Turkish Journal of Teacher Education

Volume 12, Issue 1, 2023 ISSN:2147-5156

Solar System and Beyond Unit Achievement Test: Validity And Reliability Study

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Keywords

Solar System and Beyond Unit; Achievement Test; Validity and Reliability

Article History

Received
March 21, 2023
Accepted
May 27, 2023
Published
June 30, 2023

Abstract

In Türkiye, astronomy subjects are taught within the scope of primary and secondary school science courses. With the new program change, the 7th-grade level of secondary school is the grade level where astronomy subjects are taught most intensively. The students started to encounter concepts such as space pollution, stars and their formation processes, nebula, and black holes for the first time at this grade level. All these changes and especially the wider scope of the 'Solar System and Beyond Unit', which was taught as the first unit at the 7th Grade level, necessitated the development of a new achievement test for this unit. This research aimed to develop an achievement test for the 'Solar System and Beyond' for secondary school 7th-grade students. A scanning model was used in the research. To determine the validity of the test, a pilot study was conducted with 335 7th and 8th-grade students. By the data obtained, exploratory factor analysis was performed on the tetrachoric correlation matrix. Item difficulty and discrimination indices were calculated for the structural validity of the test. KR-20 technique was used for reliability analysis. Content validity, face validity, and construct validity were also examined for the validity of the test. It has been determined that the 'Solar System and Beyond Unit Achievement Test (SSBUAT)' is quite valid and reliable.

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Introduction

The results of a field study conducted by the Scientific and Technological Research Council of Türkiye (TUBITAK) to measure the scientific literacy of the children between the ages of 15-24 in Türkiye revealed that the subjects that most attract the attention of Turkish youth are "Internet" and "astronomy" (MEB, 2010). Astronomy, which is a comprehensive branch of science, can be expressed as a branch of science that investigates the structure and evolution of celestial bodies, and the universe, and makes use of observational and theoretical studies. In addition, astronomy education is defined as a field of pedagogical research aimed at improving the methods currently used to teach astronomy and these methods. They emphasize that the quantity and quality of astronomy taught in schools during this golden age of astronomy is very important. However, in many countries, it is seen that they do not take part in astronomy programs at all, or that teachers do not have enough equipment in this regard, although they are in the programs (Bailey & Lombardi, 2015; Fraknoi, 2014; MEB, 2010; Pasachoff & Percy, 2009; Tascan & Unal, 2015).

In Türkiye, astronomy subjects are given within the scope of primary and secondary school science courses. Astronomy subjects, which were taught as the last unit within the scope of the science course until 2018, started to be taught as the first unit of the science course under the subject area of 'Earth and the Universe' at all grade levels after the program change in 2018 (MEB, 2018).In the program, it will be seen that at the 3rd, 4th, and 5th grade levels, the gains related to the structure of the Earth, Sun, and Moon and their movements are included. At the 6th grade level, the achievements about the solar system and planets are covered. 7. Grade level is the grade level where astronomy subjects are taught most intensively. At the same time, students encounter concepts such as space pollution, stars and their formation processes, nebula, and black holes for the first time at this grade level. Again, the subject of light pollution, which was taught at the 4th grade level, was also referred to at this grade level. Within the scope of space exploration, the structure and types of the telescope and the history of the research are also covered within the scope of the 7th Class 'Solar System and Beyond'. At the 8th grade level, the formation of the seasons in the unit of 'Seasons and Climate' is covered within the framework of the Earth's annual movements and axial tilt. All these changes and especially the wider scope of the 'Solar System and Beyond Unit', which was taught as the first unit at the 7th Grade level, necessitated the development of a new achievement test for this unit.

Fraenkel, Wallen, and Hyun (2011), divided the measurement tools into two those that should be filled in by the researcher and those that should be filled in by the participants. According to this classification, achievement tests are included in the measurement tools that must be filled by the participants. In the literature, achievement test is defined as the tests developed and used to measure the success level of students in a particular subject or course. (Demirel, 2005; Fraenkel, Wallen and Hyun, 2011; Tan, 2005). Achievement or ability tests measure an individual's knowledge or skill in a particular field or subject. They are mostly used by teachers in schools to measure learning or teaching effectiveness. The process of developing an achievement test; consists of six stages: fully defining the universe of behaviors to be measured, determining the sample of behaviors to be measured, creating the measurement tool, piloting and getting expert opinion, application and item analysis, and creating the final test (Tan, 2005).

This research aimed to develop an 'Achievement Test' related to the achievements of the 'Solar System and Beyond' Unit in the Science course for the 7th-grade students of secondary school.

Methods

Research Model

This research is a scale development study. In this chapter; the study group, the development phase of the test developed by the researchers related to the 'Solar System and Beyond' Unit, and information about the pilot application.

The Sample

The measurement tool, which was prepared by the researchers to collect the data within the scope of the research, was applied to 335 7th and 8th-grade students studying at a state secondary school in Pamukkale District of Denizli Province in the 2022-2023 academic year.

