of physics, like principle of moments, Archimedes principle, principle of Floatation etc. which were completely irrelevant.

Example:

- 1) Aeronautical aerodynamics is a branch of physics, which is the about the study of aeroplane making.
- 2) different machines like cars, AC, washing machine, their construction could not have been possible without physics.
- 3) every machine works on the basic principles of physics.

Question 2:

The given speed-time graph shows the journey of a motorcyclist.



- Calculate the acceleration of the motorcyclist in the first 20 seconds.
- The motorcyclist has constant speed for how many seconds?

Better responses were able to correctly calculate the acceleration of the motorcyclist in the first 20 seconds by using the correct formula, i.e. $a = \frac{\Delta v}{\Delta t}$ and in the second part of the question, candidates were also able to find the constant speed of the motorcyclist using the data given in the question, i.e. 30 seconds.

Example:

a.

$$v_i = 0 \text{ m/s}$$

$$v_f = 25 \text{ m/s}$$

$$t = 20 \text{ sec}$$

$$a = ?$$

$$a = \frac{v_f - v_i}{t}$$

$$a = \frac{25 - 0}{20}$$

$$a = 1.25 \text{ m/s}^2$$

b.

For 30 seconds the motorcyclist has constant speed.

~~20-50=30~~ 50-20=30

Weaker responses revealed that candidates were unable to interpret the segment given in the graph with respect to acceleration and were unable to find out the initial and final velocities of the motorcyclist. Low-scoring candidates gave the correct formula of acceleration but were unable to calculate the correct answer. Similarly, they could not estimate the time in seconds of the motorcyclist for its constant speed.

Example:

a.

$$a = \frac{v_f - v_i}{t}$$

$$a = \frac{0 - 60}{20}$$

$$a = \frac{60}{20} \quad [a = 3 \text{ m/s}^2] \quad [3 \text{ m/s}^2]$$

b.

for 70 Sec
10 — 50 Sec.

Question 3:

A car has mass of 1000 kg and it moves in a circular path of radius 50 m with a constant speed of 25 m/s. Calculate the centripetal force of the car.

Better responses correctly calculated the centripetal force of the car by using the correct formula, $F = \frac{mv^2}{r}$, substituted the correct values of variables and found the correct answer by using the data given in the question, i.e. $F = 12,500 \text{ N}$.

Example:

Data		
$v = 25 \text{ m/s}$	$\therefore F_c = \frac{mv^2}{r}$	Centripetal force of the car is 12500N
$m = 1000 \text{ kg}$		
$r = 50 \text{ m}$	$F_c = \frac{(1000)(25)^2}{50}$	
$F_c = ?$		
	$F_c = 12500 \text{ N}$	

Weaker responses misunderstood the demands of the question and wrongly substituted the values of velocity and radius in the formula. Some of the low scoring candidates failed to take the square of the velocity after putting the variables in the formula of centripetal force.

Example:

$$\begin{aligned} m &= 1000 \text{ kg} \\ r &= 50 \text{ m} \\ v &= 25 \text{ m/s} \end{aligned} \quad F_c = \frac{mv^2}{r}$$
$$= \frac{(1000)(50)^2}{25}$$
$$= (1000)(2)^2 = 4000 \text{ N}$$

Question 4:

The centre of gravity of a hollow sphere always lies within the hollow region of the object. Justify the given statement.

Better responses correctly justified that the centre of gravity of a hollow sphere always lies within the hollow region of the object by writing the concept of gravity, weight and point of rotation of an object.

Example:

This is because at the hollow region all the weight of the body appears to act vertically downward. This is the position of centre of gravity; it is in the ^{centre} ~~center~~ to provide stability to objects so that they do not topple over their base. Centre of gravity is present in the middle hollow region of the object also because Earth attracts everything towards its centre. For this reason objects have weight which is equal to the product of their mass and gravity.

Weaker responses wrote irrelevant terms like atmospheric pressure, buoyancy, pressure on the liquid etc. in their answers. Responses from the low scoring candidates showed lack of conceptual understanding and in-depth knowledge of the given topic.

Example:

The Centre of gravity is due to the radius of an sphere and if the region is hollow then Centre of gravity, the Centre of gravity also depends upon the atmospheric pressure of an region, if there is no atmospheric pressure then there is no Gravity

Question 5:
Differentiate between the orbit of a comet and the orbit of a planet in THREE points.

