



**DISCOVER THAILAND'S
ASTRONAUT SCHOLARSHIP**

2017

SCAT

SPACE CAMP APTITUDE TEST

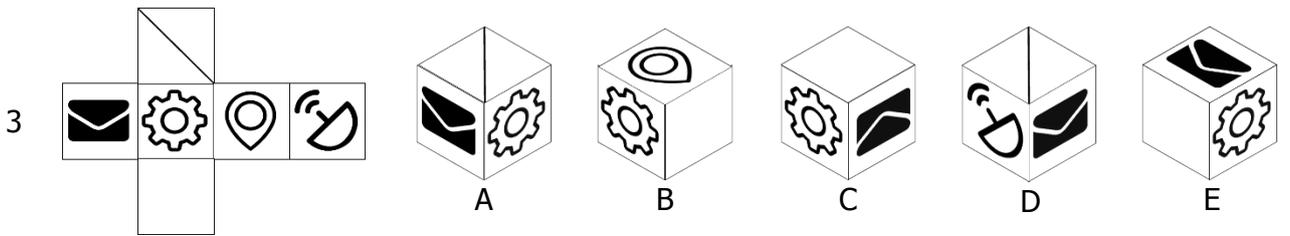
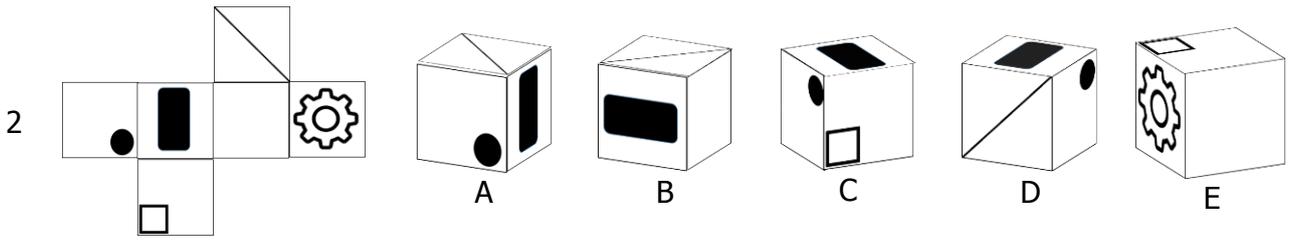
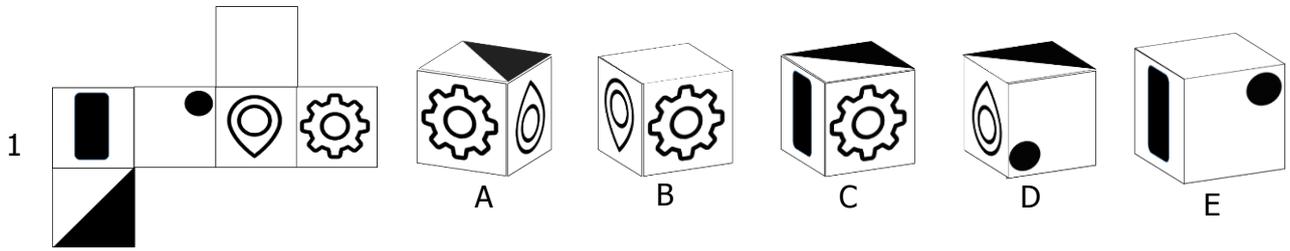
SCAT is a 100 multiple-choice exam. The test is on physics, dynamics, logics, and history of space exploration, current development and the future of Mars colonization.

QUESTIONS

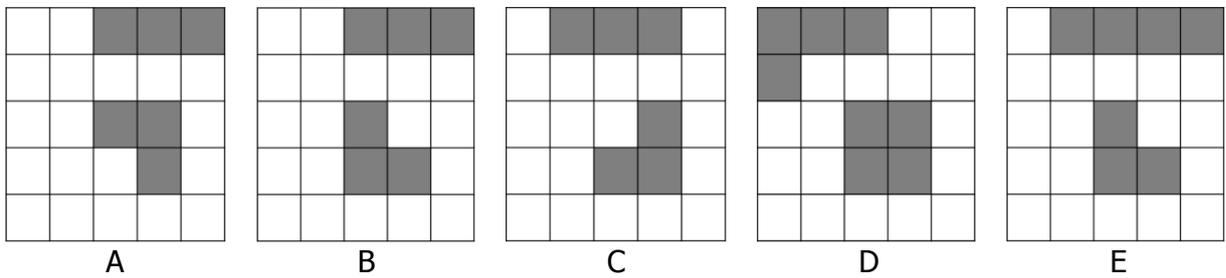
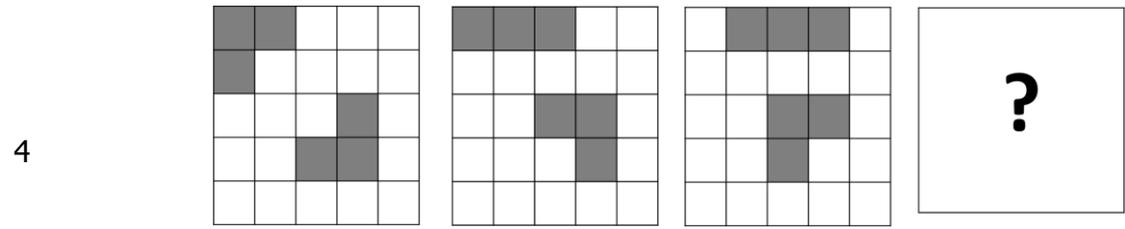


Part1: Spatial & Abstract Reasoning Tests

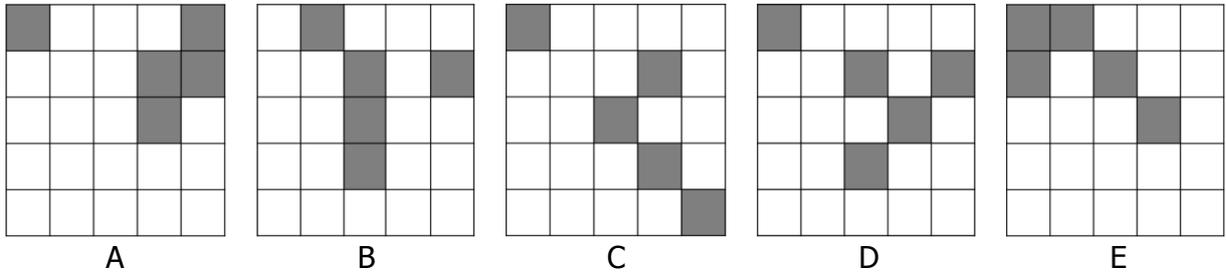
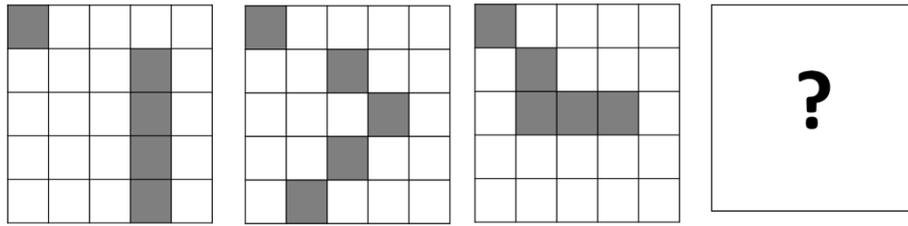
For question 1 – 3, select a cube that cannot be made based on the unfolded cube on left hand side.



