**Appendices**

***Appendix A*-Checklist for reviewing multiple-choice items**

* Has the item been constructed to assess a single written objective?
* Is the item based on a specific problem stated clearly in the stem?
* Does the stem include as much of the item as possible, without including irrelevant material?
* Is the stem stated in positive form?
* Are the alternatives worded clearly and concisely?
* Are the alternatives mutually exclusive?
* Are the alternatives homogeneous in content?
* Are the alternatives free from clues as to which response is correct?
* Have the alternatives “all of the above” and “none of the above” been avoided?
* Does the item include as many functional distracters as are feasible?
* Does the item include one and only one correct or clearly best answer?
* Has the answer been randomly assigned to one of the alternative positions?
* Is the item laid out in a clear and consistent manner?
* Are the grammar, punctuation, and spelling correct?
* Has unnecessarily difficult vocabulary been avoided?

***Appendix* B-Pre test**

The aim of this test is to know previous students’ academic achievement on work and energy and to take two sections with equivalent mean to participate in the study. Your answer will use only for research purpose, So fill free to give honest answers. You are not required to write your name, only write your section here \_\_\_\_\_\_

 Time allowed-1hr

 Thank you for your cooperation

Direction: - Below are statements of items followed by alternatives.

Read each of items and select the correct answer from the given alternatives and put the letter on the space provided.

1. A rock sitting at the edge of a cliff contains energy called ----- energy.

A) Potential B) kinetic c) chemical d) radiation e) electrical

2. A woman runs up a flight of stairs. The gain in her gravitational potential energy is U. If she runs up the stairs at twice the speed, her gain in gravitational potential energy will be

A) U/4 B) U/2 C) U D) 2U E) 4U

3. If the work required to get an object with mass mo from rest to a speed vo is Wo, the additional work required to increase its speed from vo to 2vo would be Wo x \_\_\_.

A) 1 B) 1/2 C) 2 D) 1/4 E) 4

4. Two students cooperate in moving a box across the floor by exerting forces on it directed as depicted in the figure 1 below. The crate is moved a distance do with constant speed vo toward the right. If the magnitude of force **F**2 was increased slightly, the box would \_\_\_.

(A) Continue to move with the same constant speed vo

(B) Move with a constant speed v > vo C) Move with a constant speed v < vo

(D) Begin to speed up uniformly (E) Begin to slow down uniformly



 Figure 1

5. A block that is on a table (not frictionless) is pushed to the left by a force equal to 5N. The block moves to the left over a distance of 1m at a constant speed of 2m/s. We can conclude that the total work done by all forces acting on the object is

A) greater than zero. B) less than zero. C) equal to zero. D) unknown.

6. If air resistance is negligible, the sum total of potential and kinetic energies of a freely falling body \_\_\_\_\_\_\_

A) Increases B) Decrease C) Becomes zero D) Remains the same

7. Which form of energy does the flowing water possess?

A) gravitational energy B) potential energy C) electrical energy D) kinetic energy

8. If the gravitational potential energy of a 1Kg box on a shelf 1m high is PEo, the gravitational potential energy of a 2Kg box on a shelf 3 m high would be PEo x \_\_\_.

A) 0 B) 1 C) 2 D) 3 E)6

9. King Kong falls from the top of the Empire State Building, through the air (air friction is present), to the ground below. How does his kinetic energy (K) just before striking the ground compare to his potential energy (U) at the top of the building?
 A)K is equal to U B) K is greater than U C) K is less than U D) It is impossible to tell

10. The work required to stretch a relaxed spring with spring constant ko an amount xo is Wo. The additional work required to stretch the spring from xo to 2 xo would be Wo x \_\_\_.

A) 0 B) 1 C) 2 D) 3 E) 4

11. A bead is used to demonstrate the inter-conversion of kinetic and potential energies in a model roller coaster track in figure 2 below. The bead is released at point *A* with certain speed. Assume that there is no energy loss, which of the following statements is not always true?