Better responses correctly differentiated between the orbit of a comet and the orbit of a planet by mentioning the shapes of comet and planet, distance from the Sun and time to complete the rotation around the Sun.

Example:

S. No.	Orbit of a Comet	Orbit of a Planet
1	Orbit of a comet is highly elliptical.	orbit of a planet is almost spherical.
2	During their orbit they may cross orbits of other planets and their orbits are not along a planetary plane	Their orbits are along a planetary plane and during their orbit they remain in their orbit and donot cross orbit of other planets
3	They slowly and gradually come near to sun due to which sun heats their surface and dust is emitted from it and they can be seen	They remain in their orbit and donot come close to sun. Each planet has fixed distance from sun

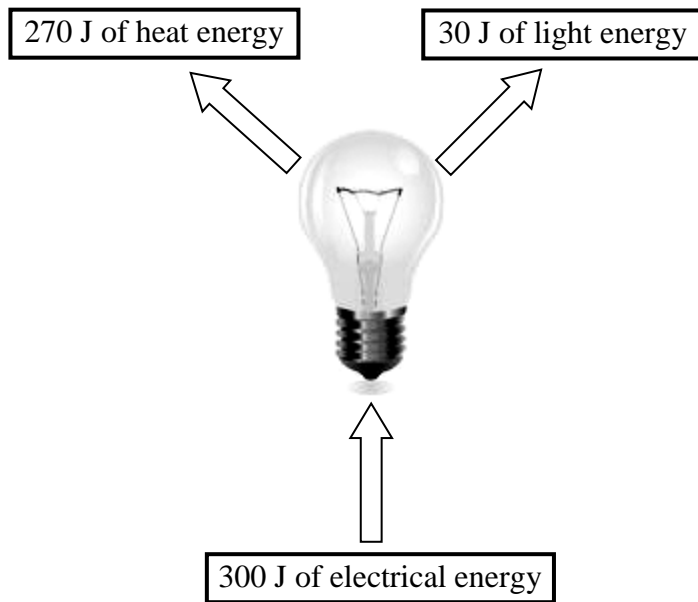
Weaker responses failed to completely differentiate between the orbit of a comet and the orbit of a planet in three points. Low scoring candidates wrote about the radius and diameter of the orbits of comet and planet, number of rotation around the Sun. Few low scoring candidates correctly wrote about shape of the comet and planet only in their answers.

Example:

S. No.	Orbit of a Comet	Orbit of a Planet
1	Orbit of a comet is smaller in radius.	Orbit Orbit of a planet is larger in radius.
2	Orbit of a comet has less circular motion smaller momentum	Orbit of a planet has less more circular motion larger momentum
3	Spherical comet in shape	spherical Semi- comet in shape.

Question 6:

Calculate the efficiency in percentage of the light bulb shown in the given diagram.



Better responses correctly calculated the efficiency in percentage of the light bulb by putting the correct formula of the $\text{Efficiency} = \frac{\text{Energy converted into the required form}}{\text{Total energy input}}$ and found efficiency, i.e. 10%.

Example:

Input = 300 J	Eff. = $\frac{30}{300} \times 100$	Efficiency of light bulb is 10%.
Output = 270 J heat Energy 30 J light energy	Eff. = $\frac{3000}{300} = 10\%$	
Eff. = $\frac{\text{output}}{\text{input}} \times 100$		

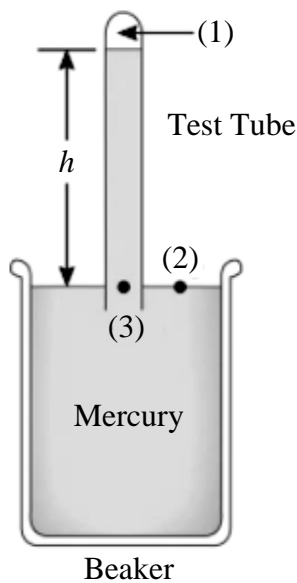
Weaker responses neither wrote the correct formula nor calculated the correct value of efficiency in percentage. Many of the candidates wrote about output and input, useful workdone and workdone on the system, which were completely irrelevant.

Example:

$$E = \frac{\text{Lost of energy} \times \text{useable energy}}{\text{Input of energy}}$$
$$E = \frac{270 \times 30}{300} \Rightarrow E = 27 \text{ J}$$

Question 7:

In the given diagram, a test tube filled with mercury is inverted into a beaker that is also filled with mercury. Assume that the closed end of the test tube is a vacuum.