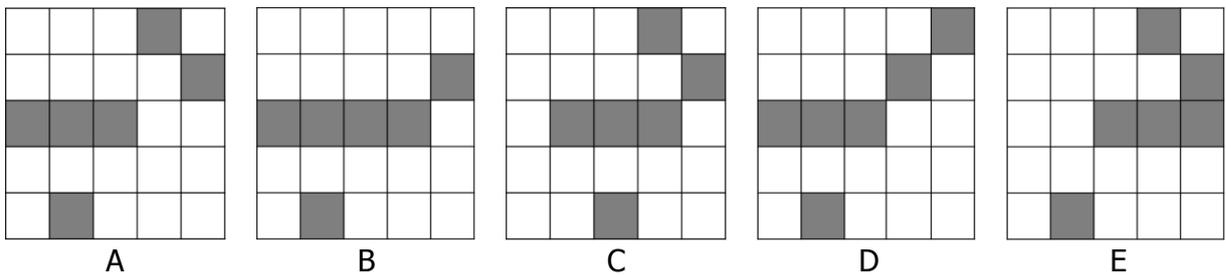
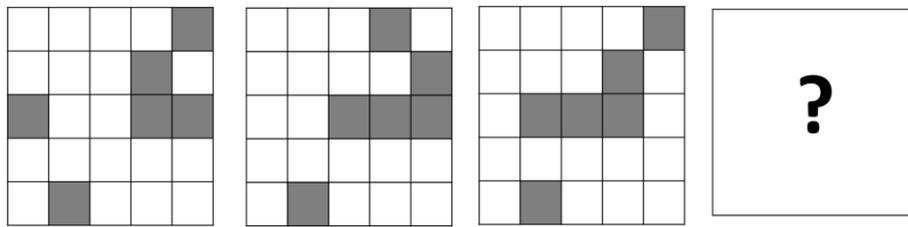
For question 4 -6, select a picture that should come next to complete the following series



5



6



7. Which number logically come next in the series?

4 - 6 - 9 - 6 - 14 - 6 -

- A. 11
- B. 16
- C. 6
- D. 21
- E. 19

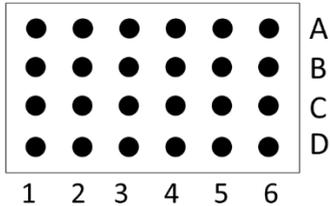
8. Which one of the numbers does not belong in the following series?

1 - 1 - 2 - 3 - 5 - 8 - 13 - 17 - 21 - 34

- A. 3
- B. 8
- C. 13
- D. 17
- E. 34

For question 9 – 11: The sequence of drawings show a sheet of paper has been folded step by step (the dashed lines represent the whole sheet). The last drawing shows the black dot which is the hole was punched on paper. Select positions where do the holes appear when unfold sheet.

The position of holes on a sheet of paper:



9. Step 1 Step 2 Step 3 Step 4

A. 5D, 6D B. 3D, 4D, 5D C. 3D, 4D, 5D, 6D
D. 2D, 3D, 4D, 5D E. 4D, 5D, 6C

10. Step 1 Step 2 Step 3 Step 4

A. B5, C5 B. A6, B5, C5, D6 C. A5, B5
D. A6, B5, C6, D5 E. None of the above

11. Step 1 Step 2 Step 3 Step 4 Step 5

A. B4, B5, C4, C5 B. A4, B3, C3, D4 C. B1, B4, B6, C1, C4, C6
D. B1, B4, B5, C1, C4, C5 E. None of the above

12. Select a conclusion that logically follows to the given statements

Statements:

None of the adventurers is a professor.

All the researchers are adventurers.

The conclusions:

A. All the adventurers are researchers

B. Some adventurers are professor.

C. Professors are not researchers.

D. No adventurers are researchers

E. Some researchers are professor.

13. Which conclusions are logically follows to given statements

Statements:

All the books are papers.

Some papers are journals.

Some journals are calendars.

Conclusions:

1. Some journals are books.

2. Some calendars are papers.

3. Some books are journals.

4. Some books are calendars.

Which conclusions are logically follows to given statements

A. Only conclusion (1)

B. Only conclusion (2)

C. Only conclusion (3)

D. Only conclusion (4)

E. None of the above

14. The workers in the factory are working with the following rules:

1. When Piti works, Mana works too.

2. When Mana works, Manee is not.

3. When Manee doesn't work, Chujai doesn't work too.

Which of the following conclusions is derived from this information?

A. If Mana works, Piti works too.

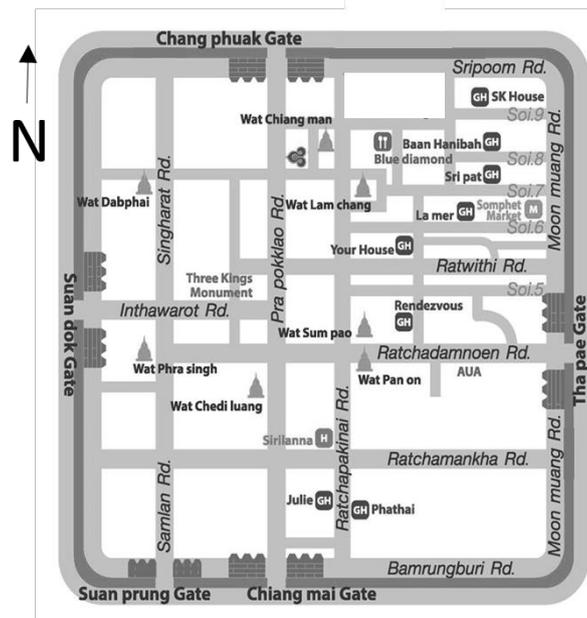
B. If Piti works, Chujai doesn't

C. If Mana doesn't work, Chujai doesn't work too.

D. If Chujai doesn't work, Mana doesn't work too.

E. If Chujai works, Mana doesn't.

Use the following map to answer question 15 -16



15. The best way to come to building A is by entering Suan dok gate – heading east, turn left on Pra pokklao Rd. - heading north and turn second left. The building A will be on the right hand side.

Which direction will pass by the building A too?

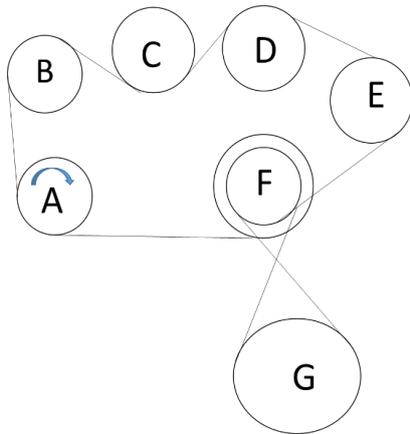
- A. Enter Suan prung Gate - heading east and turn first left.
- B. Enter Tha pae Gate – heading south - turn right on Pra pokklao Rd. - turn second left.
- C. Enter Chang phrak Gate – heading south - and turn second right.
- D. Enter Chaing mai gate – heading north - turn second left – turn first right.

16. Mr. Piti is standing on Ratchadamnoen Rd. If Sri pat is in the west relate to his position, what direction is he facing?

- A. North
- B. South
- C. East
- D. West

Part2: Mechanical tests

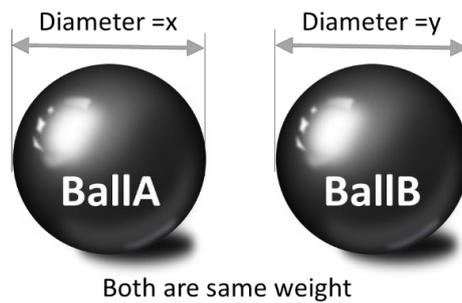
17. If wheel A rotate clockwise, how many wheels rotate clockwise includes wheel A ?