Development of Data Collection Tools

Before the development of the data collection tool, the achievements related to the "Solar System and Beyond" Unit in the 7th-grade science curriculum were examined one by one and an acquisition pool was created. Afterwards, these gains were examined and each item in the Achievement Test was prepared by the relevant acquisition. What these gains are and the question numbers in the test to which the gains are related are given in Table 1 in the form of an Indication Table. Then, during the preparation phase of the test items, the literature related to this field was scanned and the measurement tools prepared for the 'Solar System and Beyond' Unit were examined. A thirty-question Achievement Test was prepared by the researchers, corresponding to three questions for each acquisition. The levels of the achievements in the unit and the questions created according to Bloom's Taxonomy are given in Table 2. To question whether the items in the outcome and the items in the measurement tool are compatible with each other and whether the items contain the relevant outcome, the opinions of 3 faculty members who are experts in their fields and 2 science teachers who teach according to this outcome were consulted. In addition, the opinions of 1 academic member who is an expert in his field were consulted on whether the questions were suitable for the Turkish language structure. As a result of the opinions of the experts, the necessary adjustments were made and the measurement tool developed was made ready for pilot application.

Table 1

Class 7 Solar System and Beyond Unit Specification Table

Subject Matter	Attainment Number and Name	Questions
Space Researches	F.7.1.1.1. Explains space technologies. a. Artificial satellites are mentioned. b. The satellites sent by Türkiye to space and their missions are mentioned.	1, 2, 26

Space Researches	F.7.1.1.2. Expresses the causes of space pollution and predicts the possible consequences of this pollution.	3, 4, 27
Space Researches	F.7.1.1.3. Explain the relationship between technology and space exploration.	5, 6, 28
Space Researches	F.7.1.1.4. Explain the structure of the telescope and what it does. a. Types of telescopes are mentioned. b. Light pollution is mentioned.	7, 8, 29
Space Researches	F.7.1.1.5. He makes inferences about the importance of the telescope in the development of astronomy. a. The selection of the observatory (observatory) establishment sites and the conditions of these places are mentioned. b. The contributions of Western astronomers and Turkish-Islamic astronomers are mentioned.	9, 10, 25
Space Researches	F.7.1.1.6. Prepares and presents a simple telescope model.	11, 12, 30
The Solar System and Beyond: Celestial Bodies	F.7.1.2.1. Becomes aware of the star formation process. a. The concept of nebula is mentioned. b. Examples of nebulae are given. c. The concept of a black hole is mentioned.	13, 14, 15
The Solar System and Beyond: Celestial Bodies	F.7.1.2.2. Explain the concept of the star. a. Star types are mentioned. b. The constellations with the nomenclature of the star groups seen as viewed from the Earth are mentioned. c. It is mentioned that the distance between celestial bodies is expressed in light years.	16, 17, 18
The Solar System and Beyond: Celestial Bodies	F.7.1.2.3. Explain the structure of galaxies. a. Types of galaxies are mentioned. b. The Milky Way and Andromeda galaxies are cited as examples of galaxies.	19, 20, 21
The Solar System and Beyond: Celestial Bodies	F.7.1.2.4. Explain the concept of the universe.	22, 23, 24

Table 2

Levels of Achievement Test Questions According to Bloom's Taxonomy

			Bloom's Taxonomy Steps					
UNIT 1: SOLAR AND BEYOND / EARTH AND THE UNIVERSE	F.7.1.1.Space Researches	Attainments	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
		F.7.1.1.1. Explains space technologies. a. Artificial satellites are mentioned. b. The satellites sent by Türkiye to space and their missions are mentioned.		X				
		Question 1		X				
		Question 2		X				
		Question 26		X				

	F.7.1.1.2. Expresses the causes of space pollution and predicts the possible consequences of this pollution.					X
	Question 3		X			
	Question 4				X	
	Question 27	X				
	F.7.1.1.3. Explain the relationship between technology and space exploration.		X			
	Question 5	X				
	Question 6					X
	Question 28		X			
	F.7.1.1.4. Explain the structure of the telescope and what it does. a. Types of telescopes are mentioned. b. Light pollution is mentioned.		X			
	Question 7		X			
	Question 8		X			
	Question 29	X				
	F.7.1.1.5. He makes inferences about the importance of the telescope in the development of astronomy. a. The selection of the observatory (observatory) establishment sites and the conditions of these places are mentioned. b. The contributions of Western astronomers and Turkish-Islamic astronomers are mentioned.				X	
	Question 9		X			
	Question 10	X				
	Question 25		X			
	F.7.1.1.6. Prepares and presents a simple telescope model.					X
	Question 11					X
	Question 12			X		
	Question 30		X			
F.7.1.2. The Solar System and Beyond: Celestial Bodies	F.7.1.2.1. Becomes aware of the star formation process. a. The concept of nebula is mentioned. b. Examples of nebulae are given. c. The concept of a black hole is mentioned.		X			
	Question 13		X			
	Question 14		X			
	Question 15		X			
	F.7.1.2.2. Explain the concept of the star. a. Star types are mentioned. b. The constellations with the nomenclature of the star groups seen as viewed from the Earth are mentioned. c. It is mentioned that the distance between celestial bodies is expressed in light years.		X			
	Question 16		X			
	Question 17			X		
	Question 18		X			
	F.7.1.2.3. Explain the structure of galaxies. a. Types of galaxies are mentioned. b. The Milky Way and Andromeda galaxies are cited as examples of galaxies.		X			

Question 19	X		
Question 20			X
Question 21	X		
F.7.1.2.4. Explain the concept of the universe.	X		
Question 22	X		
Question 23		X	
Question 24	X		

The Pilot Intervention

For the pilot study of the test developed by the researchers, the data collection tool was applied to 335 7th and 8th-grade students studying at a state secondary school in Pamukkale District of Denizli Province, with the necessary permission from Denizli Provincial Directorate of National Education. During the pilot application, the places where the students had difficulty understanding the questions in the test were noted, and then necessary arrangements were made. Before and after the pilot application, the necessary corrections were made regarding the items in the data collection tool by consulting the opinions of 3 faculty members (including science education, measurement, and evaluation specialist, and statistics specialist) and 2 science teachers. In addition, the scales, spelling, and spelling rules in this data collection tool were checked by an expert in the field of Turkish education, and the test was finalized.

