Methodological recommendations for summative assessment

on the subject of “Physics”

Grade 11

(social and humanitarian direction)

Nur-Sultan, 2020

These methodological recommendations for Summative Assessment are designed to assist teachers in planning, organizing and carrying out Summative Assessment in Physics for students in the 11th grade in the social and humanitarian direction. The methodological recommendations are aligned with the Subject Programme and Course plan. Summative Assessment in Grade 11 is conducted in Terms 1,2, 3 and 4.

Assignments for summative assessment for the section / cross-cutting theme will allow the teacher to determine the level of achievement of the learning objectives by the students for each term.

For a summative assessment for a section of the topic, the methodological recommendations comprise tasks, assessment criteria with descriptors and marks for conducting Summative Assessment across the units. Also the book describes the possible levels of educational achievement of students (rubrics). Assignments with descriptors and marks are of an advisory in nature. Guidelines are intended for teachers, school administrators, methodologists of education departments, school and regional coordinators and other stakeholders for criteria based assessment. In preparing the guidelines, resources were used (drawings, photographs, texts, video and audio materials, etc.) that are publicly available on official websites.

CONTENT

1 TERM

Summative assessment for the unit "mechanical ocsilliations"

Learning objectives 11.5.1.1 – investigate harmonic oscillations (*x(t), v(t), a(t)*) experimentally, analytically and graphically

Assessment criteria *A learner*

- Definition of simple harmonic motion
- Analyze the graph and match the physical quantities

Level of thinking skills Application
Higher order thinking skills

Duration 20 minutes

1. State what is meant by *simple harmonic motion*.

   _____
   _____
   _____

   [2]

2. A trolley is attached to two extended springs, as shown in Fig. 2.1.

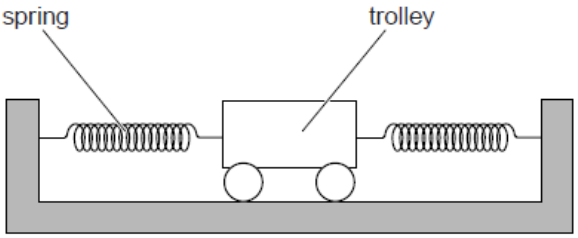


Fig 2.1.

The trolley is displaced along the line joining the two springs and is then released. At one point in the motion, a stopwatch is started. The variation with time *t* of the velocity *v* of the trolley is shown in Fig. 2.2.

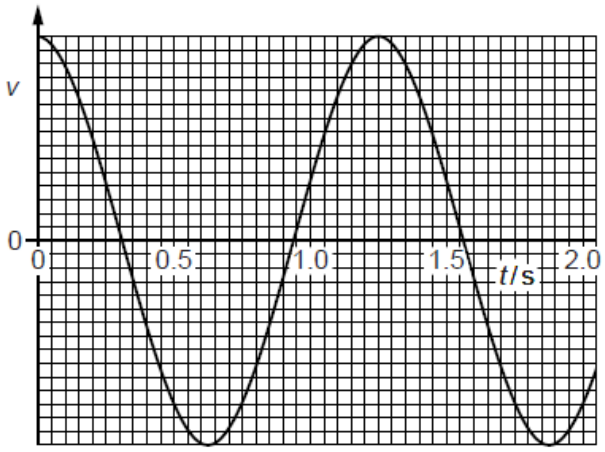


Fig 2.2.

The motion of trolley is simple harmonic.

(a) state one time at which the trolley is moving through the equilibrium position and also state the next time that it moves through this position.

……s and ……..s [1]

(b)The amplitude of vibration of the trolley is 3.2 cm.
Determine
i. the maximum speed v0 of the trolley,

v0 =……cms^{-1}[3]

ii. the displacement of the trolley for a speed of 1/2v0,

displacement = ... cm [2]

Assessment criteria	Task №	Descriptor	Mark
		A learner	
Definition of simple harmonic motion	1	Defines the term of the simple harmonic motion	2
Analyze the graph and match the physical quantities	2 a	Depicts the time from the motion	1
	2 b (i)	applies the formula for calculation of velocity	1
		Uses amplitude for finding velocity	1
		answers in SI unit	1
	2 b (ii)	Finds displacement from the half of velocity condition,	2
Total mark			**8**

Rubric for providing information to parents on the results of summative assessment for the unit Mechanical oscillations

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
Definition of simple harmonic motion	Has difficulties in defining the term of the simple harmonic motion ☐	Makes mistakes in defining the term of the simple harmonic motion ☐	Defines the term of the simple harmonic motion ☐
Analyze the graph and match the physical quantities	Has difficulties in defining the velocity from the graph, Has difficulties in applying the formula for calculation of velocity and answer in SI unit. Has difficulties in using amplitude for finding velocity; In finding displacement from the half of velocity condition; ☐	Makes mistakes in defining the velocity from the graph, Applying the formula for calculation of velocity and answer in SI unit. Using amplitude for finding velocity; Finding displacement from the half of velocity condition ☐	Defines the velocity from the graph, Applies the formula for calculation of velocity and answer in SI unit. Uses amplitude for finding velocity; Finds displacement from the half of velocity condition; ☐

Summative assessment for the unit "electromagnetic ocsilliations"

Learning objectives	11.5.2.1 – describe the conditions of free and forced oscillations; 11.5.2.2 – compare mechanical and electromagnetic oscillations;
Assessment criteria	*A learner* • Describes the occurrence of free and forced oscilliations • Draws analogies of both mechanical and electromagnetic oscilliations • Uses of electric current in the home appliances
Level of thinking skills	Application
Duration	20 minutes

Tasks

1. An alternating current supply is connected in series with a resistor R, as shown in Fig. 1.1.

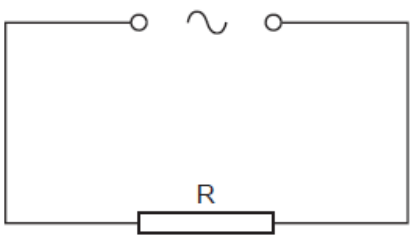


Fig 1.1.