- A. 2
- B. 3
- C. 4
- D. 5
- E. None of the above

Use following information to answer question 18 - 19

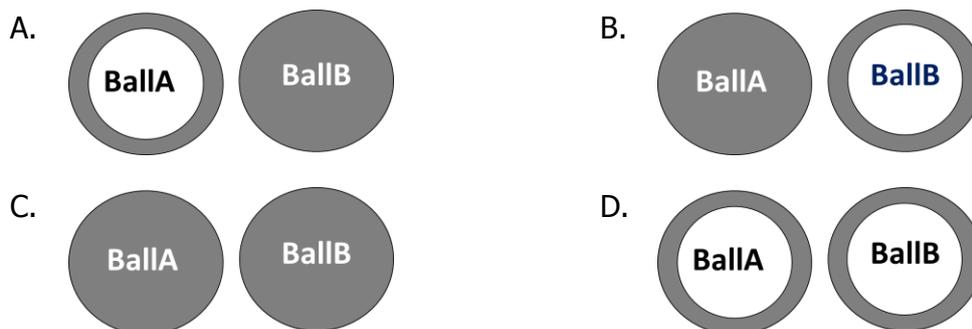
The following picture shows 2 different balls: ballA and ballB are made from different material and have different sizes but have same weight.



18. If BallA float, which sentence is correct about BallB ?

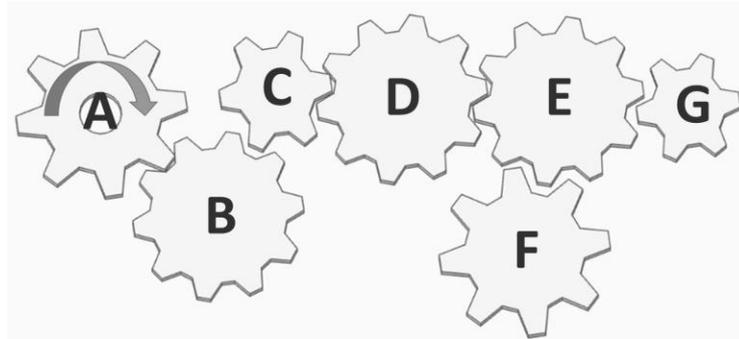
- A. If BallB is larger than BallA ($y > x$), BallB is always float.
- B. If BallB has same size as BallA ($y = x$), BallB is always float.
- C. If BallB is smaller than BallA ($y < x$), BallB is always float.
- D. Both A. and B. are correct
- E. Both B. and C. are correct

19. If BallA sink but BallB float, how inside these 2 balls should look like when we cut them off in the middle?



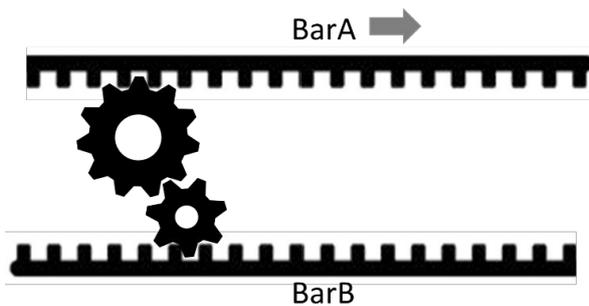
- E. All is possible

20. The gear A – G are fixed and can only rotate around their own axis. If gear A turns clockwise, which one is correct?



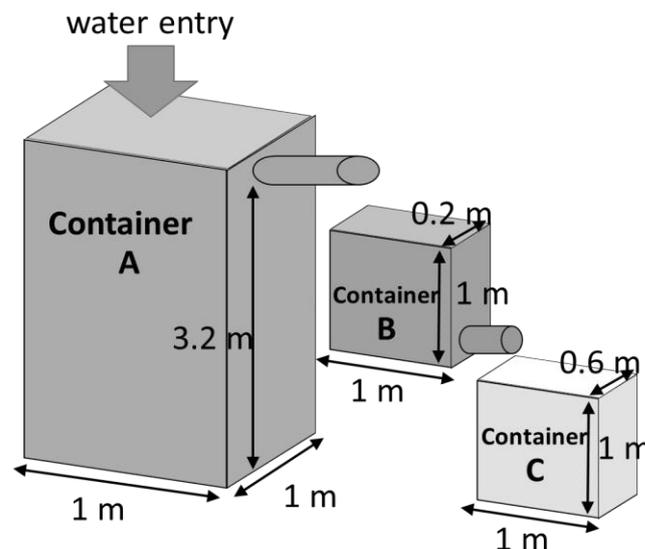
- A. Gear B, D and E rotate in same direction
- B. Gear G rotate faster than F
- C. Gear A and G rotate in same velocity
- D. Gear D and F rotate in different direction
- E. Gear A rotate fastest in this system.

21. If BarA moves right at speed of 4 cm/s, how does BarB moves?



- A. Moves left, same speed as BarA
- B. Moves right, same speed as BarA
- C. Moves left, speed less than BarA
- D. Move right, speed more than BarA
- E. Move right, speed less than BarA.

22. All 3 containers are empty. Container A and B have a small opening at the top and bottom that can drain water. When fill water in to container A with flow rate 1 liter/second, how long does it take to full the container C? (water 1m x 1m x 1m = 1,000 liter)



- A. Less than 30 minutes
- B. Between 1 – 2 hours
- C. Between 4 – 6 hours
- D. More than 6 hours
- E. Not possible to full container C

23. According to question 22. If we increase water flow rate to be 2 liter/second, how long does it take to full container B

- A. Less than 30 minutes
- B. Between 30 minutes to 1 hour
- C. Between 1 – 2 hours
- D. More than 2 hours
- E. Not possible to full container B

Use following picture to answer question 24 - 25



24. A bottle of water has leak at the lower side. As the water level goes down, what happens to the speed of water coming out from the hole?

- A. It increase
- B. It increase at the beginning and decrease at the end
- C. It never change speed.
- D. It decrease
- E. Water stop coming out.

25. If a bottle are dropped from height of 5 meters. What should happens to the speed of water coming out from hole?

- A. It increase
- B. It increase at the beginning and decrease at the end
- C. It never change speed.
- D. It decrease
- E. Water stop coming out.

26. If a bottle put in an altitude chamber, a room that simulate high altitude with environment of low oxygen and low ambient air pressure. What should happens to the speed of water coming out from hole? Assume that a hole was punched after put a bottle in a chamber.

- A. Water doesn't come out.
- B. Water rush out for a while and speed decrease.
- C. Water should come out with same speed as normal situation.
- D. Water come out with very slow speed
- E. Water come out with stable speed

There are candles and wireless speakers that play music put inside of different bell jars as shown on following picture. Use it to answer question 27 – 28



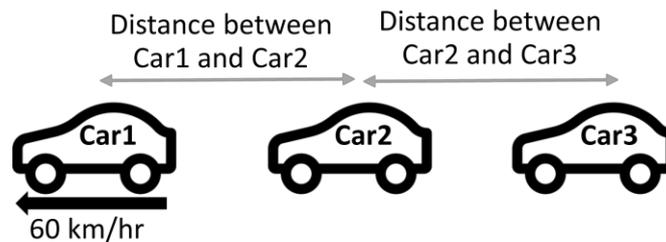
27. If three bell jars cover candles and speakers at the same time, the candle in which bell jar would have its flame disappear first?