 Figure 2

A) Mechanical energy is always conserved

B) Kinetic energy and potential energy is inter-changing.

C) The velocity of the bead at point B is greater than at point A

D) It has the highest kinetic energy at point C if the bead can pass point A**.**

12. A spring has spring constant ko.The work required to stretch the relaxed spring an amount xo is Wo. If the spring constant had been 3ko, the work required to stretch the relaxed spring an amount xo would have been Wo x \_\_\_.

A) 1 B) 2 C) 3 D) 4 E) 5

13. You push a block up a frictionless hill at constant speed. The work done by gravity when you push the block up the hill is equal to (U stands for potential energy)

A) U B) 2U C) 0 D) U/2

14. In a circus show, a demonstrator uses a rigid rod to swing from point *A* in the horizontal direction to point *B* in the vertical direction as shown in the following figure 3 below. What is his initial speed at point *A* in order to achieve this motion? Given that the rigid rod is 2 m long.

A) 3.06 ms-1 B) 6.32 ms-1 C) 7.74 ms-1 D) 9.85 ms-1



 Figure 3

15. Three springs of the same relaxed length Lo have spring constants k1 **>** k2 **>** k3. The springs are suspended from the ceiling and identical masses are then hung on each of the springs. In response to these identical stretching forces, the springs stretch amounts x1, x2 and x3 respectively. The elongation of the springs are such that \_\_\_.

A) x1 **>** x2 **>** x3 B) x1 **<** x2 **<** x3 C) x1 **=** x2 **=** x3 D)x1<x2>x3

16. A skier skis down a hill as shown in the figure 4 below. Determine his speed just before he lands on the ground?

A. 10.24 ms-1  B. 14.14ms-1  C. 20.0 ms-1  D. 22.54ms-1



 Figure 4

17. An object of mass m moves with a velocity v across a level surface. It comes to rest after traveling a distance d. The work done by friction is

A) –1/2mv2 B) – mvd C) 0

D) Can’t be determined unless we know the coefficient of kinetic friction.

18. Balls A, B, and C are thrown off a 45m high cliff. Ball A is thrown horizontally with a speed of 25m/s. Ball B is thrown 25 degrees above the horizontal with a speed of 25m/s. Ball C is thrown 25 degrees below the horizontal with a speed of 25m/s. When the balls hit the ground, we can conclude that (assume no air friction)

A) ball A hits the ground with the highest speed

B) ball B hits the ground with the highest speed

C) ball C hits the ground with the highest speed

D) they all hit the ground with the same speed

19. In the forest, there are lots of obstacles. As shown in the figure 5 below, the rope is hinder by a horizontal trunk. If the rope is inextensible, can Tarzan swing to point *B* if he starts from rest to swing from point *A*?

A. Yes, he can rise to the same height. B. No, the rope is not long enough.

C. No, he needs an initial speed. D. Not enough information

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 Figure 5

20. Which requires more work: lifting a 50-kg sand bag 2 meters straight up, or lifting a 100-kg sand bag 1 meter straight up?
A) Lifting the 50-kg sand bag 2 meters. B) Lifting the 100-kg sand bag 1 meter.
C) It depends on the rate of lifting. D) They both require the same amount of work.

***Appendix* C-Post test**

The aim of this test is to collect data to investigate the effectiveness of advance organizer model on students’ academic achievement in learning work and energy. Your answer will use only for research purpose, so fill free to give honest answers. You are not required to write your name, only write your section here \_\_\_\_\_\_\_\_

 Time allowed-1hr

 Thank you for your cooperation

Direction: - Below are statements of items followed by alternatives.

Read each of items and select the best answer from the given alternatives and put the letter on the space provided.

1. If the rock falls off of the cliff, it gains energy called ----- energy.

A) Potential B) kinetic C) chemical D) radiation E) electrical

2. A woman runs up a flight of stairs. The gain in her gravitational potential energy is U. If she runs up the stairs at half the speed, her gain in gravitational potential energy will be

A) U/4 B) U/2 C) U D) 2U

3.If the work required to get an object with mass mo from rest to a speed vo is Wo,the work required to get another object with mass 2mo also initially at rest to a speed vo would be

 Wo x \_\_\_.