Analysis of Data

SPSS 20 package program and Factor Analysis program were used in the analysis of the data. In this context, first of all, the normality test was applied to the achievement test. It is accepted that most of the variables observed in the universe show a distribution similar to the bell curve. This curve, which is similar to the bell curve formed by the data of the variables, is called the normal distribution curve, and the distribution of this curve according to the horizontal axis is called the normal distribution. (Ravid, 2011). Whether a data set is normally distributed or not can be examined by different methods such as K-S, Histogram, Q-Q Plot, and Z Score. If the group size is less than 50, Shapiro-Wilks; If it is large, the Kolmogorov-Smirnov (K-S) test is used (Buyukozturk et al., 2019). In this study, the K-S method was used to examine the normality of the data from the application of the test.

Then, exploratory factor analysis (EFA) was performed on the tetrachoric correlation matrix by using the Factor Analysis program to determine the factor structures of the test. The tetrachoric correlation coefficient is used to determine the degree of relationship between two categories of artificial discontinuous variables (Field, 2018). The reason why EFA was performed on the tetrachoric correlation matrix in this study is that the answers given by the students to the items in the test were artificially transformed into two categories 1-0.

In the last stage, the reliability and validity of the test SPSS 20 package program was used. Since the number of people who answered the test (335) in the pilot application was approximately 10 times the number of items (30), the number of samples was considered sufficient for the application of the achievement test. (Akgul & Cevik, 2005; Tavsancil, 2010).Within the scope of the reliability of the test, the internal consistency coefficient of the test was calculated by applying the KR-20 formula. Within the scope of the validity studies of the test, the "item discrimination index" was calculated to find out whether a test item

distinguishes between those who have the feature desired to be measured with that item and those who do not, and the "item difficulty index" was examined to find the correct answer rate for each item. The results obtained as a result of the analysis of the data are given in the 'Discussion and Conclusions' section.

Results

Normality Distribution of the Test

Since the statistical (null) hypothesis was established in the analysis as "the distribution of scores does not differ significantly from the normal distribution", the p-value obtained in the K-S test being greater than 0.05 is interpreted as that the scores do not show a significant (extreme) deviation from the normal distribution at this significance level and are by the normal distribution (Buyukozturk et al., 2019). However, kurtosis and skewness values in the range of +1, and -1 are acceptable values to decide that the distribution is close to normal (Hair et al., 2013). Normality values of the data from SSBUAT according to the Kolmogorov-Smirnov (K-S) Method are given in Table 3.

Table 3

Normality Values of Data According to Kolmogorov-Smirnov (K-S) Method

	Kolmogorov-Smirnov		
	Statistic	df	p
SSBUAT	0,105	335	0,000

Considering the K-S values in Table 3, it is seen that the SSBUAT total scores do not show a normal distribution ($p<0.005$). However, since the kurtosis (-.641) and skewness (-.359) values were in the range of +1, -1, it was decided that the distribution was close to normal.

Exploratory Factor Analysis (EFA) of the Test

In this section, the findings obtained within the scope of EFA studies performed on the tetrachoric correlation matrix on the test are given. First of all, the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett Test of Sphericity were examined to determine whether the data set is suitable for factor analysis. It was seen that the KMO value was .84 and the chi-square value obtained as a result of the Bartlett Sphericity Test was significant ($X^2_{(435)}=3720,6$, $p<.01$) The KMO value is expected to be higher than .60. The Bartlett Test, on the other hand, examines whether there is a relationship between the variables based on partial correlation. If the calculated chi-square statistic is significant, it is an indication that the data matrix is appropriate (Buyukozturk, 2018).

As a result of the EFA performed over the tetrachoric correlation matrix on the achievement test consisting of 30 items, it was seen that it had a single dimension explaining 29.57% of the total variance. In item selection, the factor load criterion was taken as .30 and the 2nd, 5th, 8th, and 24th items that gave factor load values below .30 were excluded from the test. In the analysis made on the remaining items, it was seen that the KMO value was .86 and the chi-square value obtained as a result of the Bartlett Sphericity Test was significant ($X^2_{(325)}$

=3735,9, p<.01). In the last case, it was seen that the test had a single dimension that explained 33.60% of the total variance. The EFA results of the SSBUAT are given in Table 4.