- A. Bell jar I
- B. Bell jar II
- C. Bell jar III
- D. They will never disappear

28. If three bell jars cover candles and speakers at the same time, the speaker in which bell jar would have its sound disappear first?

- A. Bell jar I
- B. Bell jar II
- C. Bell jar III
- D. They will never disappear

Use following picture to answer question 29 - 30



29. A Car1 drive at a speed of 60 km/hr. If distance between Car2 and Car3 does not change while the distance between Car1 and Car2 increases, what is the Car3 speed?

- A. More than Car2
- B. Same as Car1
- C. Less than Car1
- D. Both A. and C. are correct
- E. None of the above

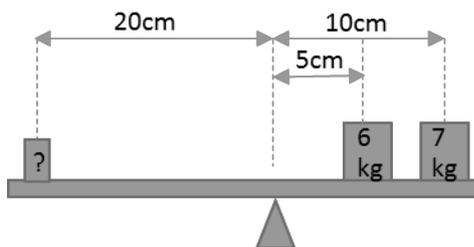
30. If Car 1 drive at speed of 60 km/hr and distance between Car1 and Car2 increases while distance between Car2 and Car3 decreases, what is the Car3 speed compare to Car1?

- A. More than Car1
- B. Less than Car1
- C. Same as Car1
- D. All is possible
- E. The situation impossible to happens.

31 If Car2 drive with speed of 40 km/hr, what is the distance between car1 and car2 get increase after 2 minutes later?

- A. < 500 meter
- B. Between 500 – 1000 meter
- C. Between 1000 – 1500 meter
- D. Between 1500 – 2000 meter
- E. 2000 meter

32. What mass is required to balance the following lever at the distance of 20 cm?



- A. 5 kg
- B. 6 kg
- C. 7 kg
- D. 8 kg
- E. 10 kg

33. From question 32. If take the mass of 6 kg out from the right hand side, which sentence is correct about mass on the left hand side to balance the lever?

- A. Decrease distance from center point
- B. Increase distance from center point
- C. Increase the mass.
- D. Both A and C are correct.
- E. Cannot make it balance.

34. Water flows into a container at a rate of 14 liters per minute. The container has a small opening at the bottom that drains water at a rate of 0.1 liter per second. How long will it take to fill the container to 240 liters?

- A. 20 minutes
- B. 30 minutes
- C. 40 minutes
- D. 60 minutes
- E. Not enough information

Part 3 Practical & Abstract numerical tests

35. Mr.Piti gave his money to his two daughters 18,000 baht, which he divided between them in a ratio of 4:5. How much did the daughter receiving the larger portion get?

- A. 9,000 baht
- B. 10,000 baht
- C. 11,000 baht
- D. 12,000 baht
- E. None of the above

36. Which one is the largest number?

- A. 50% of $\frac{1}{3}$ of 24
- B. 10% of $\frac{2}{5}$ of 50
- C. 20% of $\frac{1}{4}$ of 40
- D. All are equal
- E. Both A. and C.

37. if the total price of dinner is 321 baht including vat 7%. What is the price before include vat?

- A. 270
- B. 343
- C. 300
- D. 310
- E. none of the above

38. Calculate following equation

$$? + 44 + 28 = 16.5 * 4$$

- A. -14.5
- B. -6
- C. 11
- D. -9
- E. none of the above

39. What is the missing number in the sequence shown below?

$$1 - 2 - 9 - 28 - ? - 126 - 217$$

- A. 37
77
- B. 49
- C. 45
- D. 65
- E.

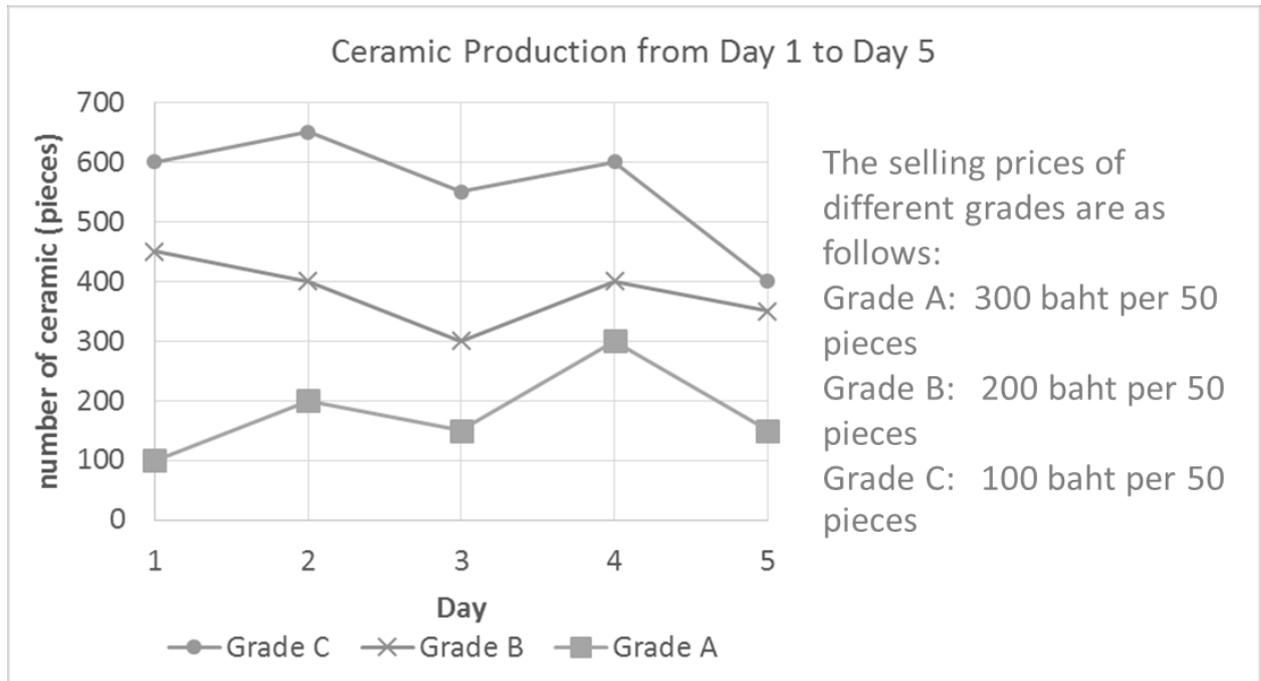
40. Ms. Manee wants to make a steak source. The following is a recipe of a steak source for 50 g.

- 30 g of ketchup
- 7 g of mustard
- 4 g of vinegar
- 4 g of salt
- 5 g of black pepper

How much of black pepper in gram (g) do Ms. Manee needs to make 90 gram of steak source?