The variation with time t (measured in seconds) of the current I (measured in amps) in the resistor is given by the expression

$$I = 9.9 \sin(380t).$$

(a) For the current in the resistor R, determine

(i)the frequency,

frequency = ... Hz [2]

(ii)the r.m.s. current,

r.m.s. current = ... A [2]

2. The defining equation of simple harmonic motion is

$$a = -\omega^2 x$$

Identify the symbols in the equation

a ……

[1]

ω……

[1]

3. State one advantages and one disadvantage of the use of alternating rather than direct current in the home.

i. Advantage …….....
.....…….

[1]

ii. Disadvantage
……
……

[1]

Assessment criteria	Task №	Descriptor	Mark
		A learner	
Description of forced and free oscilliations	1	Use the formulae in correct order	1
		Define the frequency from the given equation	1
		Calculate the alternating current using the equation	1
		express it in SI unit	1
Definition of simple harmonic motion	2	Identities of the acceleration in the equation	1
		Identities of the angular frequency	1
Use of electric current in the home appliaciences	3	Give example of one advantages of alternating current	1
		Give example of one disadvantages of alternating current	1
Total mark			**8**

Rubric for providing information to parents on the results of summative assessment for the unit Electromagnetic oscillations

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
Description of forced and free oscilliations	Has difficulties in defining the frequency from the given equation and use the formulae in correct order; In calculating the alternating current using the equation and express it in SI unit; ☐	Makes mistakes in defining the frequency from the given equation and use the formulae in correct order; In calculating the alternating current using the equation and express it in SI unit; However several mistakes might be done ☐	Defines the frequency from the given equation and use the formulae in correct order; Calculates the alternating current using the equation and express it in SI unit; ☐
Definition of simple harmonic motion;	Has difficulties in identifying of the acceleration in the equation; identifying of the angular frequency; ☐	Makes mistakes in identifying of the acceleration in the equation; Identifying of the angular frequency ☐	Identifies of the acceleration in the equation; Identitifies of the angular frequency ☐
Use of electric current in the home appliaciences;	Give example of one advantages and disadvantages of alternating current; ☐	Giving example of one advantages and disadvantages of alternating current ☐	Gives example of one advantages and disadvantages of alternating current; ☐

Summative assessment for the unit alternating current

Learning objectives	11.5.3.1 –investigate the operating principle of an alternating current generator using the generator model; 11.5.3.2 – characterise alternating current using the physical measurements such as period, frequency, maximum and effective/active value of voltage, current, electromotive force; 11.5.3.3 – explain the resonance condition and list the scopes of its application; 11.5.3.4 – calculate the resonance frequency; 11.5.3.6 – determine the number of coils in transformer windings;
Assessment criteria	*A learner* • explains of the using generator • expresses the physical quantities like period, frequency etc. • explains resonance condition and calculate frequency • solves the problem related to transformer
Level of thinking skills	Application Knowledge and comprehension
Duration	20 minutes

1. An ideal iron-cored transformer is illustrated in Fig. 1.1.

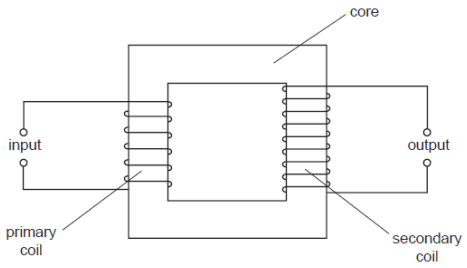


Fig 1.1. Transformer.

a. Explain why

i. the supply to the primary coil must be alternating current, not direct current,

_____

_____[2]

ii. core is laminated,

_____

_____[2]

c. The a.c. mains of 240 V r.m.s. is connected to the primary coil of a transformer, which contains 1200 turns. The r.m.s. output of the transformer is 6.0 V.

(i) Calculate the number of turns on the secondary coil.

[2]

d. A resistance of 6.0 Ω is connected across the secondary coil. Calculate:

i. The average power dissipated in the resistor

[2]

ii. The peak current in the primary coil.

[2]

Assessment criteria	Task №	Descriptor **A learner**	Mark
Research of principal work of generator of alternating current	1 a(i) (ii)	explains that primary coil must have an alternating current explains the reason of laminating the core of transformer	2 2
Application of defining the number of secondary coils	c (i)	usse the correct formulae of calculation of the secondary coils	2
	d (i)	calculates of the power dissipated by the resistor	2
	(ii)	shows the way of how to find the peak current by the secondary coils	2
Total mark			**10**

Rubric for providing information to parents on the results of summative assessment for the unit alternating current

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
Research of principal work of generator of alternating current	Has difficulties in explaining that primary coil must have an alternating current; explaining the reason of laminating the core of transformer; ☐	Makes mistakes in explaining that primary coil must have an alternating current; in explaining the reason of laminating the core of transformer; ☐	explains that primary coil must have an alternating current; explains the reason of laminating the core of transformer; ☐
Application of defining the number of secondary coils	Has difficulties in using the correct formulae of calculation of the secondary coils; In calculating of the power dissipated by the resistor; In showing the way of how to find the peak current by the secondary coils ☐	Makes mistakes in using the correct formulae of calculation of the secondary coils; In calculating of the power dissipated by the resistor; showing the way of how to find the peak current by the secondary coils; ☐	uses the correct formulae of calculation of the secondary coils; calculates of the power dissipated by the resistor; shows the way of how to find the peak current by the secondary coils; ☐