Tablo 4

SSBUAT's EFA Results

Question No	Component Common Variance	Factor 1
Q1	.116	.341
Q3	.345	588
Q4	.475	.689
Q6	.114	.337
Q7	.461	.679
Q9	.505	.711
Q10	.102	.320
Q11	.244	.494
Q12	.194	.440
Q13	.315	.561
Q14	.351	.593
Q15	.446	.667
Q16	.082	.286
Q17	.222	.471
Q18	.335	.579
Q19	.163	.404
Q20	.384	.619
Q21	.504	.710
Q22	.641	.801
Q23	.176	.420
Q25	.305	.552
Q26	.263	.513
Q27	.311	.558
Q28	.249	.499
Q29	.605	.778
Q30	.213	.462
Explained Variance Sum: %33.60 Factor 1: %33.60		

Validity and Reliability Analysis of the Test

The reliability of the SRSI, which was finalized as a result of exploratory factor analysis, was examined. The internal consistency coefficient of the test was calculated by applying the KR-20 formula and was found to be .849. It seems that the reliability coefficient calculated for the test is .70 and higher, in general, is sufficient for the reliability of the test scores. (Buyukozturk, 2018). Accordingly, it can be said that the test prepared is reliable.

The test consisted of four multiple-choice options and was evaluated by giving 1 point for correct answers and 0 points for incorrect or empty answers. The item discrimination index was calculated to find out whether a test item discriminates between those who have the characteristic to be measured with that item and those who do not, and the item difficulty index was used to find the correct response rate for each item. The distinctiveness indices (D) and difficulty levels (P) of the items in the test are given in Table 5.

Table 5

Discrimination indices (D) and difficulty levels (P) of the items in the SSBUAT

Question	Groups	P Value (Item Difficulty Index)	D Value (Substance Discrimination Index)
1	Upper Group (%27=20) Subgroup (%27=20)	0,616	0.366
3	Upper group (%27=20) Subgroup (%27=20)	0.722	0.488
4	Upper group (%27=20) Subgroup (%27=20)	0.827	0.300
6	Upper group (%27=20) Subgroup (%27=20)	0.750	0.255
7	Upper group (%27=20) Subgroup (%27=20)	0.716	0.433
9	Upper group (%27=20) Subgroup (%27=20)	0.688	0.555
10	Upper group (%27=20) Subgroup (%27=20)	0.444	0.355
11	Upper group (%27=20) Subgroup (%27=20)	0.622	0.533
12	Upper group (%27=20) Subgroup (%27=20)	0.644	0.422
13	Upper group (%27=20) Subgroup (%27=20)	0.644	0.533
14	Upper group (%27=20) Subgroup (%27=20)	0.738	0.411
15	Upper group (%27=20) Subgroup (%27=20)	0.605	0.655
16	Upper group (%27=20) Subgroup (%27=20)	0.372	0.366
17	Upper group (%27=20) Subgroup (%27=20)	0.572	0.500
18	Upper group (%27=20) Subgroup (%27=20)	0.516	0.611
19	Upper group (%27=20) Subgroup (%27=20)	0.483	0.455
20	Upper group (%27=20) Subgroup (%27=20)	0.655	0.511
21	Upper group (%27=20) Subgroup (%27=20)	0.588	0.666
22	Upper group (%27=20) Subgroup (%27=20)	0.577	0.711
23	Upper group (%27=20) Subgroup (%27=20)	0.561	0.522
25	Upper group (%27=20) Subgroup (%27=20)	0.661	0.500
26	Upper group (%27=20) Subgroup (%27=20)	0.500	0.555
27	Upper group (%27=20) Subgroup (%27=20)	0.527	0.611

28	Upper group (%27=20) Subgroup (%27=20)	0.561	0.588
29	Upper group (%27=20) Subgroup (%27=20)	0.650	0.655
30	Upper group (%27=20) Subgroup (%27=20)	0.622	0.422

It is seen from Table 5 that the items of the test are distinctive and reliable. The average difficulty of the test (the arithmetic mean of the scores = 17.58 / the highest score that can be obtained from the test = 26) was determined as 0.610. Although the difficulty level of each of the items in a test is different, it is desirable that the average strength of the test, which will be found by averaging them, is around 0.50 (Cepni et al., 2008). In addition, if the item discrimination index value of the test is 0.40 and above, it is concluded that the discrimination power of the item is high (Tekin, 2010). It is seen that the average item discrimination index obtained for this study is 0.499. Accordingly, the item discrimination and item difficulty indexes of the SRSI are at the expected level for a measurement tool.

Discussion and Conclusions

The purpose of this research is to develop an achievement test for the 'Solar System and Beyond' for secondary school 7th-grade students. While creating the success test with this match, some steps were followed. When the literature is examined, the process of developing an achievement test; It is seen that it consists of the steps of fully defining the universe of the behaviors to be measured, determining the sample of the behaviors to be measured, creating the measurement tool, piloting and getting expert opinion, application and item analysis, and creating the final test. (Bolat &e Karamustafaoglu, 2019; Gelen, 2021; Karaca, 2023; Ozdemir, 2019; Sevim et al., 2021; Sahin et al., 2023; Tan, 2005).