- A. 5 g
- B. 9 g
- C. 12 g
- D. 16 g
- E. > 30 g

The following graph shows the ceramic production from day 1 to day 5. Use it to answer question 41 - 43



41. What is the total value of grade A B and C ceramic produced on Day 2?

- A. 3,900 B. 4,100 C. 4,400 D. 5,500 E. 6,500

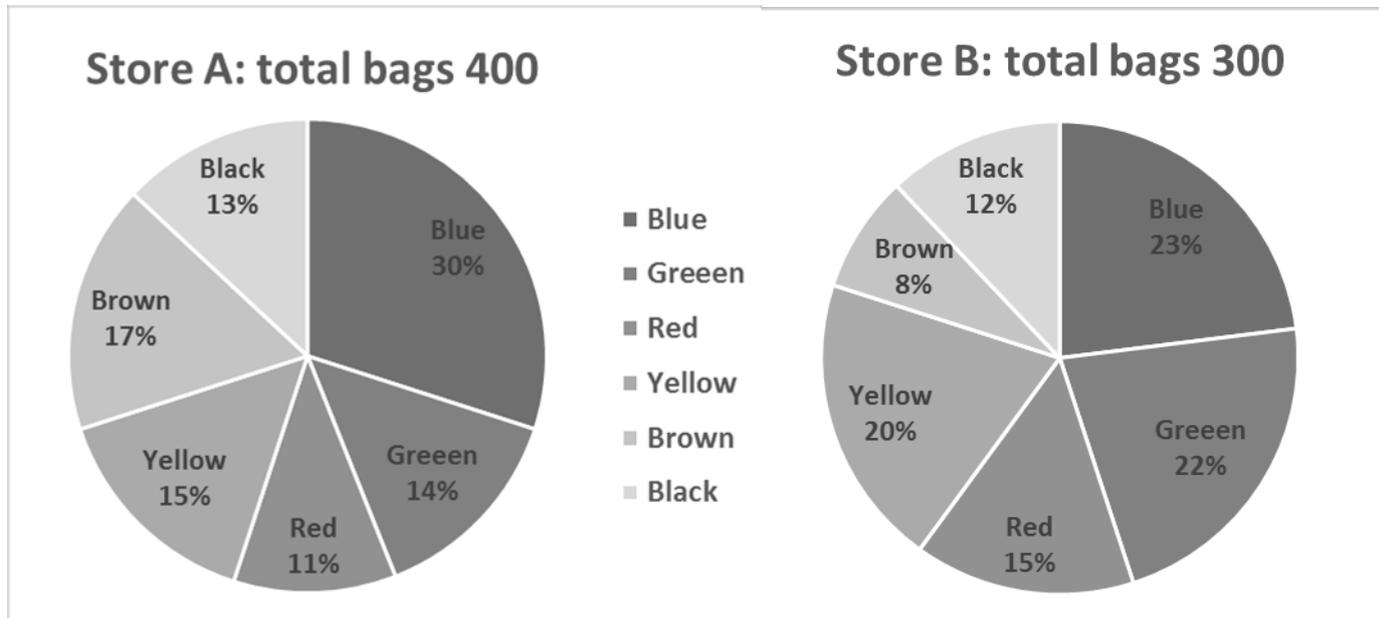
42. If production ceramic grade C on Day 6 increase by 25% from Day 5. What is the value of grade C ceramic produced on Day 6?

- A. 1,000 B. 1,200 C. 1,400 D. 1,600 E. 1,800

43. Which sentence is correct?

- A. The value of ceramic grade A on Day 5 increase 50% from Day 4
 B. The total value of Day 4 is less than Day 3
 C. The total value of Day 5 is more than Day 1
 D. The ratio value of ceramic grade A to grade C on Day 1 is 1:2
 E. None of the above

The following charts represent stock of bags in store A and store B in different color. Total bags in Store A is 400 and in Store B is 300.



44. What is the ratio amount of yellow bags in store A and store B ?

- A. 1:4
- B. 1:2
- C. 3:4
- D. 1:1
- E. None of the above

45. Which sentence is correct?

- A. Amount of yellow bags of store A is equal to red bags of store B
- B. Amount of Black and brown bags of store A is equal to blue bags of store A
- C. Total number of blue bags in store A and B are 120
- D. Both A and B are correct
- E. None of the above

Part 4 Space Explorations

46. Which galaxy is the closest to our galaxy?

- A. Milky Way
- B. Andromeda
- C. Proxima Centauri
- D. Trappist-1

47. Which of the following is incompatible with the rest?

- A. Phobos
- B. Deimos
- C. Titan
- D. Phobia

48. Neil Armstrong's footprints are still visible on the moon. What can best explain this fact?

- A. Moon has a microgravity that is almost 0.
- B. Moon is airless.
- C. The space boots were very heavy.
- D. All is correct.

49. What is not true about Trappist-1?

- A. It is a solar system.
- B. It is a star.
- C. It has 7 temperate terrestrial planets.
- D. It is located in a nearby galaxy.

50. What is another name of MARS?

- A. Ares
- B. Aphrodite
- C. Pandora
- D. Atlas

51. The Earth spins at the rate of 1,670 kms/hr. One rotation of the Sun is equal to 1,002,000 kms. How many days on Earth to match the distance of a spin on the Sun?

- A. 24 days
- B. 25 days
- C. 26 days
- D. 27 days

52. Which of the following is the word, "Blue Origin," related to?

- A. The color of the Earth
- B. A NASA's space project
- C. Elon Musk
- D. Jeff Bezos

53. Which of the following is not related to the rest?

- A. Lunokhod
- B. Yutu
- C. Apollo lunar roving vehicle
- D. Moon Express

54. During the 1960s, moon race was for political hegemony. In the near future, what has been expected to be the major reason?

- A. Leisure
- B. Resources
- C. Espionage
- D. Military

55. Which country recently launched 104 satellites into orbit in a single mission?
- A. USA
 - B. Russia
 - C. India
 - D. China
 - E. Japan
56. In early August 1971, during the moon mission, Apollo 15 Commander David Scott dropped a falcon feather and a rock hammer at the same time. The result was they hit the ground simultaneously. How was this experimentation proved Galileo's principle?
- A. Friction
 - B. Gravity
 - C. Acceleration
 - D. All is true.
57. When did the laws of physics as we know it today begin?
- A. When there is mass and motion.
 - B. Big bang
 - C. When there is energy.
 - D. It is impossible to tell the origin of physics.
58. What is Cassini-Huygens closely related?
- A. Mars
 - B. Saturn
 - C. Jupiter
 - D. Pluto
59. What were the first animals sent to space?
- A. Dogs
 - B. Monkeys
 - C. Flies
 - D. Rabbits
60. What is not the reason to explore space?
- A. Proving that we are not alone
 - B. Profit seeking
 - C. Mining
 - D. Tearing down the iron curtain
 - E. None is answer.
61. Helium-3 in the lunar soil has a high potential for what purpose?
- A. Treating cancer
 - B. Fuel source for nuclear fusion
 - C. Precious metal for ornament
 - D. All is true.

62. What is not the purpose of the XPrize Foundation?

- A. AI
- B. Mathematics
- C. UFO
- D. Privatize lunar exploration

63. What does not exist on Mars?

- A. Water
- B. Seasons
- C. Solid ground surface
- D. Air
- E. All is wrong.

64. According to the current information, how many planets does our solar system carry?

- A. 7 planets
- B. 8 planets
- C. 9 planets
- D. 10 planets

65. The International Space Station (ISS) orbits the Earth once every 92 minutes, how many times does an astronaut see sun settings in a day?

- A. 13
- B. 15
- C. 17
- D. 19
- E. This question is dubious! Space is dark. It is impossible to see sun rising or setting in Space.

66. In our solar system, besides of Pluto, which of the following is considered a dwarf planet?

- A. Titan
- B. Eris
- C. Enceladus
- D. All is true

67. FACT: "Cold white dwarf stars are made of carbon, squeezed and pressed down into a tight structure." What could possible be the result of this process?

- A. Granite
- B. Platinum
- C. Diamond
- D. Gold
- E. Silver

68. The distance between the Earth and the Sun is 150 million kilometers or 1 astronomical unit (AU). The distance between the Sun and the edge of our Solar System is 63,000 AU or 1 light year (ly). It takes 46,000,000,000 ly to travel from our Sun to the edge of our Universe. How long does it take for a light from our Sun to reach Proxima Centauri, which is 40.2 trillion kilometers (40.2×10^{12} km) from our Sun?

