

Aga Khan University Examination Board
Notes from E-Marking Centre on SSC I Physics Examination May 2015

Introduction

This document has been produced for the teachers and candidates of SSC Part I (Class IX) Physics. It contains comments on candidates' responses to the 2015 Secondary School Certificate (SSC-I) Examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E-Marking Notes

This includes overall comments on students' performance on every question and some specific examples of students' 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 Student Learning Outcomes 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.

Question 1

'Physics helps in the development of our society.' In the light of the given statement mention any THREE important roles of physics giving a brief description of each.

Better responses correctly mentioned three correct roles of Physics e.g. household appliances, communication devices, electricity etc. Furthermore the discoveries such as magnetism, electricity and conductors resulted in the development of modern conveniences and the concepts of physics have assisted in the development of modern means of transportation, such as aircraft and telecommunications.

Example:

- Almost every day we deal with some important physics invention even for simple housework such as washing machine, oven, etc.
- Mobile phone or laptops are one of the most important parts of our life, they are based on the principles of physics. They help us to extract information and perform other tasks.
- We get knowledge about heat, light, electricity, their uses, advantages and disadvantage. It is also important as we should completely know them before we use them such as electricity.

Weaker responses mentioned only one role of Physics e.g. inventions of new technologies which help in easing manual work, saving time and money.

Example:

Physics play a curial role and helps in the development of our society by inventing new technologies. By technologies we can improve our society. Physics can help to replace the manual work by machinery and electronics. These machineries can reduce the human work, they are more productive and make things by which we can generate money which can be spent on our society.

Question 2

Give any ONE difference between each of the following pairs.

Distance	Displacement
Speed	Velocity
Scalar Quantities	Vector Quantities

Better responses correctly wrote all of the three differences in terms of length between two points and shortest distance, scalar and vector quantities, distance and speed covered in a unit time, scalar quantities are added or subtracted by simple addition/ subtraction of magnitudes whereas vector quantities are added by the graphical method etc.

Example:

Distance	Displacement
The length of path between two points is called distance.	The shortest length of path between two points which have magnitude and direction both.

Speed	Velocity
Speed is the distance covered in unit time.	The rate of displacement is called velocity.

Scalar Quantities	Vector Quantities
Scalar Quantities are those which are described completely by its magnitude.	vector Quantities are those which are described by its magnitude and direction both.

Weaker responses mostly showed the misunderstanding and confuses in all of the three differences.

Example:

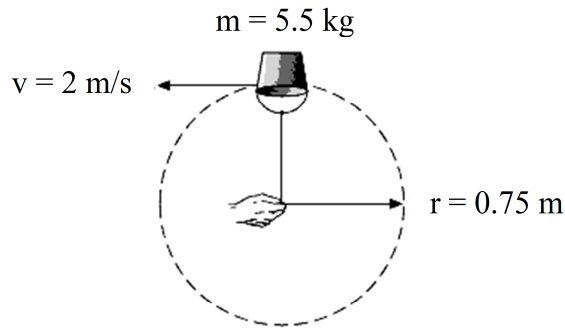
Distance	Displacement
The distance is that the line b/w two points covered.	The displacement is where the two event work it displaces.

Speed	Velocity
The rate of unit time is called speed.	The rate of time and object has mass is called velocity.

Scalar Quantities	Vector Quantities
It has not magnitude and shows from dot point.	It has magnitude and it shows from by cross section.

Question 3:

In the below diagram, calculate the centripetal force acting on the bucket of water.
 (Note: Extract data from the given diagram and provide your answer in SI unit.)



Better responses correctly collected the data from the given figure in the question and found the centripetal force by using the correct formula also mentioned correct SI unit in the final answer.

Example:

<u>Data:-</u>	<u>Solution:-</u>
mass = 5.5 kg.	$F_c = \frac{mv^2}{r}$
radius = 0.75 m.	
velocity = 2 m/s.	$= \frac{(5.5)(2)^2}{0.75} = \frac{5.5 \times 4}{0.75}$
F_c (centripetal force) = ?	$= 29.3 \text{ kgm/s}^2 \text{ or N}$
	The centripetal force is 29.3N.