2-TERM

Summative assessment for the unit electromagnetic waves

Learning objectives	11.6.1.1 - explain the condition of the occurrence of EM waves and describe its characteristics. 11.6.1.3 –explain the operating principle of radio 11.6.1.5 – systematise communication means and suggest possible ways of their improvement;
Assessment criteria	*A learner* • Explains the condition of the EM waves with description in further • Explains how system of radio-communications work • Suggests the enhancing method of communication system
Level of thinking skills	Knowledge and comprehension Higher order thinking skills
Duration	25 minutes

1. State one property of electromagnetic waves that is not common to other transverse waves.

.....[1]

2. Seven regions of the electromagnetic spectrum are represented by blocks labelled A to G in Fig. 2.1.

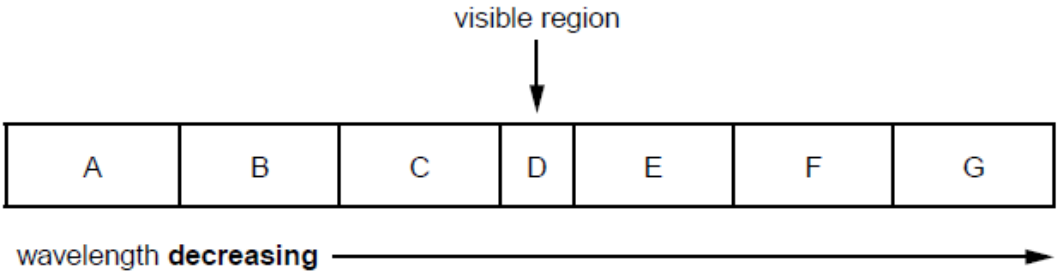


Fig 2.1.

A typical wavelength for the visible region D is 500 nm.

i) Name the principal radiations and give a typical wavelength for each of the regions B, E and F.

B: name: ..... wavelength: ..... m
E: name: ..... wavelength: ..... m
F: name: ..... wavelength: .....m

[3]

ii) Calculate the frequency corresponding to a wavelength of 500 nm.

frequency _____Hz[2]

iii) The waves in the spectrum shown in Fig. 2.1 can be polarised. Explain the meaning of the term *polarised*.

.....
.....[2]

3. One channel of communication is by the use of a coaxial cable. Such a cable is illustrated in Fig 3.1.

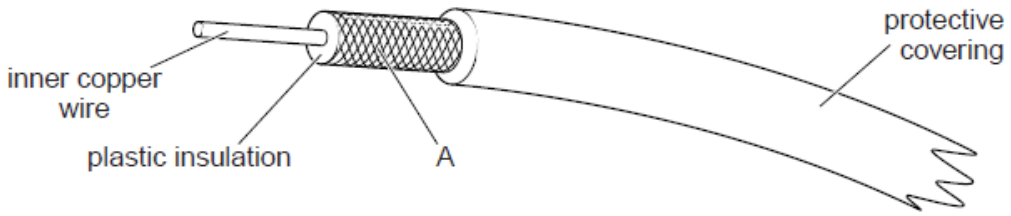


Fig 3.1. Coaxial cable

a) Suggest the material from which the component labelled A on Fig. 3.1 is made.
.....[1]

b) Suggest two functions of the component labelled A.
1.....
.....[1]
2.....
.....[1]

Assessment criteria	Task №	Descriptor **A learner**	Mark
Explains the condition of the EM waves with description in further	1	Indicates the common property of EM waves	1
Explains how system of radio-communications work	2	i)Name the types of waves according to its wavelengths	3
		ii)Calculate the frequency	2
		iii) depicts the property of EM waves that how EM can be polarised	2
Suggests the enhancing method of communication system	3	a) shows the suitable material	1
		b) indicate the two functions of label A	1 1
Total mark			11

Rubric for providing information to parents on the results of summative assessment for the unit electromagnetic waves

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
Properties of EM waves	Not able to: Indicate the common property of EM waves ☐	Be able to: Indicate the common property of EM waves; Cause some difficulties; ☐	Be able to: Indicate the common property of EM waves ☐
EM spectrum classification and use it in radio-communication	Not able to: i)Name the types of waves according to its wavelengths; ii)Calculate the frequency; iii) depicts the property of EM waves that how EM can be polarized; ☐	Be able to: i)Name the types of waves according to its wavelengths; ii)Calculate the frequency; iii) depict the property of EM waves that how EM can be polarized; Cause some difficulties. ☐	Be able to: i)Name the types of waves according to its wavelengths; ii)Calculate the frequency; iii) depicts the property of EM waves that how EM can be polarized; ☐
System of the communication procedure and its improvement	Not able to: i) shows the suitable material; ii) indicate the two functions of label A ☐	Be able to: i) shows the suitable material; ii) indicate the two functions of label A; Cause some difficulties; ☐	Be able to: i) shows the suitable material; ii) indicate the two functions of label A ☐

Summative assessment for the unit wave optics

Learning objectives	11.7.1.1 – define conditions for observation of interference and diffraction of light waves; 11.7.1.2 – describe the use of diffraction grating to define a wave length; 11.7.1.3 – investigate the polarization of light experimentally
Assessment criteria	*A learner* • Uses diffraction grade to define the wavelength • Understand the meaning of polarization of light • Solve the problems related to wavelength and frequency
Level of thinking skills	Knowledge and comprehension Higher order thinking skills
Duration	20 minutes

Tasks

1. Explain what is meant by the *diffraction* of a wave.

.....
.... [2]

2. A double-slit interference experiment is set up using coherent red light as illustrated in Fig.1.

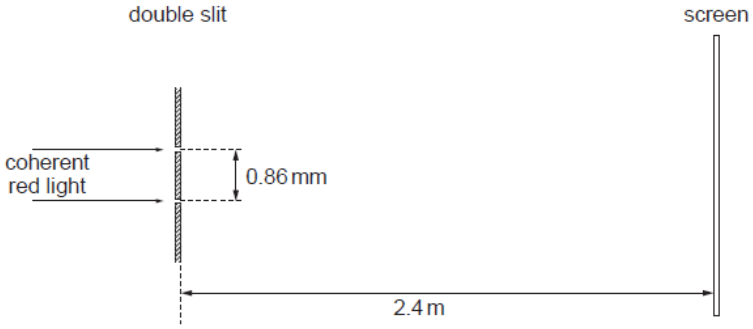


Fig 1.