In this study, the validity and reliability studies were carried out in detail while applying the achievement test development steps given above. At the first stage, the achievements of the Solar System and Beyond Unit were examined and questions were prepared with 3 (three) questions for each achievement. A table of specifications was created showing the questions and the questions to be measured. Expert opinion was sought to ensure the content validity of the test. The final version of the test was applied to 7th and 8th-grade students consisting of 335 students. Exploratory factor analysis (EFA) was performed on the data obtained over the tetrachoric correlation matrix. As a result of this analysis, it was seen that the test had a single dimension that explained 29.57% of the total variance. In item selection, the factor load criterion was taken as .30 and the 2nd, 5th, 8th, and 24th items that gave factor load values below .30 were excluded from the test. In the analysis made on the remaining items, it was seen that the KMO value was .86 and the chi-square value obtained as a result of the Bartlett Sphericity Test was significant. ($X^2_{(325)}$ =3735,9, p<.01). In the last case, it was determined that the test had a single dimension that explained 33.60% of the total variance. In the next step, within the scope of reliability studies, the internal consistency coefficient of the test was calculated by applying the KR-20 formula and was found to be .849. When the literature is examined, it seems that the reliability coefficient calculated for the test is .70, and higher, in general, is sufficient for the reliability of the test scores. (Buyukozturk, 2018). At the last stage, the discrimination and difficulty indices of each item in the test were calculated. The average

difficulty of the test (the arithmetic mean of the scores = 17.58 / the highest score that can be obtained from the test = 26) was determined as 0.610. Although the difficulty level of each of the items in a test is different, it is desirable that the average strength of the test, which will be found by averaging them, is around 0.50 (Cepni et al., 2008). In addition, if the item discrimination index value of the test is 0.40 and above, it is concluded that the discrimination power of the item is high (Tekin, 2010). It is seen that the average item discrimination index obtained for this study is 0.499. Accordingly, item discrimination and item difficulty indices of the SRSI are at the expected level for a measurement tool. As a result of the research, it is thought that a valid and reliable achievement test has been developed that can contribute to the literature for the 'Solar System and Beyond' Unit at the secondary school 7th-grade level.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

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Appendix: Solar System and Beyond Unit Achievement Test (Turkish)

SORU 1. F.7.1.1.1.
Günümüzde Türkiye, uzayda uydu sahibi olan 30 ülkeden biridir.
Türkiye'nin uyduları ile ilgili olarak;
I-Türkiye'nin günümüzde aktif olarak 7 tane uydusu bulunmaktadır.
II-Türkiye'nin aktif olarak yörüngede bulunan uyduları haberleşme, iletişim ve askeri amaçlı görev yapmaktadırlar.
III- Türkiye, günümüzde uzayda en çok uydusu olan ülke durumundadır.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız I B) I ve II C) Yalnız II D) I, II ve III

SORU 2. F.7.1.1.1.
Uzay mekikleri ile ilgili olarak:
I-Tekrar kullanılabilirler.
II- İnsansız uzay araçlarıdır.
III- Sputnik I, üretilen ilk uzay mekiğidir.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız I B) I ve II
C) I ve III D) I, II ve III

SORU 3. F.7.1.1.2.
Dünya'nın çevresinde, değişik yörüngelerde dolanan ve artık, herhangi bir işlevi olmayan, insan yapımı cisimlerin tümü, uzay kirliliği olarak adlandırılır.
Uzay kirliliğinin yol açabileceği olası sonuçlar ile ilgili olarak:
I-Uzaydaki uyduların çalışmalarına zarar verebilir.
II-İnsanlı uzay görevlerinde insan hayatını tehlikeye atacak sonuçlar doğurabilir.
III-Bu nesnelerin herhangi bir uydu ile çarpışması sonucunda uydunun Dünya'ya düşmesine sebep olabilir.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız I B) I ve II
C) I ve III D) I, II ve III

SORU 4. F.7.1.1.2.
Aşağıdaki işlemlerden hangileri uzay kirliliğini azaltmak için alınabilecek önlemlerdendir?

I. Tekrar kullanılabilen cihazlar geliştirmek
II. Görevini tamamlayan uyduları hemen dünyaya getirmek
III. Görevini tamamlayan cihazları toplayan sistemler geliştirmek

A) Yalnız I B) I ve II C) Yalnız II D) I, II ve III

SORU 5. F.7.1.1.3.
Günümüzde kullanılan teknolojik araçların çoğu uzay araştırmaları sonucu ortaya çıkmıştır. Aşağıdakilerden hangisi uzay araştırmaları sonucu ortaya çıkan bir ürün **değildir?**

A) Navigasyon cihazı B) Dijital saat
C) Tükenmez kalem D) Strafor köpük

SORU 6. F.7.1.1.3.
Uzay mühendisi Charles Yost ile 1966'da çalışmaya başlayan NASA, uzay mekikleri için daha uygun koltuklar geliştirerek çarpmalara karşı daha iyi bir koruma sağlamayı amaçlıyordu. Bunun üzerine Yost, herhangi bir nesnenin şeklini alarak şiddetli çarpmaları yumuşatabilen ve yüksek konfor sunan hafızalı süngeri geliştirdi. Uçak yolculuklarında iniş sırasında yaşanan sarsıntıları azaltan ve sonrasında eski haline dönen akıllı süngerler, astronotların kasklarında da kullanılan şok emicilere dayanıyordu. Yost'un NASA için ürettiği bu süngerler, günümüzde otomobillerden uçaklara kadar birçok alanda kullanılmaktadır.
Yukarıdaki metne göre;
I-Yost'un uzay araştırmaları için geliştirdiği ürün sadece astronotlar için üretilmiştir.
II-Günlük hayatta kullandığımız bazı araçlar uzay çalışmaları sonucu bulunmuş olabilir.
III-Yost tarafından geliştirilen süngerler astronotların güvenliği için geliştirilmiştir.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız I B) II ve III C) Yalnız III D) I, II ve III