Weaker responses wrote the correct formula of centripetal force but forgot to take the square of the velocity and hence unable to give the correct answer.

Example:

$C.F = \frac{mv}{r^2}$	$C.F = 19.56 \text{ N.}$
$C.F = \frac{(5.5) \times (2)}{(0.75)^2}$	
$C.F = \frac{11}{0.5625}$	

Question 4

A body that remains at rest or moves uniformly even though a number of forces are acting on it is said to be in equilibrium. There are three states of equilibrium.

Write any ONE example of each state of equilibrium from daily life. For each example, make clear which state of equilibrium is involved.

Better responses showed complete understanding about the three states of equilibrium and wrote one example of each state from the daily life e.g. candidates wrote an example of a chair/ book at rest in the stable equilibrium, a stick/ needle on the tip of a finger in unstable equilibrium and a ball rolled on the floor in the neutral equilibrium.

Example:

A book is lying on the table after a slightly tilt it return back to its previous position this is stable equilibrium. A needle is balanced on its tip on a surface it is unstable equilibrium. A ball is rolled over the smooth surface it doest return to its previous position. This is Neutral equilibrium.

Weaker responses showed the misunderstanding regarding states of equilibrium. They wrote the conditions of equilibrium instead of mentioning the examples of each state of equilibrium from daily life.

Example:

Stable equilibrium:- When a body is said to be in rest when forces is acting on it. e.g:- A car with empty fuel.
Unstable equilibrium:- When a body is said to be in rest the couple force is applied on it but it is in rest.
The stable equilibrium is involved because it is at rest or moves uniformly even the forces are applied on it.

Question 5

How does the gravitational force cause artificial satellites to orbit the Earth?

Better responses correctly showed candidates' understanding of the movement of artificial satellites around the Earth and defined the necessary force provided by the gravitational force of the Earth.

Example:

The gravitational force provides necessary centripetal force for the artificial satellites to orbit the Earth. The centripetal force is a center-seeking force which makes the object to move in a circle with constant speed but not constant velocity.

Weaker responses indicated that candidates did not understand the concept of gravitational force causes artificial satellites to orbit the Earth. They mentioned or made reference to the centripetal force correctly but failed to write the correct reason.

Example:

The gravitational force cause artificial satellite to orbit the Earth due to the gravitational force of earth is ~~42300~~ 42300 km. then the artificial satellite is reach or cross this range ~~the~~ the gravitational force of earth, not act on satellites. then artificial satellites fixed to the orbit of Earth.

Question 6

An object falls from the height of 40 m. Calculate its velocity, when it strikes the ground where the value of 'g' = 9.8 m/s².

(Note: Extract data from the question and provide your answer in SI unit.)

Better responses correctly collected the required data from the question and then used the correct formula for their calculation. Candidates either used the concept ($K.E = P.E$) of the conversion of energies or the third equation of motion ($2aS = v_f^2 - v_i^2$) for calculating their answers.

Example:

Data	$784 = v_f^2$
height = 40 m	Taking square root
gravity = 9.8 m/s ²	$\sqrt{784} = v_f$
$v_f = ?$	28 m/s = v_f
Formula: $2gh = v_f^2 - v_i^2$	Result: Velocity of the
$\Rightarrow 2(9.8)(40) = v_f^2 - (0)^2$	object is 28 m/s

Weaker responses were either unable to collect the correct data from the question or failed to write the correct formula for calculating the velocity or both.

Example:

$v = \frac{s}{t}$	
$= \frac{40}{9.8}$	
$= 4.08 \text{ m/s.}$	

Question 7

Snowshoes are flat frames that could be attached to the bottom of shoes, so that a skier can walk on the deep snow without sinking.

how the snowshoes prevent a skier from sinking into the soft snow. Describe using THREE points



Snowshoe



Normal shoe

Better responses correctly showed candidates' understanding of the use of snowshoe with flat frame i.e. the larger the area of flat frame, the lesser the pressure of the skier over soft snow or mentioned the relation $P = F/A$ or pressure is inversely proportional to the area. They also mentioned that flat frame reduces the compression of ice and prevents skier from sinking.