The separation of the slits is 0.86 mm.
The distance of the screen from the double slit is 2.4 m.
A series of light and dark fringes is observed on the screen.

a) State what is meant by *coherent* light.

.....[1]

b) Estimate the separation of the dark fringes on the screen.

separation =.....mm [3]

(c) Initially, the light passing through each slit has the same intensity.
The intensity of light passing through one slit is now reduced.
Suggest and explain the effect, if any, on the dark fringes observed on the screen.

.....
....[2]

3. State what is meant by the *polarization* of light.

_____
_____[1]

Assessment criteria	Task №	Descriptor A learner	Mark
Definition of the diffraction of the light	1	Gives the clear definition of diffraction of light	2
Solve the problems that are related to diffraction grade and its application	2	a)Gives the definition of coherence of light	1
		b) Solves the problems related to diffraction grade and uses all the provided physical quantities in correct order.	3
		c) suggests the effects of light passing through the slits	2
Definition of the polarization of light	3	Defines the polarization of light	1
Total mark			**9**

Rubric for providing information to parents on the results of summative assessment for the unit wave optics

Learner's full name _____

ssessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
Definition of the diffraction of the light	Not able to: Give the clear definition of diffraction of light ☐	Be able to: Give the clear definition of diffraction of light Cause some difficulties; ☐	be able to: Give the clear definition of diffraction of light ☐
Solve the problems that are related to diffraction grade and its application	Not able to: a)Gives the definition of coherence of light; b) Solves the problems related to diffraction grade and uses all the provided physical quantities in correct order; c) suggests the effects of light passing through the slits ☐	be able to: a)Gives the definition of coherence of light; b) Solves the problems related to diffraction grade and uses all the provided physical quantities in correct order; c) suggests the effects of light passing through the slits; Cause some difficulties; ☐	be able to: a)Gives the definition of coherence of light; b) Solves the problems related to diffraction grade and uses all the provided physical quantities in correct order; c) suggests the effects of light passing through the slits ☐
Definition of the polarization of light	Defines the polarization of light ☐	Be able to: Defines the polarization of light Cause some difficulties; ☐	Be able to: Define the polarization of light ☐

Summative assessment for the unit geometrical optics

Learning objectives	11.7.2.1 – determine the glass refractive index experimentally; 11.7.2.2 – explain the advantages of optical fiber technology when transmitting the light signals; 11.7.2.3 – set up and explain the rays in a magnifier, telescope and microscope;
Assessment criteria	*A learner* • Defines the refraction index of light • Explains the optic-fiber technology in use • Constructs and explains the way of light in optical devices
Level of thinking skills	Knowledge and comprehension Higher order thinking skills
Duration	20 minutes

Tasks

1. Different frequencies and wavelengths are used in different channels of communication. Suggest why, infra-red radiation rather than visible light is usually used with optic-fibres.

.....
....[2]

2. A beam of white light strikes the face of a prism. Copy Figure 2.1 and draw the path taken by red and blue rays of light as they pass through the prism and on to the screen AB.

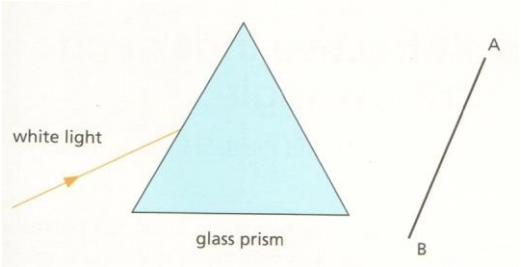


Figure 1

[2]

3. Figure 2 shows a camera focused on an object in the middle distance. Should the lens be moved towards or away from the film so that the image of a more distant object is in focus?

[2]

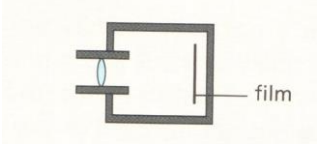


Figure 2

4. What is meant *shadows* in the light

_____
_____[1]

5. State what is meant the *angle of incidence.*

_____
_____[1]

Assessment criteria	Task №	Descriptor	Mark
		A learner	
Use of optic-fiber technology in transferring signals	1	Suggests the enhancing method of using optic fiber	2
Define the way of light in prism	2	Copies and draws the correct passage of light	2
Constructs and explains the path of light	3	Defines and explains the path light in optical devices	2
Give definition of light phenomenon	4 5	Give the definition of shadows Define the angle of incidence	1 1
Total mark			**8**

Rubric for providing information to parents on the results of summative assessment for the unit wave optics

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
Use of optic-fiber technology in transferring signals	Not able to: Suggest the enhancing method of using optic fiber ☐	Be able to: Suggests the enhancing method of using optic fiber Cause some difficulties; ☐	Be able to: Suggests the enhancing method of using optic fiber ☐
Define the way of light in prism	Not able to: Copies and draws the correct passage of light ☐	be able to: Copies and draws the correct passage of light; Cause some difficulties; ☐	be able to: Copies and draws the correct passage of light ☐
Constructs and explains the path of light	Not able to: Define and explain the path light in optical devices ☐	Be able to: Define and explain the path light in optical devices Cause some difficulties; ☐	Be able to: Define and explain the path light in optical devices ☐

3 TERM

Summative assessment for the unit Quantum physics

Learning objectives	11.8.1.2 – describe the method of spectral analysis and its application; 11.8.1.4 – explain the nature of photoelectric effect and to give examples of its application; 11.8.1.6 – make comparison between computerised tomography and magnetic resonance imaging;
Assessment criteria	***A learner*** • Analyses the given spectrum • Uses spectrum to calculate frequency • Explains the photo effect • Explains difference CT and MRI
Level of thinking skills	Knowledge and comprehension Application
Duration	25 minutes