A) 1 B) 1/2 C) 2 D) 1/3 E) 3

4. Two students cooperate in moving a box across the floor by exerting forces on it directed as depicted in the figure 1 below. The crate is moved a distance do with constant speed vo toward the right.If the angle θ1 had been slightly smaller, the work done by the student who exerted the force F1 on the crate would have been \_\_\_.

A) More B) the same C) less D) unpredictable



 Figure 1

5. Two identical objects are accelerated through the same distance by different forces such that one object gains a velocity twice that of the other object. One can conclude that the force on the faster object is

A) One-fourth that of the slower object B) Half that of the slower object

C) The same as that of the slower object. D) Twice that of the slower object

E) Four times that of the slower object

6. The type of energy possessed by a simple pendulum, when it is at the mean position is

A) kinetic energy B) potential energy C) potential energy + kinetic energy D) sound energy

7. If the speed of an object is doubled then its kinetic energy is \_\_\_\_\_\_\_

A) doubled B) quadrupled C) halved D) tripled

8. If the gravitational potential energy of a 1kg box an a shelf 1m high is PEo, the gravitational potential energy of a 2Kg box on a shelf 3m high would be PEo x \_\_\_.

A) 0 B) 1 C) 2 D) 3 E) 26

9. Two marbles, one twice as heavy as the other, are dropped to the ground from the roof of a building. Just before hitting the ground, the heavier marble has

 A) as much kinetic energy as the lighter one.

 B) twice as much kinetic energy as the lighter one.

 C) Half as much kinetic energy as the lighter one.

 D) four times as much kinetic energy as the lighter one.

 E) Impossible to determine.

10. The work required to stretch a relaxed spring with spring constant ko an amount xo is Wo.The work required to stretch the relaxed spring an amount 3 xo would be Wo x \_\_\_.

A) 0 B) 1 C) 3 D) 9 E) 8

11. As shown in the figure 2 below, a bead of 0.15 kg is allowed to roll to point C with initial speed of 3.87 m s−1. Due to friction, the bead can only reach a height of 1.5 m on the other side of the track. Find the work done against friction.

0.37 J B) 1.10 J C)0.50 J D)1.25 J



 Figure 2

12. A spring has spring constant ko. The work required to stretch the relaxed spring an amount xo is Wo.If this spring was already stretched an amount 3xo, the additional work required to stretch it another xo would be Wo x \_\_\_.

A) 1 B) 2 C) 3 D) 9 E) 7

13. You push a block up a frictionless hill at constant speed. The work that you do in pushing the block up the hill is equal to

A) U B) 2U C) 0 D) None of the above

14. A pendulum bob of mass 0.1 kg is hung on fixed point *A* and it is released from rest horizontally. There is a peg 0.1 m directly below point *A* as shown in the figure 3 below. Assume the air resistance is negligible. Calculate is the speed of the pendulum bob at point *B*?

A) 1.41 ms-1  B) 1.52 ms-1  C) 1.63 ms-1  D) 2.02 ms-1



 Figure 3

15. Three springs of the same relaxed length Lo have spring constants k1 **>** k2 **>** k3. The springs are suspended from the ceiling and identical masses are then hung on each of the springs. In response to these identical stretching forces, the springs stretch amounts x1, x2 and x3 respectively. The elastic potential energies stored in each of the three springs are such that \_\_\_.

A)EPE1**<**EPE2**<**EPE3 B) EPE1 **=** EPE2 **=** EPE3 C) EPE1 **>** EPE2 **>** EPE3 D) EPE1<EPE2>EPE3

16. A skier skis down a hill as shown in the figure 4 below. Determine his speed when he just leaves point *B*?

A) 8.75ms-1 B) 3.26 ms-1 C) 10.95 ms-1 D) 12.90 ms-1



 Figure 4

17. An object of mass m moves is in uniform circular motion across a level surface. Its speed is v. The work that friction does done in keeping the car in a circular path is

A) –1/2mv2 B) -mvd C) 0

D) Can’t be determined unless we know the coefficient of kinetic friction.