Example:

Snow shoes prevent a skier from sinking into soft snow by :

- 1) They increase the surface area of foot.
- 2) Large surface area provides less pressure to be applied as pressure is distributed over a large surface creating less pressure.
- 3) This prevent the skier from sinking into soft snow.

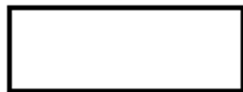
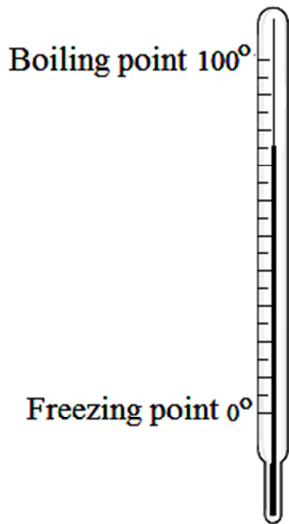
Weaker responses incorrectly reasoned that snowshoe have less friction therefore skier can walk very easily without any difficulty on the deep snow without sinking.

Example:

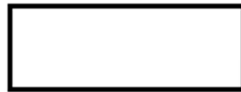
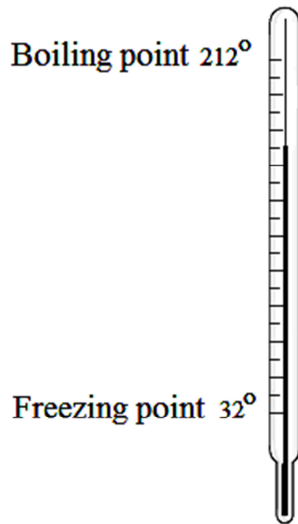
- 1-) The soft snow is very soft when we take step our leg is put into the snow the snow shoes is help for them.
- 2-) The snow shoes prevent us to sliding on snow or save our felt for any damage.
- 3-) It is fixed on the snow very easily with out any difficulty.

Question 8

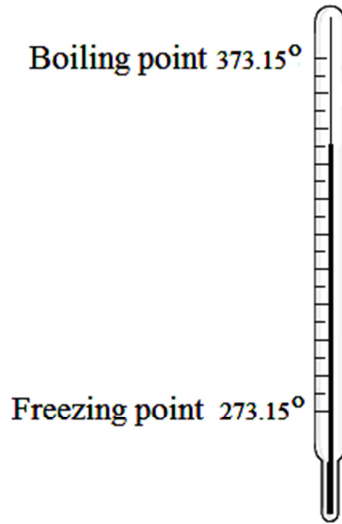
a. Identify the temperature scales of the following thermometers and write the scales in the boxes.



(A)



(B)

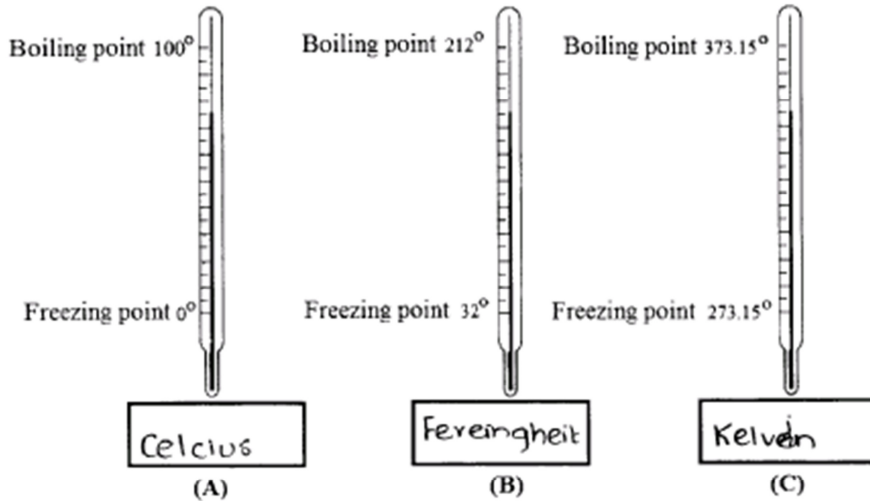


(C)

b. The reading of the thermometer (A) is approximately _____.