SORU 7. F.7.1.1.4.
Işık kirliliği ile ilgili olarak:
I- Işığın yanlış zamanda, yanlış miktarda ve yanlış yerde kullanılması olarak tanımlanır.
II-Gökyüzü gözlemlerini olumsuz etkilemektedir.
III-İnsanları ve diğer canlıları etkileyen önemli bir çevre sorunudur.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız I B) I ve II C) I ve III D) I, II ve III

SORU 8. F.7.1.1.4.
Teleskopla ilgili olarak;
I-Optik teleskopların yapısında mercek, ayna ya da ikisi birlikte bulunur.
II-Teleskop, gök cisimlerini büyütebilen bir araçtır.
III-Uzay teleskopları ışık kirliliğinden etkilenmez.
IV-Radyo teleskopları, atmosfer olaylarından etkilenmez.
İfadelerinden hangisi ya da hangileri doğrudur?

A) I ve II B) I ve III C) I, III ve IV D) I, II ve III

SORU 9. F.7.1.1.5.
Gözlem evlerinin kurulduğu yerler ile ilgili olarak;
I-Gözlem evleri ışık kirliliğinden etkilenmeyecek şekilde yerleşim merkezlerine uzak yerlere kurulmalıdır.
II-Bulutluluğu az olan bir bölge seçilmelidir.

III-Deniz seviyesinden yeterince yüksekte bir yer seçilmelidir.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız ı B) I ve II C) I ve III D) I, II ve III

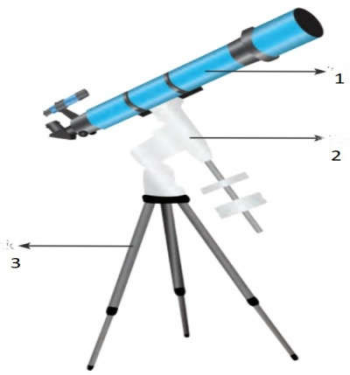
SORU 10. F.7.1.1.5.
Astronomi çalışmalarına hem batılı hem de Türk-İslam bilim insanları katkılar sunmuştur. Aşağıdaki tabloda 7. sınıf öğrencisi Kağan aşağıdaki tabloda astronomi bilimine katkı sunan batılı ve Türk-İslam bilim insanları ile yaptıkları çalışmalar eşleştirmiştir. Kağan'ın eşleştirmelerinden hangisi **hatalıdır?**

	Bilim insanı	Çalışmaları
A)	Newton	İlk aynalı teleskopu yapmıştır.
B)	Ali Kuşçu	Ay'ın ilk haritasını çıkarak kişidir.
C)	Biruni	'Büyük Patlama' teorisini ortaya atan ilk kişidir.
D)	Galileo	Geliştirdiği teleskopla Jüpiter'in en büyük dört uydusunu ilk kez gözlemlemiştir.

SORU 11. F.7.1.1.6.
Basit bir teleskop yapmayı tasarladığınızı düşünelim.
Aşağıdaki malzemelerden hangileri bu teleskop yapımında gerekli değildir?
I.Silindirik karton tüp
II.Yapıştırıcı
III.Maket bıçağı
IV.Bir adet ince kenarlı mercek
V.Bir adet kalın kenarlı mercek
VI. Bir adet tümsek ayna
VII. Bir adet düz ayna

A) I ve II B) II, III ve V
C) I, III ve IV D) VI ve VII

SORU 12. F.7.1.1.6.



7. sınıf öğrencisi İpek, kullandığı bir teleskopu sınıfa getirerek arkadaşlarına sunum yapmaktadır. İpek sunum sırasında teleskopun şekilde numaralandırılmış olan kısımları ile ilgili olarak aşağıdaki açıklamalarda bulunmuştur.
'Sevgili arkadaşlar;
I-1 nolu kısım teleskop tüpüdür ve mercekler bu tüpün içerisinde yer almaktadır.
II- 2 nolu kısım objektiftir ve teleskop ile gözlem yaparken buradan bakarsınız.
III- 3 nolu kısım üçayaktır ve teleskopun yere sabitlenmesini sağlar.'
Buna göre İpek'in bu açıklamalarından hangisi ya da hangileri **doğru değildir?**

A) II ve III B) Yalnız II C) I ve II D) I, II ve III

SORU 13. F.7.1.2.1.
Ahmet: Yıldızlar, canlı olmamalarına rağmen canlılar gibi doğar, büyür ve ölürler.
Esma: Yıldızlar, nebula adı verilen gaz ve toz parçacıkları belirli bölgelerde yoğunlaşmış bulutsu yapılarda doğarlar.
Ömer: At Başı, Kömür Çuvalı, Helezon bulutsulara örnek olarak verilebilir.
Semra: En sıcak yıldızlar kırmızı renkte ışık yayarken en soğuk yıldızlar mavi renkte ışık yayarlar.
Yukarıdaki öğrencilerden hangisi ya da hangileri yıldızlar ile ilgili **yanlış** bir bilgi vermiştir?