18. Two blocks are released from the top of a height h. One falls straight down while the other slides down a smooth ramp. If all friction is ignored, which one is moving faster when it reaches the bottom?

A) The block that went straight down. B) The block that went down the ramp.

C) They both will have the same speed. D) Insufficient information to work the problem.

19. As shown in the figure 5 below, Tarzan travels from one place to another by swinging in the forest. Assume that the rope is just long enough to swing from point *A* to point *B*, what is his initial speed in order for him to reach point *B*?

A. 5.69ms-1 B. 10.0ms-1 C. 8.5ms-1 D. 7.75ms-1



 Figure 5

20. Consider two masses m1and m2 at the top of two frictionless inclined planes. Both masses start from rest at the same height. However, the plane of which m1 sits is at an angle of 30 degrees with the horizontal, while the plane of which m2 sits is at 60 degrees. If the masses are released, which is going faster at the bottom of its plane?
A) m1 B) m2 C) they both are going the same speed
D) cannot be determined without knowing the masses E) Any help is appreciated.

***Appendix D-*Pre and post-test scores of the experimental and control group students**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  Experimental Group |  Control Group |
|  Pre-test (20%) |  Post-test (20%) |  Pre-test (20%) |  Post-test (20%) |
| 1 | M | 8 | 15 |  6 | 11 |
| 2 | M | 6 | 14 | 7 | 15 |
| 3 | F | 7 | 16 | 5 | 13 |
| 4 | F | 7 | 15 | 6 | 13 |
| 5 | F | 8 | 16 | 9 | 9 |
| 6 | M | 10 | 15 | 5 | 12 |
| 7 | M | 4 | 14 | 11 | 10 |
| 8 | M | 8 | 16 | 5 | 12 |
| 9 | F | 11 | 13 | 5 | 11 |
| 10 | M | 8 | 12 | 3 | 10 |
| 11 | M | 7 | 15 | 7 | 14 |
| 12 | F | 6 | 15 | 5 | 11 |
| 13 | F | 5 | 14 | 6 | 12 |
| 14 | M | 10 | 15 | 5 | 13 |
| 15 | F | 7 | 14 | 8 | 11 |
| 16 | M | 8 | 13 | 6 | 10 |
| 17 | F | 5 | 16 | 4 | 10 |
| 18 | M | 5 | 13 | 6 | 9 |
| 19 | M | 8 | 14 | 8 | 7 |
| 20 | M | 7 | 13 | 9 | 11 |
| 21 | M | 6 | 15 | 6 | 12 |
| 22 | F | 8 | 10 | 10 | 9 |
| 23 | F | 9 | 17 | 7 | 11 |
| 24 | F | 7 | 14 | 5 | 11 |
| 25 | F | 6 | 16 | 7 | 9 |
| 26 | F | 4 | 16 | 5 | 10 |
| 27 | M | 10 | 15 | 7 | 10 |
| 28 | M | 8 | 16 | 4 | 11 |
| 29 | M | 7 | 14 | 5 | 12 |
| 30 | F | 6 | 14 | 6 | 13 |
| 31 | F | 5 | 15 | 4 | 9 |
| 32 | F | 8 | 16 | 7 | 9 |
| 33 | M | 5 | 18 | 5 | 8 |
| 34 | F | 2 | 17 | 6 | 12 |
| 35 | M | 4 | 18 | 9 | 12 |
| 36 | M | 3 | 17 | 7 | 15 |
| 37 | F | 10 | 14 | 8 | 14 |
| 38 | M | 7 | 13 | 4 | 13 |
| 39 | M | 5 | 11 | 8 | 12 |
| 40 | F | 3 | 16 | 7 | 13 |
| 41 | M | 5 | 15 | 5 | 7 |
| 42 | M | 8 | 16 | 4 | 11 |
| 43 | F | 6 | 13 | 5 | 11 |
| 44 | M | 5 | 16 | 6 | 9 |
| 45 | M | 6 | 12 | 9 | 7 |
| 46 | M | 6 | 15 | 6 | 14 |
| Total | 304 | 677 | 288 | 507 |
| Mean | 6.61 | 14.71 | 6.26 | 11.02 |