Better responses correctly identified the types of temperature scales of each thermometer from their freezing and boiling point measurement along with correct reading of thermometer in part (b).

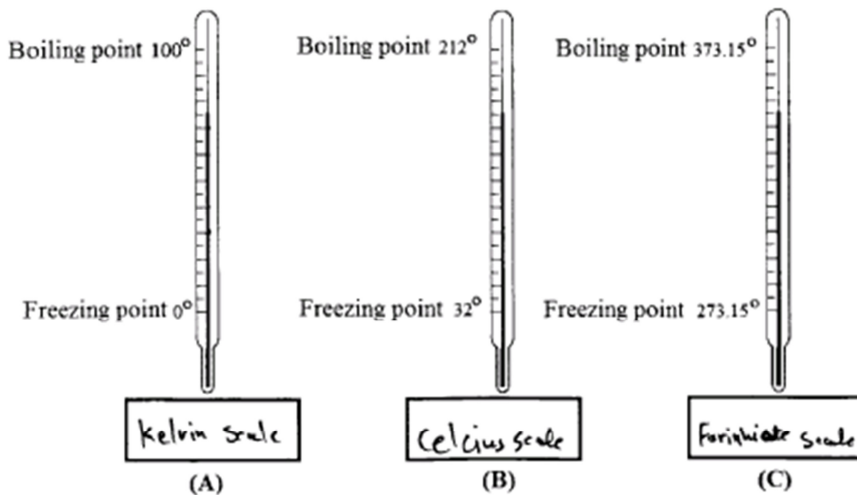
Example:



The reading of the thermometer (A) is approximately 75°C .

Weaker responses showed candidates' inability in either recognising the types of temperature scales or read the correct value on the given thermometer or both.

Example:



The reading of the thermometer (A) is approximately 76k .

Extended Response Questions (ERQs)

Question 9a

A person starts driving from his home to the petrol pump which is 1400 m away. After travelling 1600 m, he realizes that he has passed the petrol pump. He then turns his car and drives back to the pump and completes his journey to the pump in a total of 5 minutes.

Determine the total distance covered and the average speed of the car during his entire journey.

(Note: Extract data from the question and provide your answers in SI units.)

Better responses correctly extracted data from the question and determined the total distance covered, that is (1600 + 200) m, average speed and the time with correct SI units.

Example:

Data:	Solution: \odot 1600 + 200m
• distance from home to petrol pump = 1400m.	T. distance = 1800m.
• further distance = 1600m.	\odot average speed.
- hence, 1600 - 1400 = 200m.	Speed = $\frac{\text{distance}}{\text{time}}$
he came 200m ahead.	= $\frac{1800\text{m}}{300\text{s}}$
• time taken = 5 minutes = 300 seconds.	Speed = 6ms^{-1}
	Hence, the total distance covered is 1800m and the average speed is 6ms^{-1} .

Weaker responses were neither able to correctly extract data from the question nor determine the distance and the average speed. They used the correct formula of average speed i.e. $V = \frac{S}{t}$ but failed to substitute the correct values in it.

Example:

<u>Data:</u>	$S = V \times t$
$S = 1400 + 1600 = 3000\text{m}$	$S = 10 \times 300$
$t = 5\text{min} = 300\text{s}$	$S = 3000\text{m}$
<u>Formula:</u>	
$S = V \times t$	The total distance covered is 3000m
$V = \frac{S}{t}$	The average speed of the cat is 10ms ⁻¹
<u>SOL:</u>	
$V = \frac{S}{t}$	
$V = \frac{3000}{300}$	
$V = 10\text{ms}^{-1}$	

Question 9b

A stationary body acquires a velocity of 20 m/s after a force of 100 N acts on it for 5 seconds. Find the mass and the momentum of that body 5 seconds.