Tasks

1. In figure 1.1 the spectrum of the visible is given.

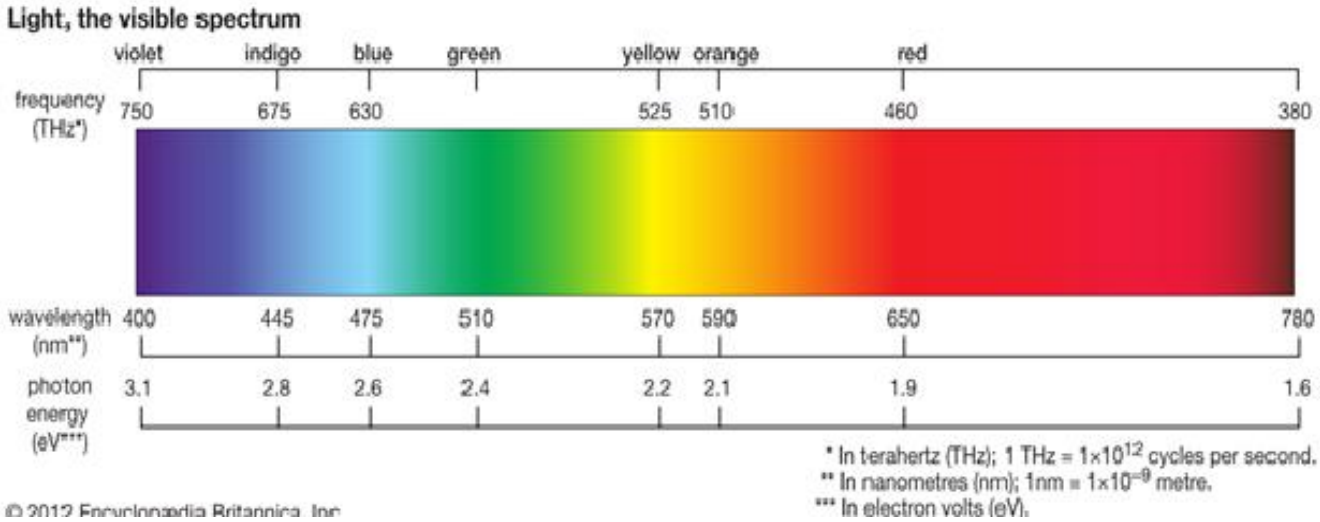


Figure 1.1.

According to figure 1.1

i. Explain frequency and wavelength in terms of spectrum.

_____

_____[1]

ii. Calculate the frequency of green color.

_____

_____

[2]

2. The variation with frequency f of the maximum kinetic energy EK of photoelectrons emitted from the surface of sodium metal is shown in Fig. 1.

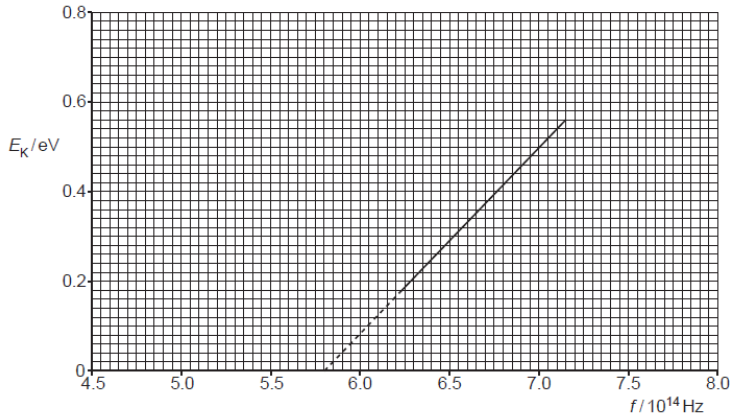


Fig 1.

Use the gradient of the graph of Fig.1 to determine a value for the Planck constant h. Show you working

[3]

3. What does the photoelectric effect demonstrate?

A) The particulate nature of light
B) The wave nature of light
C) The diffuse reflection of light
D) The total internal reflection of light

[1]

4. Write an example of a photo effect.

[1]

5. What is the difference between CT and MRI?

[2]

Assessment criteria	Task №	Descriptor	Mark
		A learner	
Analyses the given spectrum Uses spectrum to calculate frequency	1	States the frequency and wavelength	1
	2	Calculates the frequency of green color	2
		Plank constant correctly described	2
		In SI unit the meaning of plank constant	1
The photo – effect phenomenon examples	3	Finds the suitable answer	1
	4	Gives an example of photo-effect	1
Explains difference CT and MRT	5	Defines what use CT scans	1
		Defines what use MRI	1
Total mark			**9**

Rubric for providing information to parents on the results of summative assessment for the unit Quantum Physics

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
Analyses the given spectrum Uses spectrum to calculate frequency	Not able to Analyse the given spectrum of light; Calculate the frequency; ☐	Be able to Analyse the given spectrum of light; Calculate the frequency; Several mistakes may occur ☐	be able to Analyse the given spectrum of light; Calculate the frequency; ☐
The photo – effect phenomenon examples	Not able to find correct answer ☐	Find the correct answer ☐	Find the correct answer ☐
Explains difference CT and MRT	Not able to define what use CT scans and define what use MRI ☐	Defines what use CT scans Defines what use MRI ☐	Defines what use CT scans Defines what use MRI Give examples of technology in daily life ☐

Summative assessment for the unit "Physics of atomic nucleus", "Nanotechnology and nano-materials"

Learning objectives

11.9.1.3 – explain the nuclear decay and nuclear fusion;
11.9.1.4 – explain the nature of ionising effect and penetrating power of radiation;
11.10.1.1 – explain physical properties of nanomaterials, their production and use;

Assessment criteria

A learner

- Explains the decay process
- Understand radiation phenomenon
- Uses the nano-technology

Level of thinking skills

Knowledge and comprehension
Application

Duration

20 minutes

Tasks

1. Sanjar reads this about an uncontrolled nuclear chain reaction:

- at the start, one neutron causes the fission of one uranium nucleus
- at this first stage, three new neutrons are released
- each of these three neutrons causes the fission of uranium nucleus
- at this second stage, nine more neutrons are released
- each of these neutrons causes another fission.