Compare the pressure at points (1), (2) and (3) for the given diagram.

Better responses correctly compared the pressure at points (1), (2) and (3) in the given diagram by mentioning zero/ less pressure at point (1), atmospheric pressure/ ρgh / maximum atmospheric pressure at point (2) and same pressure as point (2)/ atmospheric pressure/ ρgh at point (3).

Example:

Pressure exerted at point 3 and 2 is same. According to Pascals law, pressure exerted at any point part of the liquid results in equal pressure all around the liquid. Point 1 has less pressure than 2 and 3.

Weaker responses exhibited that candidates were unable to compare the pressure at the different points in the given diagram, low scoring candidates were unable to compare not even between any two points. They wrote about liquid used in barometer, high and low pressures, more and less bubbles in the test tube and in the water containing beaker.

Example:

If we invert test tube filled with mercury
When it shows changes (1) The first side will become clear as the it has high pressure down
(2) At second region, the bubbles will takes place and spread and the some of mercury is gained
(3) The Bubbles will come out because of pressure.

Question 8:

If the length of a metallic conductor is 6 m; its area of cross section is 18 m^2 ; temperature difference between two surfaces of the conductor is 50 K and the rate of heat flow through the conductor is $40 \times 10^3 \text{ W}$, then calculate the thermal conductivity of the conductor.

Better responses correctly calculated the thermal conductivity of the metallic conductor by extracting the correct data from the question, using the correct formula, $k = \frac{QL}{\Delta T}$ and wrote the correct answer, $k = 266.6 \text{ W/m.K}$.

Example:

length = 6m	
$\pi r^2 A = 18\text{m}^2$	$40 \times 10^3 \text{ W} = \frac{c(50\text{K})(18\text{m}^2)}{1\text{GPa}}$
$\Delta T = 50\text{K}$	
$\Delta Q = 40 \times 10^3 \text{ W}$	$40 \times 10^3 \text{ W} = c(50\text{K})(m)$
$c = ?$	$c = \frac{40 \times 10^3}{150\text{K}(m)}$
$\therefore \Delta Q = \frac{c(T_2 - T_1)A}{L}$	$c = 266.66 \text{ Wm}^{-1}\text{K}^{-1} (\text{Ans})$

Weaker responses extracted the correct data from the question but were unable to write the correct formula of thermal conductivity, some of the low scoring candidates wrote the formula without constant 'k' and therefore unable to calculate the correct answer.

Example:

$Q = 40000 \text{ W}$	$A = 18\text{m}^2$	$\frac{40000}{t} = \frac{900}{6}$
$L = 6 \text{ m}$	$T_1 - T_2 = 50\text{K}$	
$t = ?$		$\frac{40000}{t} = 150$
$Q = \frac{A(T_1 - T_2)}{t} \cdot L$		$t = 6000000$
$\frac{40000}{t} = \frac{18(50)}{6}$		Thermal Conductivity = 6000000

Extended Response Questions (ERQs)

These questions offered a choice between part **a** and **b**.

(Note: Majority of the candidates attempted Question 9a and they scored well in this part.)

Question 9a:

A body is moving with initial velocity (A) and after a certain time (t), its velocity becomes (B), the distance covered during this time is (S); using the given information derive Newton's equation of motion $2aS = B^2 - A^2$.

Better responses correctly derived Newton's equation of motion $2aS = B^2 - A^2$ by mentioning the important and most essential mathematical steps in their derivation. Like, $S = \frac{(A+B) \times t}{2}$, $B = A + at$, $S = \frac{(A+B)}{2} \times \frac{(B-A)}{a}$, $2aS = (B+A) \times (B-A)$ and $2aS = B^2 - A^2$.

Example:

g) a)

$A = v_i$	$s = \frac{(v_f)^2 - (v_i)^2}{2a}$
$B = v_f$	
$t = \text{time}$	$2as = v_f^2 - v_i^2$
$s = \text{distance}$	Since, $v_f = B$ and $v_i = A$ so, putting the values
$v_{avg} = \frac{v_f + v_i}{2}$	$2as = B^2 - A^2$ Derived.
from 1 st eq. of motion	
$a = \frac{v_f - v_i}{t}$	
$t = \frac{v_f - v_i}{a}$	
$s = \left(\frac{v_f + v_i}{2}\right) \left(\frac{v_f - v_i}{a}\right)$	
$\therefore (a+b)(a-b) = a^2 - b^2$	

Weaker responses neither wrote the correct Newton's equation of motion nor showed the correct substitution steps. They mixed up more than two or three equations of motion in their derivation. Some of the low scoring candidates were unable to understand the supposition that would have to take place before starting the derivation.