(Note: Extract data from the question and provide your answers in SI units.)

Better responses correctly found the mass and momentum of the body with the help of formulae

$m = \frac{F}{A}$ and $P = m v$. They also extracted correct data from the question and provided the answer in the correct SI units.

Example:

<u>Data:-</u>	$m = \frac{F}{a}$
$v_i = 0$	$m = \frac{100}{4} = 25 \text{ kg}$
$v_f = 20 \text{ m/s}$	
$F = 100 \text{ N}$	
$t = 5 \text{ sec}$	momentum (P) = mv
	$P = mv$
<u>Required:-</u>	$P = 25 \times 20$
mass = ?	$P = 500 \text{ Ns}$
momentum = ?	
$M = \frac{F}{a}$	Ans) The mass of the
	body is 25 kg and
$a = \frac{v_f - v_i}{t} = \frac{20 - 0}{5}$	the momentum is 500 Ns
$a = 4 \text{ ms}^{-2}$	

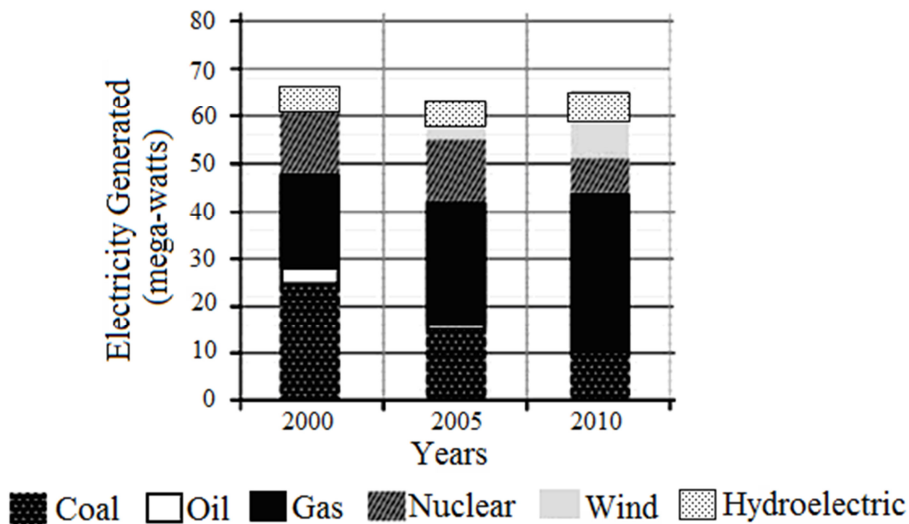
Weaker responses neither correctly found the mass nor momentum. They also failed to extract data from the question and did not provide the correct answer with the correct SI units.

Example:

For mass:	
ΔV	
Time taken	
where $\Delta V =$ change in velocity.	
$\frac{204}{51}$	
$m=4$ $m=4$	
for momentum	
mass x force	
4×100	
$m \times v = 400$	

Question 10a

The given graph shows the energy sources used by a small scale electricity generation plant from the year 2000 to 2010. In this graph, the electricity produced in mega-watt units is plotted on the y-axis while the time in years is on the x-axis.



- Name any ONE renewable energy source used for power generation shown in the graph.
- Approximately how many mega-watts of electricity is generated from non-renewable energy sources in the year 2005?
- Name the largest power generation source in the year 2010.
- Highlight any TWO environmental issues associated with non-renewable energy sources.

Better responses correctly read the bar charts and answered all the questions. They also wrote two environment issues correctly. Like

- Produce carbon monoxide which causes global warming and ozone layer depletion.
- Produce sulphur dioxide which causes acid rain and harms plants and animals.
- Produce nitrogen oxides and volatile organic compounds which contribute to smog.
- Produce particulate matter which contributes to asthma and chronic bronchitis in humans.
- Produce lead and various air toxins such as benzene etc, all of which come with significant human health hazards.
- Moreover, exploring and drilling for these products disturbs natural habitats on land and in the sea.
- Contaminate groundwater.
- Cause seepage of toxins into human drinking water.
- Mercury is released when coal is burned – linked to neurological and developmental problems in humans.