***Appendix* E-Pre-test and post-test result for each objectives**

|  |  |  |
| --- | --- | --- |
|  |  Experimental Group |  Control Group |
|  Post-test (20%) | Knowledge(5%) | Understanding(7%) | Application(8%) |  Post-test (20%) | Knowledge(5%) | Understanding(7%) | Application(8%) |
| 1 | 15 | 4 | 5 | 6 | 11 | 3 | 4 | 4 |
| 2 | 14 | 3 | 4 | 7 | 15 | 5 | 4 | 6 |
| 3 | 16 | 4 | 6 | 6 | 13 | 4 | 4 | 5 |
| 4 | 15 | 3 | 6 | 6 | 13 | 4 | 3 | 6 |
| 5 | 16 | 4 | 5 | 7 | 9 | 3 | 2 | 4 |
| 6 | 15 | 4 | 6 | 5 | 12 | 5 | 3 | 4 |
| 7 | 14 | 3 | 5 | 6 | 10 | 3 | 4 | 3 |
| 8 | 16 | 4 | 6 | 6 | 12 | 3 | 5 | 4 |
| 9 | 13 | 3 | 4 | 6 | 11 | 2 | 4 | 5 |
| 10 | 12 | 2 | 5 | 5 | 10 | 3 | 4 | 3 |
| 11 | 15 | 3 | 4 | 8 | 14 | 4 | 4 | 6 |
| 12 | 15 | 4 | 6 | 5 | 11 | 3 | 5 | 3 |
| 13 | 14 | 3 | 4 | 8 | 12 | 4 | 3 | 5 |
| 14 | 15 | 3 | 5 | 7 | 13 | 5 | 4 | 4 |
| 15 | 14 | 5 | 4 | 5 | 11 | 2 | 5 | 4 |
| 16 | 13 | 3 | 5 | 5 | 10 | 3 | 3 | 4 |
| 17 | 16 | 4 | 6 | 6 | 10 | 2 | 5 | 3 |
| 18 | 13 | 2 | 7 | 4 | 9 | 4 | 3 | 2 |
| 19 | 14 | 5 | 4 | 5 | 7 | 2 | 3 | 2 |
| 20 | 13 | 3 | 5 | 5 | 11 | 4 | 4 | 3 |
| 21 | 15 | 4 | 6 | 5 | 12 | 3 | 4 | 5 |
| 22 | 10 | 2 | 4 | 4 | 9 | 3 | 3 | 3 |
| 23 | 17 | 5 | 5 | 7 | 11 | 4 | 4 | 3 |
| 24 | 14 | 3 | 4 | 7 | 11 | 3 | 4 | 4 |
| 25 | 16 | 5 | 6 | 5 | 9 | 2 | 3 | 4 |
| 26 | 16 | 4 | 5 | 7 | 10 | 4 | 3 | 3 |
| 27 | 15 | 3 | 6 | 6 | 10 | 3 | 4 | 3 |
| 28 | 16 | 4 | 6 | 6 | 11 | 4 | 3 | 4 |
| 29 | 14 | 3 | 4 | 7 | 12 | 4 | 4 | 4 |
| 30 | 14 | 5 | 4 | 5 | 13 | 4 | 5 | 4 |
| 31 | 15 | 3 | 5 | 7 | 9 | 3 | 3 | 3 |
| 32 | 16 | 5 | 5 | 6 | 9 | 2 | 3 | 4 |
| 33 | 18 | 4 | 6 | 8 | 8 | 2 | 3 | 3 |
| 34 | 17 | 5 | 6 | 6 | 12 | 4 | 3 | 5 |
| 35 | 18 | 5 | 7 | 6 | 12 | 4 | 4 | 4 |
| 36 | 17 | 3 | 6 | 8 | 15 | 5 | 5 | 5 |
| 37 | 14 | 3 | 6 | 5 | 14 | 4 | 5 | 5 |
| 38 | 13 | 2 | 4 | 7 | 13 | 3 | 5 | 5 |
| 39 | 11 | 2 | 4 | 5 | 12 | 4 | 4 | 4 |
| 40 | 16 | 4 | 5 | 7 | 13 | 5 | 2 | 6 |
| 41 | 15 | 3 | 4 | 8 | 7 | 1 | 4 | 2 |
| 42 | 16 | 4 | 4 | 8 | 11 | 4 | 3 | 4 |
| 43 | 13 | 4 | 4 | 5 | 11 | 3 | 4 | 4 |
| 44 | 16 | 3 | 5 | 8 | 9 | 3 | 3 | 3 |
| 45 | 12 | 2 | 4 | 6 | 7 | 2 | 3 | 2 |
| 46 | 15 | 4 | 5 | 6 | 14 | 5 | 4 | 5 |
| Total | 677 |  |  |  | 507 |  |  |  |
| Mean | 14.71 |  |  |  | 11.02 |  |  |  |