Example:

$$2as = B^2 - A^2$$

$$\text{acceleration} = a = A$$

$$v_i = A, \quad v_f = B, \quad v_i = \frac{1}{2} v_f$$

$$\frac{A}{t} = \frac{v_f^2 - v_i^2}{\text{distance}(s) \times t}$$

multiplying both sides by t

$$\frac{A}{t} \times t = \frac{(v_f^2 - v_i^2) \times t}{s \times t}$$

$$A = \frac{v_f^2 - v_i^2}{s}$$

$$As = B^2 - \frac{1}{2} A^2$$

$$2As = B^2 - A^2$$

$$\therefore A = g$$

$$2as = B^2 - A^2$$

Question 9b:

Seatbelts and airbags are two of the safety features provided in the cars to protect passengers during any accident.

- i. Explain these features with the help of the phenomenon of momentum.
- ii. How can you connect the same phenomenon explained in part (i), when a person jumps from height.

Better responses correctly explained that seatbelts and airbags are the safety features provided in the cars to protect passengers during any accident and relate the phenomenon of momentum, when a person jumps from height. In the first part of the question, high scoring candidates used the concept of momentum, force felt by the passenger and crumple zones in cars increased the time to reach zero momentum and in the second part, candidates reflected the ideas of jumping on the ground with bending knees and reduced the force felt when a person jumps from the height.

Example:

i) Momentum is the quantity of motion a body possess due to its mass and velocity. mass and velocity are directly proportional to momentum. when a body collides with another body its impact on the other is greater if its mass or velocity is greater, that's why to cope with collisions of cars and automobiles safety measures are arranged in vehicles to safe passengers from severe hits and wounds e.g. seat belts and air bags present in cars increases the time taken for the momentum to change/reduce and having less impact it's because time taken by momentum to change decreases the force felt.

ii) when a person jumps from a height, both ~~with~~ ^{his} weight and acceleration due to gravity increases his momentum so he would hit the ground strongly with knees locked. Due to his large momentum the impact on his legs by the hardness of earth would be greater. so people bend their knees and increases the time for momentum to change. and hence feel less force/impact.

Weaker responses wrote irrelevant terms in the first and second part of the question like product of mass and velocity, increasing and decreasing velocities etc. Low scoring candidates were unable to connect the relationship between first and second part of the question that showed their lack of conceptual understanding and in-depth knowledge.

Example:

Ans: i) Momentum is the product of mass and Velocity. and when we drive the increasing of Velocity and decreasing of Velocity is much needed. so in case of accident while driving a Car or any 4 wheel to protect others and to protect ourselves we should have to fit safety features like we should to tight our seat belt and put airbags in it. so these are safety features of life while driving a car. and ii) when a person jumps from height for its safety it should have to take airbag and its belt tightly. so that's a two safety features which should have to done by persons and passengers.

(Note: Majority of the candidates attempted Question 10b and they scored well in this part.)

Question 10a:

‘Renewable energy sources are better than non-renewable source.’

Justify in FIVE points the given statement in the context of Pakistan.

Better responses correctly justified that renewable energy sources are better than non-renewable sources. High scoring candidates mentioned the important points in their answers. For example, renewable energy provides necessary support to get rid of our over-dependence on oil, while it strengthens our economy and defence capability, our country is also well placed for more plausible but technological matured renewable energy sources like wind energy, photovoltaic technology and biomass. Furthermore, some candidates wrote that due to the more favourable climatic conditions in Pakistan, solar PV possesses almost infinite potential to generate electricity in Pakistan.