Example:

- i One renewable energy source used for power generation shown in the graph is wind energy.
- ii Approximately ~~55~~ mega-watts is the electricity generated from non-renewable energy sources in the year 2005.
- iii Gas was the largest power generation source in 2010.
- iv Two environmental issues with non-renewable energy sources are that when they are burnt their emissions i.e. gases Green house gases e.g. CH₄, CO₂ etc are emitted in the air which harms our ozone layer; it causes a hole in it and so increase global warming. Their industrial waste contaminates water and harms marine life and water.

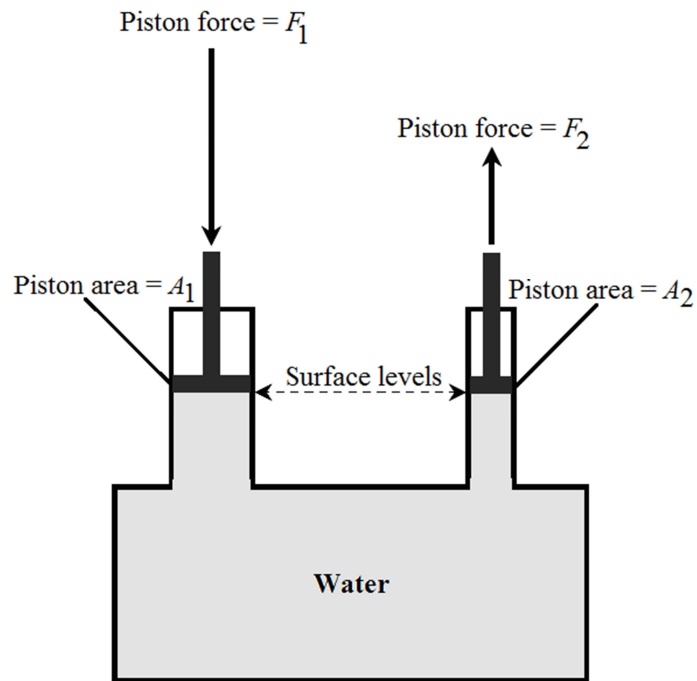
Weaker responses either read the given chart or highlighted the two environment issues correctly only.

Example:

- i ~~The~~ ^{Nuclear / Hydroelectric} ~~source~~ is a ONE renewable energy source used for power generation.
- ii Approximately Hydroelectric many mega-watts of electricity is generated from non-renewable energy sources in the years 2005.
- iii Hydroelectric the largest power generation source in the year 2010.
- iv Oil, Gas Highlight is a environmental issues associated with non-renewable energy sources.

Question 10b

In the illustrated system, if the piston with the area A_1 is pushed downwards with a force F_1 , using Pascal's law, explain the upward force F_2 on the piston with the area A_2 .



Better responses correctly explained the upward force F_2 on the piston, using area A_2 with the help of all the mathematical steps of derivation of Pascal's Law.

Example:

Pascal's Law states: Liquid enclosed in a container will be transmitted to other parts equally without having a loss.

• Hydraulic press is an example of Pascal's law.

→ There are 2 pistons and pressure is exerted on piston one i.e F_1 . Thus it'll be $P_1 = F_1/A_1$. This pressure will exert pressure on A_2 with the force ' F_2 '. $P_2 = F_2/A_2$.

→ Mathematically we can write this as.

$$\Rightarrow \frac{F_2}{A_2} = \frac{F_1}{A_1} \Rightarrow F_2 = \frac{F_1 \times A_2}{A_1} \rightarrow \text{through this equation we can find } F_2.$$

→ Force 2 (F_2) will always be greater than F_1 although the pressure will be constant because smaller the area, greater the pressure.

Weaker responses showed that candidates were unable to recognise the piston that was being affected and explained only one or two mathematical steps of derivation in their explanation.

Example:

Pascal said that if we force to a thing downward so the thing forced upward like here we push the A_1 piston downward the A_2 piston automatically pulled upward and pushed by water with same force.