- A. 40.5 ly
- B. 268 ly
- C. 10.5 ly
- D. 4.25 ly

69. Who was the first person that did the spacewalk?

- A. Alan Shepard
- B. Yuri Gagarin
- C. Alexei Leonov
- D. Neil Armstrong
- E. Valentina Tereshkova

70. What was the reason of the Cassini spacecraft to end its mission by burning down during the controlled fall into the planet's atmosphere?

- A. Scientists needed the spacecraft to get closer to the planet and it could only be done before ending the mission.
- B. To prevent biological contamination
- C. It was the way NASA celebrated to grand finale.
- D. All is wrong.

71. Which of the following orbiter was constructed as a test article?

- A. Pathfinder
- B. Endeavor
- C. Enterprise
- D. Atlantis

72. EVA – Extravehicular is meant to match which of the following?

- A. Orbital flight
- B. Spacewalk
- C. Moon Lander
- D. Moonwalker

73. EMU – Extravehicular Mobility Unit is similar to which of the following?

- A. Space suit
- B. Manned Maneuvering Unit
- C. Spacecraft
- D. Rocket

74. If it is true that some asteroids carry ice, what could be the role of the asteroids in interplanetary traveling?

- A. Fuel station
- B. Oxygen-extraction base
- C. Oasis
- D. All is true.

75. An astronaut accidentally fall off a cliff on Miranda, a moon of Uranus. What would happen to the ill-fated astronaut when Miranda creates a pull of gravity at about a hundredth less than the Earth's?

- A. The astronaut would fall quickly and crushed.
- B. The astronaut would fall slowly and land gently.
- C. The astronaut would float and glide through the atmosphere.
- D. The astronaut would float and stay still without any movement.

Part 5 Newton Rocketry Skills & Science Analysis
Mysterious objects

Use the following information to answer questions 76 – 78

	Object 1	Object 2	Object 3
			
Shape	Cone	Sphere	Cube
Material	Diamond	Rock	Lead
Mass	0.1 tonnes	10 tonnes	1 tonne
Size	200 m	10 m	100 m
Velocity	150 m/s	100 m/s	100 m/s

76. All 3 objects travel towards space without colliding to any object and no external force on them. Which statement is correct?

- A. Object 1 will be the last one which stop moving because it has the highest velocity.
- B. Object 2 will be the last one which stop moving because it has the largest mass.
- C. Object 3 will be the last one which stop moving because it has the highest density.
- D. None of the above is correct.

77. If all three objects are travelling towards a space station which orbits the earth at 350 kilometers above the earth's surface, which object would cause the greatest damage to the space station? Note that the space station's wall is extremely strong that it could not be penetrated through.

- A. Object 1 would cause the greatest damage, Object 2 less damage, and Object 3 the least damage.
- B. Object 2 would cause the greatest damage, Object 3 less damage, and Object 1 the least damage.
- C. Object 3 would cause the greatest damage, Object 1 less damage, and Object 2 the least damage.
- D. All objects would cause equal amount of damage because gravity does not exist in outer space.

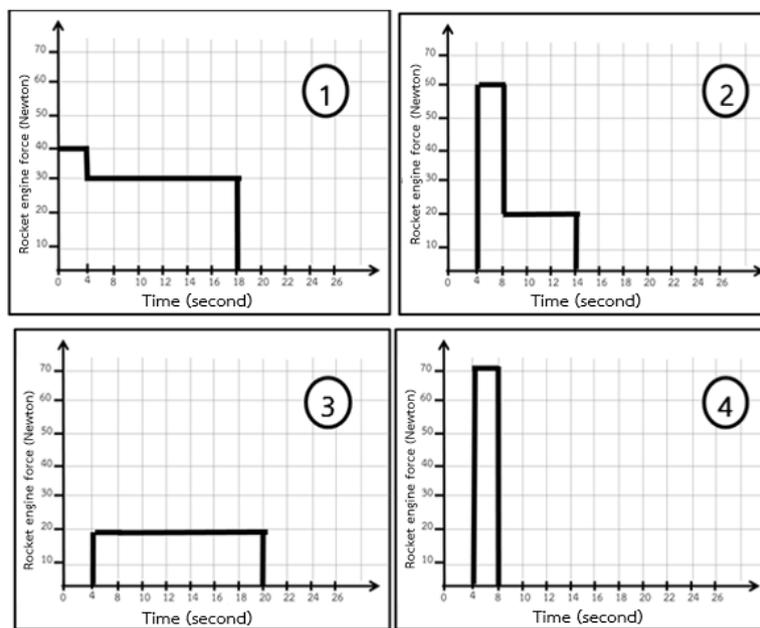
78. From a question 77, suppose that an astronaut shoots Object 2 to cause a head-on collision with Object 1 without any penetration. Would the astronaut be able to stop Object 1 to move straight toward the space station? Why?

- A. Yes, he would. Because Object 2 has a much higher density than Object 1.
- B. Yes, he would. Because Object 2 has a much greater momentum than Object 1.
- C. No, he would not. Because Object 1 has a much greater velocity than Object 2.
- D. No, he would not. Because Object 1 has a much bigger size than Object 2.

Rocket engine selection

Use the following information to answer questions 79 – 82.

A group of Thai engineers are selecting a small rocket engine for working in outer space. Four engines have been included for the selection process. A relationship between time and rocket engine force of the four engines are shown below.



79. Suppose that the engines are taken to outer space and stuffs that need to carry with is negligible. Which engine can deliver the stuffs to Mars earlier? Rank the engines in order of arrival to Mars?

- A. Engine 1, engine 3, engine 2, engine 4
- B. Engine 4, engine 2, engine 1, engine 3
- C. Engine 2, engine 4, engine 1, engine 3
- D. Engine 1, engine 2, engine 4, engine 3

80. If a living creature is attached to the engine, which engine is most likely to cause g-force that could harm that living creature? Rank the engines from most harmful to less.

- A. Engine 1, engine 3, engine 2, engine 4.
- B. Engine 4, engine 2, engine 1, engine 3
- C. Engine 2, engine 4, engine 1, engine 3
- D. Engine 1, engine 2, engine 4, engine 3

81. Rank the engines from most powerful to less.

- A. Engine 1, engine 3, engine 2, engine 4
- B. Engine 4, engine 2, engine 1, engine 3
- C. Engine 2, engine 4, engine 1, engine 3
- D. Engine 1, engine 2, engine 4, engine 3

82. Which engine has a rocket engine force that shows characteristic of gun firing?

- A. Engine 1 B. Engine 2 C. Engine 3 D. Engine 4

83. A scientist takes three very tiny objects including wood, iron, and water into an oven at 70 °C for six hours. Afterwards, the scientist uses his hand to touch these objects and find that iron is the hottest object, water is less hot, and wood is the least hot object. Which statement is correct?

- A. Wood has the lowest temperature because of its thermal insulation capacity.
B. After a while in an oven, water can absorb heat and eventually boils.
C. Iron has the highest temperature because it has a good thermal conductivity.
D. All three objects have equal temperature.

84. Liquid nitrogen is a liquid at -200 °C. It changes its state after absorbing heat from environment. What will happen if a dry ice with a temperature of -70 °C is put into a bath containing liquid nitrogen at room temperature?