A) Ahmet, Esma ve Semra B) Esma, Ömer ve Semra
C) Yalnız Semra D) Esma ve Semra

SORU 14. F.7.1.2.1.

Kara delik, küçük kütleli yıldızların ölmesi sonucu mu oluşur?	
Kara deliklerde çok yüksek bir çekim gücü mü vardır?	
Yıldızların doğum yerlerine bulutsu adı mı verlir?	
Yıldızların şekli bayrağımızdaki gibi midir?	

Yukarıdaki tablo 'EVET' ve 'HAYIR' şeklinde doldurulduğunda doğru sıralama hangi seçenekteki gibi olur?

A)	B)	C)	D)
EVET	EVET	HAYIR	HAYIR
HAYIR	EVET	HAYIR	EVET
EVET	HAYIR	EVET	EVET
HAYIR	HAYIR	EVET	HAYIR

SORU 15. F.7.1.2.1.
Öğretmen: Yıldızlar hakkında bilgi verebilir misiniz?
Canan: Yıldızların sonunu büyüklükleri belirler.
Can: Küçük kütleli yıldızlar ömürlerini nötron yıldızı veya kara delik olarak tamamlarken büyük kütleli yıldızlar beyaz cüce olarak tamamlar.
Cemal: Yıldızların rengi sıcaklıkları ile ilgili bilgiler verir.

Ceren: En sıcak yıldızlar mavi-beyaz renkte ışık verirken en soğuk yıldızlar kırmızı renkte ışık verir.
Öğretmenin sorduğu soruyla ilgili olarak hangi öğrenci **yanlış** cevap vermiştir?

A) Canan B) Can C) Cemal D) Ceren

SORU 16. F.7.1.2.2.
Takımyıldızları ile ilgili olarak;
I-Gökyüzünün bölündüğü 88 alandan her birine verilen isimdir.
II-Takımyıldızlarını oluşturan yıldızların konumları birbirine göre değişebilir.
III- Dünya'dan bakıldıklarında benzedikleri şekillere göre isimlendirilirler.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız I B) I ve II
C) I ve III D) I, II ve III

SORU 17. F.7.1.2.2.
Uzayla ilgili bir kitap okurken en çok karşılaşılan kavramlardan birisi de 'Işık Yılı' kavramıdır. Bu kavram ile ilgili olarak aşağıda verilen açıklamalardan hangileri doğrudur?
I.Bir zaman birimidir
II. Bir uzaklık birimidir.
III. Işığın bir yılda aldığı yolu ifade eder.

A) Yalnız I B) Yalnız II
C) Yalnız III D) II ve III

SORU 18. F.7.1.2.2.
Arda: Dünya'ya en yakın yıldız Güneş'tir. Dünya ile Güneş arasındaki uzaklık yaklaşık 150 milyon kilometredir.
Azra: Kutup Yıldızı, Küçük Ayı Takımyıldızı'nda bulunur. Kuzey Yarım Kürede daima kuzeyi gösterir.
Arda ve Azra'nın söyledikleri ile ilgili olarak aşağıdakilerden hangisi doğrudur?

A) Her ikisinin de verdiği bilgiler doğrudur.
B) Sadece Arda'nın verdiği bilgiler doğrudur.
C) Sadece Azra'nın verdiği bilgiler doğrudur.
D) Her ikisinin de verdiği bilgiler yanlıştır.

SORU 19. F.7.1.2.3.
Galaksiler ile ilgili olarak;
I – Eliptik, sarmal ve düzensiz olmak üzere çeşitleri vardır.
II- Dünya, Samanyolu Galaksisi adı verilen eliptik bir galaksi içinde yer alır.
III – Samanyolu Galaksisi, Ejderha Takımyıldızı içinde yer alır.
İfadelerinden hangisi ya da hangileri **doğru değildir?**

A) Yalnız I B) Yalnız II
C) II ve III D) I, II ve III

SORU 20. F.7.1.2.3.
Uzaydaki astronomik yapılardan bazılarını Yıldız, Galaksi, Gezegen, Takımyıldızı ve Doğal Uydu olarak ele alırsak, bu yapıların büyüklük bakımından **en büyükten en küçüğe doğru** sıralaması cevap seçeneklerinden hangisinde doğru verilmiştir?

A) Galaksi, Takımyıldızı, Yıldız, Gezegen, Doğal uydu
B) Galaksi, Yıldız, Takımyıldızı, Gezegen, Doğal uydu
C) Galaksi, Takımyıldızı, Yıldız, Doğal Uydu, Gezegen
D) Takımyıldızı, Galaksi, Yıldız, Gezegen, Doğal Uydu

SORU 21. F.7.1.2.3.

Dünya, Samanyolu Galaksisi içindeki Avcı Kolu'nda yer alır.	
Andromeda Galaksisi, Samanyolu Galaksisi'ne en yakın galaksidir.	
Samanyolu Galaksisi, eliptik bir galaksidir.	
Galaksiler, milyonlarca gök cismini barındıran gök adalardır.	

Yukarıdaki tablo hatasız bir şekilde 'DOĞRU', ve 'YANLIŞ' şeklinde doldurulduğunda hangi seçenekteki gibi olur?