Question 11a

Evaporation occurs at all temperatures whereas boiling takes place at a specific temperature which varies depending on the external pressure. Justify the given statement.

Better responses showed most of the necessary steps at which evaporation occurs. Like

- Evaporation of a liquid occurs from the surface of a liquid at all temperature,
- Overcome the attractive force,
- Escape out of the liquid,
- Saturated vapour pressure becomes equal to the external atmospheric pressure,
- Bubbles of vapours throughout the liquid.

They also described evaporation and boiling with respect to atmospheric pressure.

Example:

Evaporation is the escaping of high energy molecules from the surface of a liquid at any temperature. When the liquid molecules absorb heat from the surroundings and increase their kinetic energy, they escape in the form of vapours from the surface of the liquid.

Boiling is the state of dynamic equilibrium in which when the vapour pressure of the liquid is equal to the external or atmospheric pressure takes place. This dynamic equilibrium takes place when the liquid molecules gain enough heat to overcome their inter molecular force of attraction, this increases their kinetic energy and their internal energy increases causing

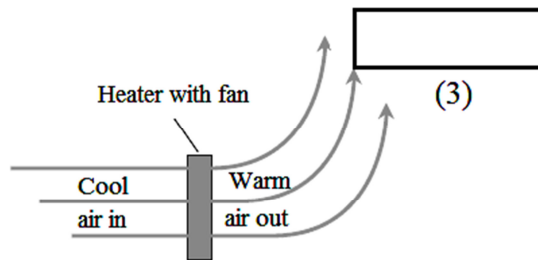
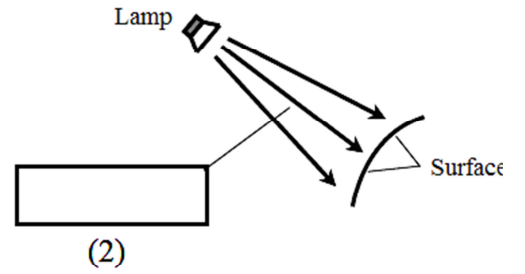
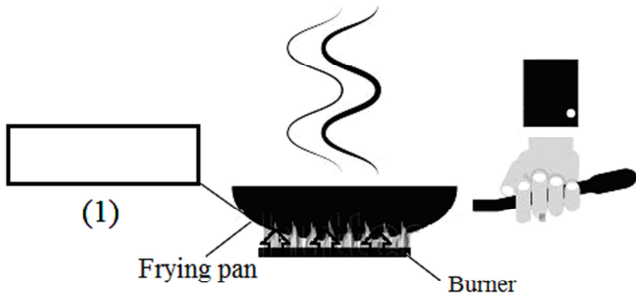
Weaker responses were unable to describe evaporation and boiling correctly with respect to atmospheric pressure rather they wrote the definition of boiling and evaporation.

Example:

Evaporation the liquid convert
into gas phase this phase
is known as
evaporation the cloth
was dip in water
and takes sunlight from
cloth then vapour should
evaporate this evaporation
the boil the water
the vapour up and
evaporate out side is