***Appendix F-*Result of pilot study for pre-test and post test**

|  |  |  |
| --- | --- | --- |
| S.NO | Pre-test (20%) | Post-test (20%) |
| 1 | 7 | 9 |
| 2 | 6 | 10 |
| 3 | 3 | 6 |
| 4 | 5 | 8 |
| 5 | 6 | 4 |
| 6 | 7 | 3 |
| 7 | 8 | 8 |
| 8 | 6 | 9 |
| 9 | 5 | 9 |
| 10 | 5 | 9 |
| 11 | 10 | 9 |
| 12 | 7 | 10 |
| 13 | 8 | 6 |
| 14 | 7 | 9 |
| 15 | 4 | 5 |
| 16 | 5 | 3 |
| 17 | 6 | 10 |
| 18 | 5 | 5 |
| 19 | 6 | 9 |
| 20 | 7 | 7 |

***Appendix G-*Item analysis pilot study of pre-test**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13 | Q14 | Q15 | Q16 | Q17 | Q18 | Q19 | Q20 | Total |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 12 |
| 2 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 7 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 5 |
| 5 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 |
| 6 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 10 |
| 7 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 11 |
| 8 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 9 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| 10 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| 11 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 10 |
| 12 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 11 |
| 13 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 12 |
| 14 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 10 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 |
| 16 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 5 |
| 17 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 6 |
| 18 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 5 |
| 19 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 |
| 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 7 |
| Total | 11 | 9 | 8 | 6 | 8 | 4 | 7 | 11 | 7 | 6 | 10 | 5 | 6 | 5 | 6 | 4 | 8 | 6 | 7 | 8 | 146 |
| P valu | .55 | .45 | .4 | .3 | .4 | .2 | .35 | .55 | .35 | .3 | .5 | .25 | .3 | .25 | .3 | .25 | .4 | .3 | .35 | .5 |  |
| D value | 0.66 | .33 | .33 | 0.5 | 0.33 | 0.33 | 0.33 | 0.66 | 0.33 | 0.5 | 0.33 | 0.33 | 0.5 | 0.33 | 0.33 | 0.33 | 0.5 | 0.33 | 0.5 | 0.33 |  |
|  |