A)	B)	C)	D)
DOĞRU	DOĞRU	DOĞRU	YANLIŞ
DOĞRU	DOĞRU	YANLIŞ	YANLIŞ
DOĞRU	YANLIŞ	DOĞRU	DOĞRU
YANLIŞ	DOĞRU	YANLIŞ	DOĞRU

SORU 22. F.7.1.2.4.
Evren ile ilgili olarak;
I- Dünya + Uzay'ı kapsayan bir bütündür.
II- Evrenin tamamını Dünya'dan çıplak gözle görebiliriz.
III- Samanyolu Galaksisi, evrenden çok daha geniş bir yer kaplar.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız I B) I ve II
C) I ve III D) I, II ve III

SORU 23. F.7.1.2.4.
Evrenin oluşumu ile ilgili günümüzde en çok kabul gören 'Big Bang(Büyük Patlama) teorisidir. Bu teoriye göre:

I- Evrendeki gökcisimleri birbirinden uzaklaşmaktadır.
II-Evren, başlangıçta şimdiki halinden daha az yer kaplıyordu.
III-Evren, sonsuza kadar şu anki halini koruyacaktır.

Çıkarımlarından hangisi ya da hangileri yapılabilir?

A) Yalnız I B) I ve II
C) I ve III D) I, II ve III

SORU 24. F.7.1.2.4.
Erkin : Isaac Newton, durağan evren görüşünü ortaya atmıştır. Buna göre evren sonsuzdan beri var olmuştur ve sonsuza kadar da varlığını bu şekilde koruyacaktır.
Ece: Georges Lemaitre, Büyük Patlama görüşünü ortaya atmıştır. Buna göre evren sürekli genişliyorsa evrendeki gök cisimlerinin geçmişte birbirine daha yakın olmaları gerekirdi.
Erkin ve Ece'nin söyledikleri ile ilgili olarak aşağıdakilerden hangisi doğrudur?

A) Her ikisinin de verdiği bilgiler doğrudur.
B) Sadece Erkin'in verdiği bilgiler doğrudur.
C) Sadece Ece'nin verdiği bilgiler doğrudur.
D) Her ikisinin de verdiği bilgiler yanlıştır.

SORU 25. F.7.1.1.5.
Teleskopun gök biliminin gelişimine yaptığı katkılar ile ilgili olarak aşağıda verilenlerden hangisi **yanlıştır?**

A) Teleskopun icadı astronomideki çalışmaları hızlandırmıştır.
B) Astronomi ile ilgili çalışmalar uzun yıllardır sürmektedir.
C)Astronomi ile ilgili çalışmalar Hubble Uzay Teleskopu'nun 1990 yılında uzaya gönderilmesiyle son bulmuştur.
D) Gökyüzü gözlemleri amacıyla kullanılan ilk teleskop 1609 yılında Galileo tarafından yapılmıştır.

SORU 26. F.7.1.1.1.
Uzay araçları ile ilgili olarak;
I- Yapay uydular, astronotları uzaya götürebilen araçlardır.
II- Uluslararası Uzay İstasyonu, Güneş Sistemi dışında görev yapan insansız bir uzay aracıdır.
III- İnsansız hareket eden ve uzaydan veri toplayabilen uzay araçlarına uzay sondası adı verilir.
İfadelerinden hangisi ya da hangileri doğrudur?

A) Yalnız I B) Yalnız III
C) II ve III D) I, II ve III

SORU 27. F.7.1.1.2.
Aşağıdaki cisimlerden hangisi uzay kirliliğine **neden olmaz?**

A) Astronot eldivenleri
B) Meteor parçaları
C) Yakıt tankları
D) İşlevini tamamlamış yapay uydular

SORU 28. F.7.1.1.3.
'Uzay araştırmaları sonucu ortaya çıkan pek çok teknoloji günlük hayatımızda kullanılmaktadır(1). Bebek mamaları gibi toz haldeki yiyecekler ve MR cihazı bunlara örnek verebilir(2). Bu ürünler artık uzay araştırmalarında yer almayıp sadece günlük hayatta yer almaktadır(3). Uzay araştırmaları uzun süredir gelişerek devam etmektedir(4).'

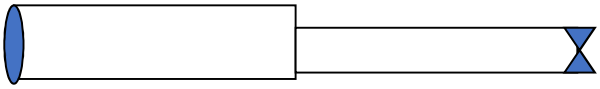
Teknoloji ile uzay araştırmaları arasındaki ilişkiyi açıklayan yukarıdaki metinde kaç numaralı cümle **doğru bilgi içermemektedir?**

A) 1 B) 2 C) 3 D) 4

SORU 29. F.7.1.1.4.
Teleskop uzay araştırmalarında kullanılan en önemli araçlardan birisidir. Teleskopların birçok çeşidi bulunmaktadır. Buna göre aşağıdakilerden hangisi bir teleskop çeşidi değildir?

A) Aynalı teleskop B) Mercekli teleskop
C) Radyo teleskopları D) Ekranlı teleskoplar

SORU 30. F.7.1.1.6.



7. sınıf öğrencisi olan Ayşe, fen bilimleri dersinde proje ödevi olarak tasarladığı bir aracın basitçe bir çizimini sınıfta göstermiştir. Ayşe'nin tasarladığı araç aşağıdakilerden hangisidir?

A) Mercekli Teleskop B) Mikroskop
C) Aynalı Teleskop D) Fotoğraf M