Example:

Renewable energy sources are better than non-renewable sources. Renewable energy sources are the energy sources which cannot be finished for e.g. sun, water, wind etc. Non-renewable energy sources are the energy sources which can be finished for e.g. coal, oil, natural gas etc. Pakistan have 15 main rivers which are well enough to produce hydro power electricity. Pakistan is a country in which non-renewable energy resources are in very less amount and these resources take millions of years to form. Use of non-renewable sources are enough in daily routine that we can't use them for industrial purposes. Renewable resources are in nature for years. Pakistan itself is an agricultural country, it get sufficient sunlight to produce electricity. In northern areas of Punjab and all over Pakistan, it receives ~~as much as~~ with great strong winds and in coastal areas, land and sea breezes ~~are also~~ can also generate electricity through winds. Pakistan is very polluted, non renewable resources pollute the environment through their reactions. Renewable energy sources don't pollute the environment and are beneficial for Pakistan & environment. Non-renewable sources also cause diseases like asthma, lungs cancer etc, which are already present in Pakistan environment and we are trying to eliminate it from Pakistan.

Weaker responses showed that candidates were unable to provide the correct justification for the given statement in the context of Pakistan. Low scoring candidates wrote the names of renewable energy sources like air and water. They mentioned irrelevant terms in their answers like oxygen gas, petrol, and diesel etc. Few of the candidates mixed up renewable and non-renewable energy sources.

Example:

⇒ Because Renewable is reoccurring process
For example air and water

⇒ Because in Pakistan electricity is produced by
wind this is advantage of wind in Renewable.

⇒ Human depend upon Oxygen. Oxygen
will not give than Human are died. ~~that~~ that
why Renewable is better than non Renewable
source.

⇒ when coil are end than Human live
in Rural area. We have not fire and not
produce heat that why the ~~Renewo~~ Renewable
are better than non Renewable.

⇒ when we filled petrol in tank we open
their duck and the petrol will skip out.
when petrol skip out it will not Reoccur.
that why Renewable is better than non Renewable
source.

Question 10b:

Submarines, as compared to ships are designed in such a way that they can either float or submerge under water.

- i. Name and state the principle on which submarines work.
- ii. Explain the working of submarines with reference to the principle identified in part (i).

Better responses correctly named the principle on which submarines work, i.e. Archimedes principle. They also correctly stated it as 'when an object is immersed in a liquid, the liquid exerts a buoyant force on the object. This is equal to the weight of the liquid displaced by the object.' In part (ii) of the question, high scoring candidates explained that in a submarine, there are tanks, they can be filled with water and when the weight of the submarine becomes more than the weight of the water displaced by it, it submerged in the sea and in order to bring the submerged submarine to the sea surface, the water from tanks is pumped out.

Example:

b.) Principle: Archimede's Principle.

statement: when ^{an object} ~~a body~~ is partially or completely immersed in a liquid, upthrust acts on it, which is equal to weight of fluid it displaces.

ii Submarines work on same Principle. They have a system of tanks. When it wants to sink in water the tanks are filled with sea water. By doing this, weight of the body becomes more than the water it displaces and the submarine sinks.

If it wants to float, the tanks are emptied from sea water.

By doing this, weight of the body becomes ^{or equal} less ~~x~~ than the water it displaces. In this way the submarine floats in the water.

So ^{to} conclude, we can say that if upthrust acting on a body is less or equal to the weight of water it displaces ~~then~~ ^{then} the body floats. On the other hand, if upthrust acting on a body is greater than the weight of water it displaces then the body sinks.

Weaker responses displayed that candidates were unable to name the principle on which submarines work. Some of low scoring candidates wrote irrelevant terminologies like upthrust, buoyancy etc. They were also unable to state and explained the working of submarines with reference to the principle they identified. They wrote the definition of density and buoyancy, state the Newton's laws of motion in the answers.

Example:

i) Submarines work on the principle of 'upthrust'.

ii) When submarines are on the water they displace some volume of water. The volume of water displaced by submarine is equal to upthrust it experiences, upthrust is an upward force that keeps a submarine floating.

Working of submarine also connects with Newton's 3rd law of motion, Every action has an opposite but equal reaction, the pressure which is exerted by submarine ^{on} water is in return exerted by water on submarine and it keeps floating.

(Note: Majority of the candidates attempted Question 11a and they scored well in this part.)

Question 11a:

‘Evaporation takes place at all temperatures whereas boiling takes place at a fixed temperature under a given pressure.’ Explain the given statement with reference to the concept of evaporation and boiling point.