Sanjar tries to understand the process and begins to draw a table like this.

point in chain reaction	start	at first stage	at second stage	at third stage	at fourth stage	at fifth stage
number of neutrons released	1	3	9			

[3]

How many neutrons are probably released at the fifth stage?

A) 45
B) 81
C) 243
D) 6561

[1]

2. A pure sample of an unknown radioactive nuclide has a very long half-life. For the sample the following quantities are known
I. the number of nuclei in the sample
II. the mass of the sample
III. the activity of the sample.
Which of the following will enable the half-life of the nuclide to be determined?
A. III only
B. II and III only
C. I and III only
D. II only

[1]

3. Many television receivers are connected to an aerial using a coaxial cable. Such a cable is

illustrated in Fig. 1.

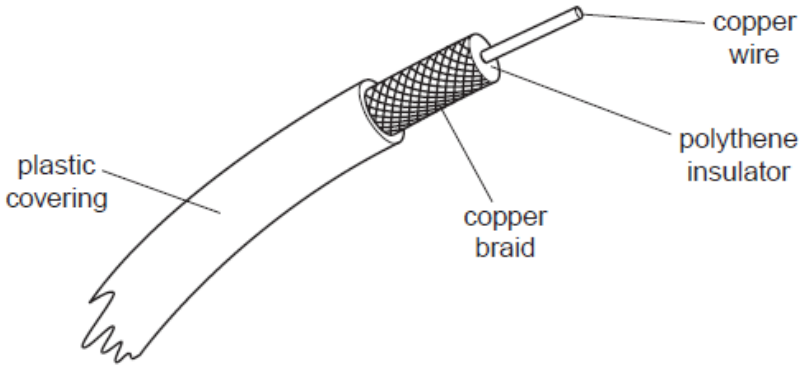


Figure 1.

State two functions of the copper braid.

1. .....

2. .....[2]

4. Suggest two reasons why a coaxial cable is used, rather than a wire pair, to connect the aerial to the receiver

1. .....

.....

2.....

.....

[2]

5. The radioactive decay of nuclei is both spontaneous and random.

Explain what is meant by radioactive decay of a nucleus,

.....

..... [2]

Assessment criteria	Task №	Descriptor *A learner*	Mark
explain the processes of decay and nuclear synthesis	1	Shows the stages of procedure	3
	2	Find the neutrino number	1
		Determine the half-life of nuclei	1
explain the physical properties of nanomaterials, methods for their preparation and use	3	Suggest two functions of copper braid	2
	4	Express two reasons of using copper wire	2
explain the nature of the ionizing effect and penetration; radioactive radiation;	5	Explains the nature of radioactive decay	2
Total mark			**10**

Rubric for providing information to parents on the results of summative assessment for the unit Atomic and nuclear physics. Nanotechnology and nano-materials

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
explain the processes of decay and nuclear synthesis	Not able to: Shows the stages of procedure Find the neutrino number ei ☐	able to: Shows the stages of procedure Find the neutrino number Determine the half-life of nuclei However several mistakes might be done ☐	able to: Shows the stages of procedure Find the neutrino number Determine the half-life of nuclei Clear explanation of each findings ☐
explain the physical properties of nanomaterials, methods for their preparation and use	Not able to: Suggest two functions of copper braid Express the reason of using copper wire ☐	Be able to: Suggest two functions of copper braid Express the reason of using copper wire However several mistakes might be done ☐	Be able to: Suggest two functions of copper braid Express the reason of using copper wire ☐
explain the nature of the ionizing effect and penetration; radioactive radiation;	Not able to: Explain the nature of radioactive decay ☐	Be able to: Explain the nature of radioactive decay; However several mistakes might be done ☐	Be able to: Explain the nature of radioactive decay; ☐