- A. A dry ice will cool down the liquid nitrogen and slow down the change of its state
B. Liquid nitrogen will change its state faster due to heat released from a dry ice.
C. A dry ice will evaporate rapidly due to the cold from liquid nitrogen
D. No any change will be caused by a dry ice.

85. A group of villagers living in deep jungle use water from a well for consumption. It is found out later that a number of villagers who drink water from this well fell sick. Then, a local scientist adds chlorine into the well and finds that the number of sick villagers still keep increasing.

Given that: (1). Food Poisoning (2) Cancer (3) HIV infection
(4) Diseases related to toxic chemicals (5) kidney stone (6) Leptospirosis(โรคฉี่หนู)
(7) Cholera(อหิวาตกโรค) (8) Malaria

Which disease does the villagers may have?

- A. (3) (6) (8)
B. (1) and (7)
C. (1) (2) (4)
D. (2) (4) (5)

86. From the question 85, if you were the local scientist, how would you solve the problem?

- A. Let the villagers to boil water before consumption.
B. Install RO filtering system to clean water from the well before consumption.
C. Add twice more chlorine.
D. Separate the sick villagers from normal villagers to prevent a disease outbreak

Use the following information to answer questions 87-88.

Helium gas is lighter than air and it can be used to lift stuffs up to the sky. It is estimated that 1 cubic meter of helium gas can be used to carry 1 kg of object.

87. Each of three gas tanks of the same type has volume of 6 cubic meter. One of these gas tanks is empty, another one contains 6 cubic meter of helium gas, and the other contains 6 cubic meter of air. A scientist identifies each gas tank by weighing them. Rank the three gas tanks in order of weight from the smallest to the greatest.

- A. A helium tank, an air tank, and an empty tank
B. An air tank, an empty tank, and a helium tank
C. An empty tank, a helium tank, and an air tank
D. A helium tank, an empty tank, and an air tank

88. Mr. Auf wants to use helium balloons to float up in the sky. Each balloon is weight 900 g and can fill helium volume of 1 cubic meter. If Auf's weight is 50 kilogram, how many helium balloons will he need to be able to make him float up?

- A. 50 B. 100 C. 500 D. 1,000

89. A truck driver is transporting 500 birds in his truck. The total weight of birds in a sealed container is 2000 kilogram. The driver knows that his truck exceeds the weight limit. Then, he plays a trick by startling the birds to make all of them fly above the container's floor. Do you think the truck's weight will decrease or not? Why?

- A. The weight will increase due to a lifting force from 500 birds' wings.
 B. The weight will slightly decrease because a lifting force from the birds' wings will make the container slightly lighter.
 C. The weight will remain unchanged whether the birds will stand on the container's floor or fly above the floor.
 D. The weight will decrease. This is because when the birds fly up, their weight will no longer exert the force on the container's floor.

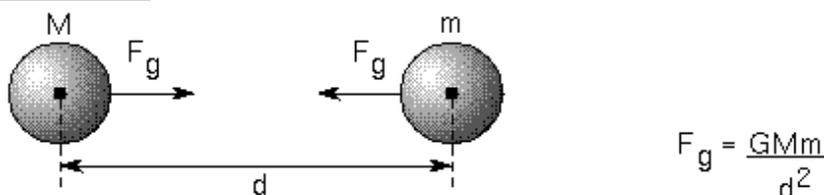
90. An engineer uses a laser beam to destroy three balloons of the same size. The laser beam can destroy two balloons; a black-colored balloon and a red-colored one. However, a green color balloon cannot be destroyed. If power of the laser beam remains unchanged all the time, which color of laser beam does the engineer use? Why?

- A. A red-colored laser beam because it can be shot to a balloon of the same color.
 B. A green-colored laser beam because it cannot be shot to a balloon of the same color.
 C. A purple-colored laser beam because it has a low energy.
 D. An infrared laser beam because it can destroy a black-colored balloon.

Science Analysis

Use the following information to answer questions 91-93.

Gravitational force is a phenomenon which causes an attraction between any two objects with mass. The larger the mass of the object, the greater the force of attraction. On the contrary, the smaller the distance between center of mass of two objects, the greater the force of attraction.



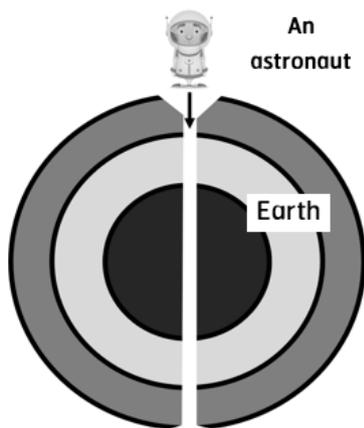
91. If the sun in our solar system is replaced by a black hole of equal mass but with smaller size, which statement is correct?

- A. Planets in the solar system with very large mass such as Jupiter and Saturn would be the first planets that are sucked into the black hole.
 B. Planets in the solar system which orbit near the black hole such as Mercury and Venus would be the first planets that are sucked into the black hole.
 C. All planets in the solar system would be sucked into the black hole at the same time.
 D. No changes would happen to the orbit within the solar system.

92. Which analysis about gravitational force is correct?

- A. Mars lost its atmosphere due to its very low gravity caused by its long distance from the sun.
- B. If we weigh our body on Uranus, our weight would be greater than the weight on the earth. This is because the mass of Uranus is greater than that of the earth.
- C. The larger the diameter an object has, the greater the gravitational force the object has.
- D. All the above are correct.

93. In 2100, scientists successfully discover a method to drill a tunnel on the earth's surface all the way down to another side of the earth and it has air inside. Then they decide to let an astronaut jump into the tunnel. Which statement is correct?



- A. An astronaut would fall through the other side of the earth with high speed and go beyond in space.
- B. An astronaut would fall through the other side and stop when reach on the surface.
- C. An astronaut would be stuck at the center of the earth.
- D. An astronaut would fall to the center of the earth and bounce back to the beginning point.

Use the following information to answer questions 94-95.

Graph 1 shows an experiment to determine changes in battery's capacitance (mAh) during 0-1,200 cycles of use (cycle).

Table 2 shows a relationship between depth of discharge (DOD) and battery's life cycle, from 100% DOD (fully discharged and then recharge) to 10% DOD (90% of capacitance reserved and then recharge).

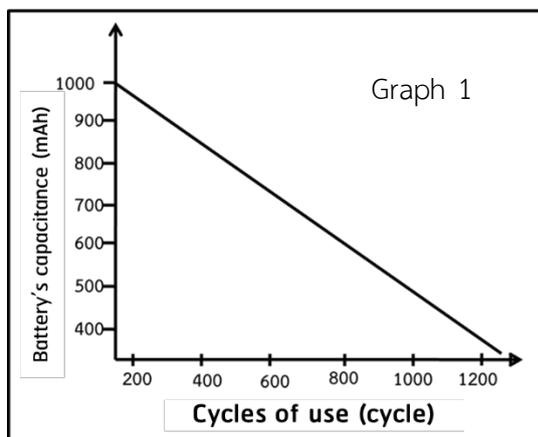


Table 2

Depth of discharge	Cycles of use before battery's capacitance decreases to 50%
100%	300-400
80%	600-700
50%	1000-1100
10%	3000-3100

94. "New Horizons" is a spacecraft which would take nine years journey to reach Pluto. Therefore it is very likely that the battery would die before it completes the mission. If you were a spacecraft controller, which method would you use to increase the battery's lifetime? It is given that a nuclear reactor has been installed in the spacecraft to generate energy for use during the journey.