**Item analysis pilot study of post-test**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13 | Q14 | Q15 | Q16 | Q17 | Q18 | Q19 | Q20 | Total |
| 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 11 |
| 2 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 13 |
| 3 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 6 |
| 4 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 8 |
| 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 4 |
| 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 3 |
| 7 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 8 |
| 8 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 12 |
| 9 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 12 |
| 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 9 |
| 11 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 9 |
| 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 13 |
| 13 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 6 |
| 14 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 15 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 3 |
| 17 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 11 |
| 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 5 |
| 19 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 9 |
| 20 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 7 |
| Total | 11 | 7 | 8 | 8 | 7 | 7 | 6 | 8 | 8 | 10 | 4 | 6 | 7 | 9 | 10 | 11 | 6 | 7 | 8 | 14 | 168 |
| P value | .55 | .35 | .4 | .4 | .35 | .35 | .3 | .4 | .4 | .5 | .2 | .3 | .35 | .45 | .5 | .55 | .3 | .35 | .4 | .7 |  |
| D value | 0.33 | 0.5 | 0.33 | 0.5 | 0.33 | 0.33 | 0.33 | 0.5 | 0.66 | 0.5 | 0.5 | 0.5 | 0.33 | 0.5 | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 |  |

***Appendix H-*Sample lesson plan based on advance organizer model**

Name of the teacher-Asay Gidena, Duration-40min, Grade&sec-11c

Lesson 1-Work as a scalar product

|  |  |
| --- | --- |
| Teacher’s activities  | Students’ activities |
| Phase I: presentation of the advance organizer (5 min)teachers present the advance organizer (chart) in front of the students and ask students to observe the pictures and to reflect what they understand from the pictures. The advance organizer is presented at appendix J. | Students observing the pictures on the different type of organizers(eg chart ) and reflect what they observe from the organizers. |
| Phase II: presentation of the learning task or material (20 min)* Teacher give orientation to the process
* Teacher provide positive exemplars(yes) and negative exemplars(No)

Exemplars* If force is parallel to distance there is work done(yes)
* If the force is perpendicular to distance no work done(No)
* If force is applying but no distance no work done(No)
* If force is not applying to an object(No)
* If force is applying to an object at an angle to the horizontal (yes and No)
* Teacher ask the students to classified as yes or no the pictures from the chart
 | Students define the conceptStudents categorized the pictures in to yes or noGive additional yes or no examples |
| Phase III:strengthening of cognitive organization (15 min)Teacher presents unlabelled examples one by one and ask students to classify as yes or noTeacher ask students to give yes or no examples | Students labeled the unlabelled examples as yes or noStudents give yes or no examples Students analyze their hypotheses Students describe their thought process |

***Appendix I*-Sample lesson plan based on conventional teaching method**

Name of the teacher -Asay Gidena Grade & section-11B Duration -40min

Lesson 1-Work as a scalar product

Objective of the lesson

Define work done with their own words

Verify formulae for work done

Explain the concept of work based on point of view of physics

Solve different problems using the formulae for work done

|  |  |
| --- | --- |
| Teacher’s activities  | Students’ activities |
| Phase I: Introduction(5min)The teacher prepares student for the lesson. The teacher refers to knowledge learned in previous lessons. The teacher Previews new lesson, often with a question | Students answer the question asked by their teacher |
| Phase II: presentation(23min)The material is presented by the teacher. Example here the teacher explains about definition work and different concept about work done and solve different examples about work donePhase II: Stabilization(7min) | Students listen attentively to what their teacher presentStudents ask and ask question  |
| Phase II: Stabilization(7min)The teacher summarizes the main points of the lesson. Example in this lesson the teacher summarizes the main point of work.Work is the transfer of energy.Work is the scalar product of force and the displacement along the direction of the force .i.e. W=F.sWork is given by the following formula when the force makes an angle θ to the horizontal W=Fscosθ | Students take the short notes Students ask questions |
| Phase Iv: Evaluation(5min)The teacher asks questions to the students to check if the objectives are achieved.ExamplesDefine work done with your own wordsExplain the concept of work from physics point of viewGiven that F=50N & S=5m if F and S are parallel find W? | Students answer questions |

***Appendix* J-Chart Presenting Advance organizer about concept of work**

A B C D E F



 G H I J K L

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 M N O P Q