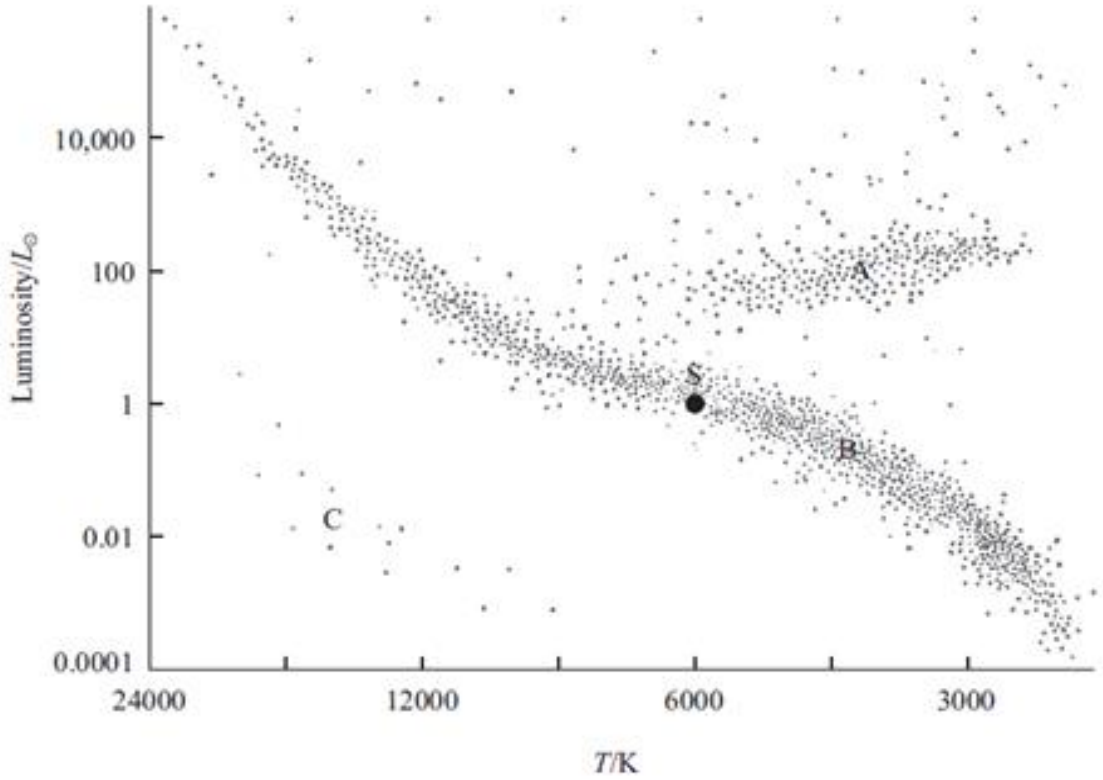
4 TERM

Summative assessment for the unit Cosmology

Learning objectives	11.11.1.2 – use the Hertzsprung–Russell diagram to explain stellar evolution; 11.11.1.7 – be able to estimate the age of the Universe using the Hubble law; 11.11.1.8 – explain the Big Bang theory using data on microwave background radiation;
Assessment criteria	***A learner*** • Uses diagram H-R for star evolution; • Estimates the age of universe using Hubble law; • Explains the theory of Big-Bang
Level of thinking skills	Application Higher order thinking skills
Duration	25 minutes

Task 1

(a) The position of our Sun, S is shown on the Hertzsprung-Russell (H-R) diagram below.



(i) Identify the three main regions of the H-R diagram.

(3)

Region A = ...

Region B = ...

Region C = ...

(ii) Add lines to the diagram to show the evolutionary path of our Sun from the time when it comes to the end of its hydrogen-burning phase.

(2)

Task 2

(a) Describe what is meant by the Big Bang model of the universe. [2]

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(b) State **two** features of the cosmic microwave background (CMB) radiation which are consistent with the Big Bang model. [2]

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. . . . . .
. . . . . .
. . . . . .

(c) A particular emission line in a distant galaxy shows a redshift $z = 0.084$.

The Hubble constant is $H_0 = 68\ \text{km s}^{-1}\ \text{Mpc}^{-1}$.

(i) Determine the distance to the galaxy in Mpc. [2]

. . . . . .
. . . . . .
. . . . . .
. . . . . .

Task 3

(ii) Describe how type Ia supernovae could be used to measure the distance to this galaxy. [3]

. . . . . .

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Assessment criteria	Task №	Descriptor *A learner*	Mark
Uses diagram H-R for star evolution;	1	(i)From the diagram identifies the main regions	3
		(ii)Draws the line correspond to Sun's path evolution	2
Explains the theory of Big-Bang	2	a) shows the meaning of Big-Bang theory	2
		b) states two features of cosmic microwave background (CMB) radiation	2
Estimates the age of universe using Hubble law	3	(i) determines the distance in Mpc	2
		(ii) describes the Ia supernovae galaxy distance	3
Total mark			**14**

Rubric for providing information to parents on the results of summative assessment for the unit Cosmology

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
use diagram H-R (Герцшпрунга-Рассела) for explanation of star;	Not able to: (i)get from the diagram identifies the main regions (ii)Draws the line correspond to Sun's path evolution ☐	Be able to: (i)get from the diagram identifies the main regions; (ii)Draws the line correspond to Sun's path evolution; However several mistakes might be done; ☐	Be able to: (i)get from the diagram identifies the main regions; (ii)Draws the line correspond to Sun's path evolution; ☐
explain the theory of Big Bang	Not able to: a) show the meaning of Big-Bang theory; b) state two features of cosmic microwave background (CMB) radiation ☐	Be able to: a) show the meaning of Big-Bang theory; b) state two features of cosmic microwave background (CMB) radiation; However several mistakes might be done; ☐	Be able to: a) show the meaning of Big-Bang theory; b) state two features of cosmic microwave background (CMB) radiation; ☐
be able to estimate the age of the universe using the Hubble law;	Not able to: (i) determine the distance in Mpc (ii) describe the Ia supernovae galaxy distance ☐	Be able to: (i) determine the distance in Mpc (ii) describe the Ia supernovae galaxy distance; However several mistakes might be done; ☐	Be able to: (i) determine the distance in Mpc (ii) describe the Ia supernovae galaxy distance; ☐

Summative assessment for the unit Physical training

Learning objectives Explanation and structure of Solar planets;
From the H-R diagram make the classification of stars;

Assessment criteria ***A learner***

- Analyses the diagram and names stars according to provided H-R diagram

Level of thinking skills Application
Higher order thinking skills

Duration 20 minutes

Task 1.

1. How many planets in the Solar system?

_____
_____

[1]

2. Please place the planets in correct order starting by distance from the Sun.

_____
_____

[4]

Task 2.

3. An HR diagram shows that many well-known stars in the Milky Way galaxy. Please specify the well-known stars using Figure 1.