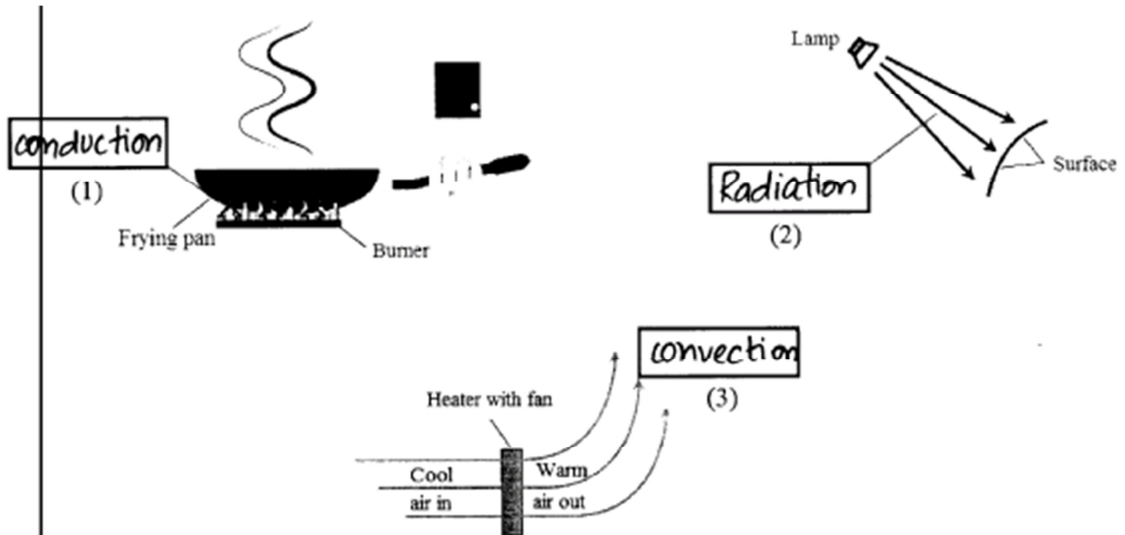
Question 11b

Name the type of heat transfer in the given boxes and explain any ONE of them.



Better responses easily recognised the types of heat transfer (conduction, radiation and convection) in each part (1), (2) and (3) respectively and explained one of the types of heat transfer correctly.

Example:

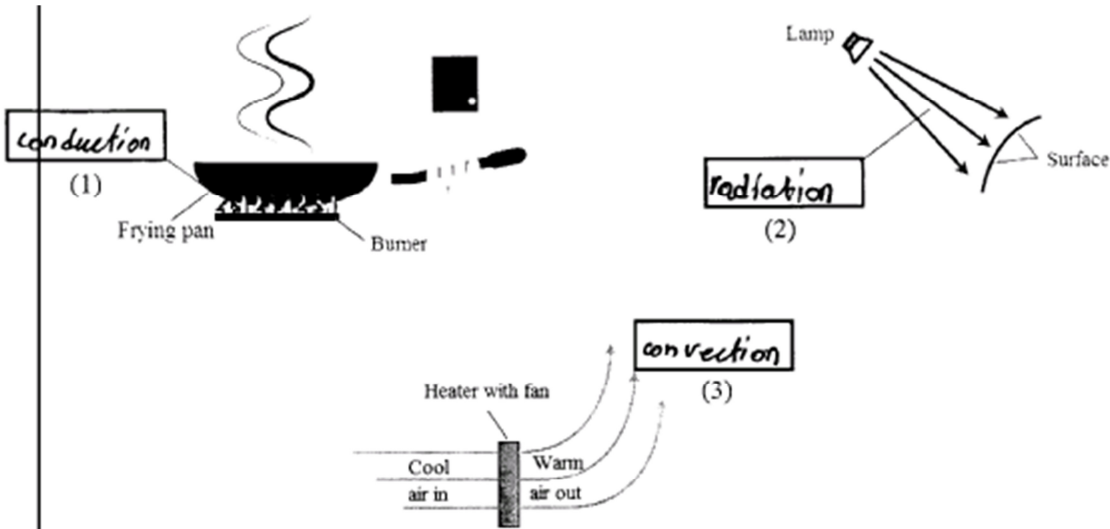


Radiation: The mode of transfer of heat in the form of waves, electromagnetic waves is called this process is called radiation.

As shown in the figure 2 the lamp rays strike on the surface through radiation. Have we ever thought that how sun rays strikes the earth surface. The rays nor strike through radiation, nor convection. They strike through radiation process. in the same way the light rays of the lamp strike through radiation. and light up the surface.

Weaker responses reflected that candidates are either unable to recognise the types of heat transfer or failed to explain one of the types of heat transfer.

Example:



Evaporation can occur in all temperatures because the substance we use is if it is evaporatable in any temperature and boiling has a specific heating point where it starts evaporating is $99^{\circ}-100^{\circ}$ although it varies upon the external pressure because of the evaporation. external pressure is based on pressurized vapours of the following boiling which is heated