Better responses correctly explained that evaporation took place at all temperatures whereas boiling takes place at a fixed temperature under a given pressure. High scoring candidates wrote evaporation is a type of slow vaporization of a liquid that occurs from the surface of a liquid into a gaseous phase, evaporation of a liquid occurs from the surface of a liquid at all temperature and when high energetic molecules reach the surface and overcome the intermolecular forces of attraction between the neighbouring molecules and escaped out of the liquid into the atmosphere. They explained boiling as the rapid vaporization of a liquid, which occurs when a liquid is heated to its boiling point, the temperature at which the vapour pressure of the liquid is equal to the pressure exerted on the liquid by the surrounding atmosphere and which is only possible at fixed temperature.

Example:

Evaporation: It is the process by which surface liquid particles change into vapor state without heating the substance.

Boiling: Changing of liquid state into ~~both~~ vapor state at particular temperature.

So evaporation is occurring all the time but only from surface.

It is escape of molecules having more than average kinetic energy from the surface of liquid. As these molecules escape the substance cools down. That's why we say evaporation is a cooling process.

Boiling only occurs at a particular temperature known as boiling point. Boiling point is reached ~~the~~ when vapour pressure becomes equal to external or atmospheric pressure. ~~when~~ Bubbles are formed in liquid which indicates that boiling point has reached. It is change of liquid to vapor state not only from the surface of liquid but from within the liquid. Boiling point is only reached by heating the substance. On heating the intermolecular forces between the liquid particles increase as kinetic energy of particles increase. By this increase liquids expand and change into vapor state.

Weaker responses mentioned irrelevant ideas like the requirement of heat to the water for evaporation or they described the factors affecting evaporation. Some of the low scoring candidates mentioned different states and nature of liquids and wrote their boiling point in degree centigrade.

Example:

Evaporation takes place at all temperature but the liquid molecules are present in the Evaporation. So the molecules get heat they evaporate.

(1) Surface area = Greater will be the surface greater will the molecules get out of it and Vice Versa, the molecules ^{escapes} when there temperature becomes high.

(2) Temperature: If the temperature increases, the kinetic energy of liquid molecule gets increase and they escape out from the surface and molecule with low kinetic energy remains in the place, the energy get transfer from molecule to molecule.

(3) Wind: If the wind is going on then it will take, most escaped molecules with it and will go away and boiling point of water is 100°C.

(4) Nature of the liquid: The Alcohol evaporates faster than ~~then~~ the water ~~because~~ because evaporation also depends upon the Nature Boiling point. The Boiling point of any liquid is when it gets heated and the molecules escape out.

Question 11b:

Describe the process of transfer of heat by radiation with reference to infrared radiation and energy of electrons in different orbits.

Better responses correctly described the process of transfer of heat by radiation with reference to infrared radiation and energy of electrons in different orbits, they wrote that the radiation is a method of heat transferred without a physical contact between the heat source and the object being heated, heat can be transmitted through empty space by thermal radiation and thermal radiation is a type electromagnetic radiation. Some of the high scoring candidates wrote that objects emit radiation when high energy electrons in a higher atomic level fall down to lower energy levels and likewise if the absorption of energy is greater than the emission of energy, the temperature of an object rises and if the absorption of energy is less than the emission of energy, the temperature of an object falls.

Example:

(b) Radiation: It is the mode of transfer of heat by which heat reaches to us by ways called Electromagnetic waves. These waves need no vacuum for transfer of heat.

One of the example of Radiation is Infrared radiation. These radiations or rays are between Earth and sun. These radiations or rays help to provide heat energy from the sun to Earth.

Another example of Radiation is the electrons revolving in the orbits.

When electrons jump from one orbit to another, then they radiate and absorb energy in the form radiations and rays. Free radicals are also transferred from one body to another or directly to a body in the of rays or radiations.

Weaker responses reflected that candidates were unable to describe the process of transfer of heat by radiation. Few of the low scoring candidates wrote about modes of transferring of heat like conduction, convection and radiation. Some of the candidates also discussed about combustion, pollution, types of pollution and environmental issues related to pollution which were completely irrelevant.

Example:

- b) Process of transfer of heat by radiation is that when object heat up, through the radiation it will be cool object. Transfer the heat from hot body to cool body.
- * In solid electron was every tightly closed so it heat up ^{slowly} ~~immediately~~, through the radiation it will heat the cool body.
- * In liquid electron was more distance not touch each other it heat up and convert into gas.
- * Gas electron very far from each other it also convert cool body to hot.