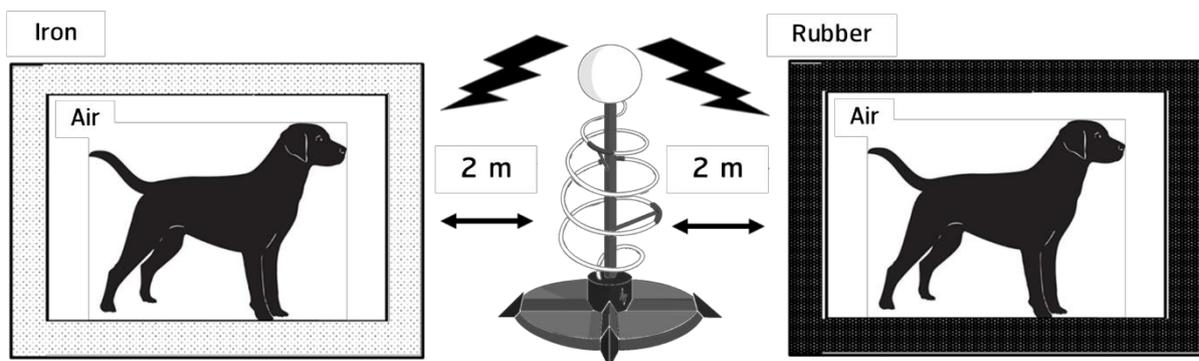
- A. Try to fully discharge the battery before recharging with the nuclear reactor.
- B. Be careful not to let the battery's power level become too low and recharge it when DOD is 20%.
- C. Maintain the battery's power level at 50% and use only power from the nuclear reactor.
- D. Design the spacecraft that it consumes less power and can be in operation throughout the journey.

95. A satellite with an installed 3200 mAh battery orbits the Earth. Every day, this satellite needs to consume at least 1600 mAh of electricity from the battery before the battery gets fully recharged by solar cells. How many days could this satellite remain in operation until it starts to have power outage?

- A. 300 days
- B. 600 days
- C. 1000 days
- D. 3000 days

Use the following information to answer questions 96 - 97

A scientist wants to design a safety box to prevent harm from lightning strike. He invents two types of safety box. The first one has a rubber protective wall while another one has the wall made of iron. Both types of walls are thin. After that he set up an experiment by putting 2 safety box with distance 2 meters from lightning machine as shown on following picture. Then, he generates lightning randomly. The result turns out that each box receives 50 times of lightning.



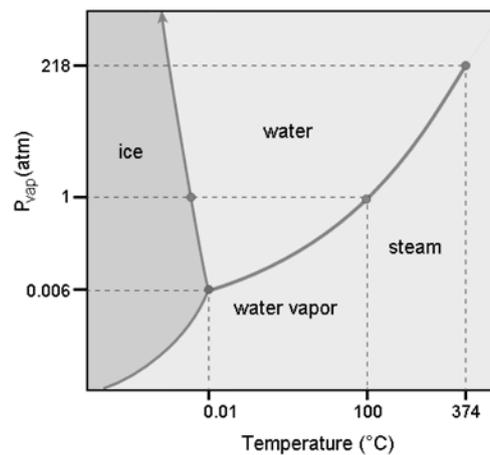
96. One of the dogs dies after the experiment has been finished. In which box does the dog die? Why?

- A. The rubber box. Because it is an electrical insulator but is not a thermal insulator. Hence it conducts heat to the dog.
- B. The rubber box. Because the lightning generates very high voltage and the rubber layer on the wall is too thin to resist such high voltage.
- C. The iron box. Because iron is a good electrical conductor and can directly conduct an electric current to the dog.
- D. The iron box. Because iron becomes heated when an electric current passes through it.

97. Which statement is correct?

- A. A person wearing a gold or metal necklace is more likely to get lightning strike than those without the necklace.
- B. A person wearing a gold or metal necklace and those without the necklace are equally likely to get lightning strike.
- C. A person sitting in a car can survive the lightning strike because car's rubber tires are good electrical insulator
- D. A person sitting in a car survive the lightning strike because the car's metal frame is strong enough to resist electrical current of the lightning.

Use the following graph to answer questions 98

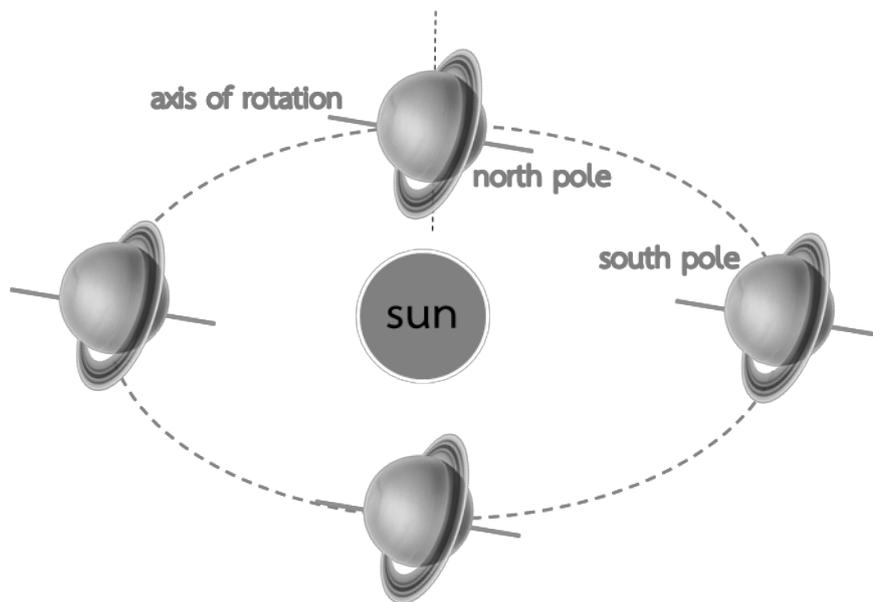


98. Suppose that Halley's Comet consists of pure ice at temperature -200°C . As the comet is moving towards the sun, the temperature of some part of its tail rises to 0.5°C . Which statement is correct?

- A. An increase in temperature will make the ice become liquid water. Hence scientists expect to see small living creatures on this comet.
- B. The comet's tail part which appears visible on the sky consists of steam, ice flake, and liquid water.
- C. The comet's tail part consists of water vapor which is originated from a direct sublimation of ice, and without any liquid water.
- D. None of the above is correct. This is because at 0.5°C , water still exists as a solid state.

Use the following information to answer questions 99-100.

Uranus rotates clockwise and its axis of rotation has an axial tilt of 98° . It orbits the Sun once every 84 years. Assume Uranus orbits the sun in circle as shown in a figure below.



99. Which is correct about sunlight on Uranus?

- A. Sometime during the year, the north pole of Uranus does not get any sunlight at all.
- B. The south pole of Uranus stays in full sunlight throughout the entire year.
- C. When the north pole of Uranus is exposed to sunlight, the south pole will also always receive the sunlight.
- D. Regardless of where the location of Uranus is, a ratio of length of daytime and nighttime is always 1:1 within its one rotational period (one day of Uranus).

100. Which statement is correct?

- A. It takes 84 years for Uranus to complete one orbital period due to its axial tilt of 98° .
- B. If Uranus's axis of rotation is not tilted, its north pole would face the sunlight sometime during the year.
- C. If Uranus' rotational period is one year (the same as the earth), the duration of daytime on Uranus would be similar to the daytime on the earth.
- D. If Uranus rotates anticlockwise the same way as the earth, length of its daytime (the duration that it is exposed to sunlight within a day) would remain unchanged.