_____
_____

[2]

4. Please specify the Solar planet according to stars-classification

_____
_____

[2]

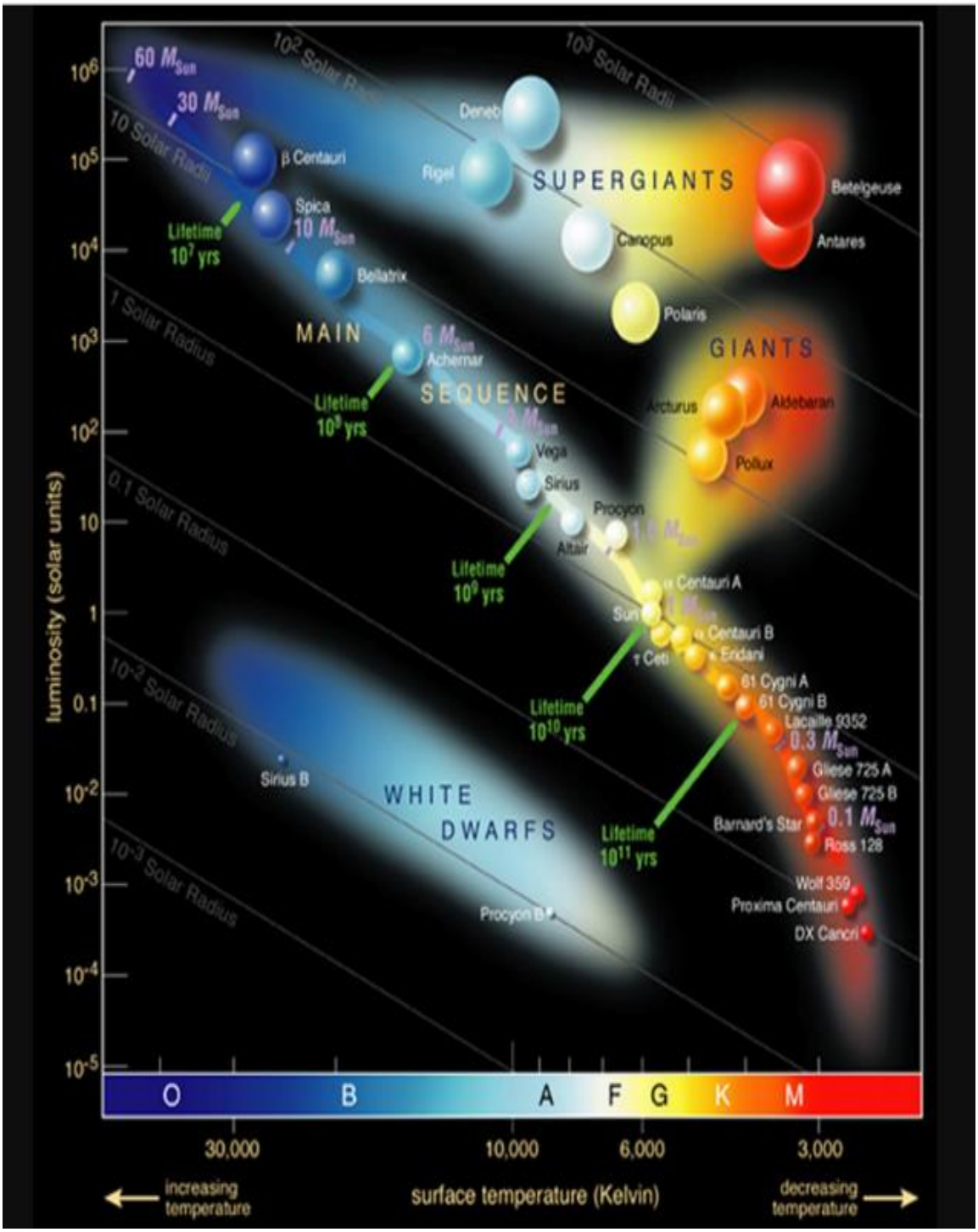
luminosity (solar units)
surface temperature (Kelvin)
increasing temperature
decreasing temperature
O B A F G K M
30,000 10,000 6,000 3,000
SUPERGIANTS
GIANTS
MAIN SEQUENCE
WHITE DWARFS
Deneb
Rigel
Betelgeuse
Antares
Canopus
Polaris
β Centauri
Spica
Bellatrix
Achernar
Arcturus
Aldebaran
Pollux
Vega
Sirius
Procyon
Altair
α Centauri A
Sun
α Centauri B
τ Ceti
ε Eridani
61 Cygni A
61 Cygni B
Lacaille 9352
Gliese 725 A
Gliese 725 B
Barnard's Star
Ross 128
Wolf 359
Proxima Centauri
DX Cancri
Sirius B
Procyon B
60 M Sun
30 M Sun
10 M Sun
6 M Sun
3 M Sun
1 M Sun
0.3 M Sun
0.1 M Sun
Lifetime 10^7 yrs
Lifetime 10^8 yrs
Lifetime 10^9 yrs
Lifetime 10^10 yrs
Lifetime 10^11 yrs
10^2 Solar Radii
10^3 Solar Radii
10 Solar Radii
1 Solar Radius
0.1 Solar Radius
10^-2 Solar Radius
10^-3 Solar Radius

Figure 1.

Assessment criteria	**Task №**	**Descriptor**	**Mark**
		A learner	
Explanation and structure of Solar planets;	1 2	Indicates the existing planets in Solar system	1
		Places planets in the correct order	4
From the H-R diagram make the classification of stars;	3 4	Depicts the well-known stars from Milky way	2
		Shows the Solar system using H-R diagram	2
Total mark			**9**

Rubric for providing information to parents on the results of summative assessment for the unit Practical Physical

Learner's full name _____

Assessment criteria	Level of academic achievement		
	Low	**Medium**	**High**
Explanation and structure of Solar planets;	Not able to: Indicate the existing planets in Solar system; ; ☐	Be able to: Indicate the existing planets in Solar system; Place planets in the correct order; However several mistakes might be done; ☐	Be able to: Indicate the existing planets in Solar system; Place planets in the correct order; ☐
From the H-R diagram make the classification of stars;	Not able to: Depict the well-known stars from Milky way; Show the Solar system using H-R diagram; ☐	Be able to: Depict the well-known stars from Milky way; Show the Solar system using H-R diagram; However several mistakes might be done; ☐	Be able to: Depict the well-known stars from Milky way; Show the Solar system using H-R diagram; ☐