BINDURA UNIVERSITY OF SCIENCE EDUCATION

DEPARTMENT OF ENVIRONMENTAL SCIENCE

BACHELOR OF SCIENCE HONOURS DEGREE IN SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT

ESM115

BSc PART I EXAMINATION

Basic Physics   JUN 2025

2 HOURS

INSTRUCTIONS

Answer **All Questions** from SECTION A, and **two** questions from SECTION B

SECTION A (ANSWER ALL QUESTIONS IN THIS SECTION)

QUESTION 1-10 CARRIES 1 MARK EACH

1. A pulley system lifts a 100N load with a force of 20N. The input distance is 3m and the output distance is 0.5m. The efficiency of this pulley system is:

A. 62.5%

B. 75.0%

C. 83.3%

D. 92.75%

2. It takes 120N of force to raise the flag up the flagpole. The load is 120N. What is the mechanical advantage?

A. 0

B. 1

C. 120

D. 240

3. A machine which has an efficiency of 80% raises a load of 50 N through a vertical height of

10 m. The work input to the machine is:

A. 400 J

B. 500 J

C. 800 J

D. 625 J

4. Friction converts kinetic energy to:

A. Mechanical energy.

B. Potential energy.

C. Non-mechanical energy.

D. Total energy.

5. A diving board is an example of what simple machine?

A. Class 1 lever

B. Class 2 lever

C. Class 3 lever

D. Inclined plane

6. Which term represents a vector quantity?

A. Work.

B. Power.

C. Force.

D. Distance.

7. The efficiency of a simple machine is:

A. Is always less than 100%

B. Is equal to 100%

C. Is always 50%

D. Is always more than 100%.

8. If the mechanical advantage of a simple machine is 4, then the:

A. Output force is 4 times the effort.

B. Effort is 4 times the output force.

C. Efficiency is 4%.

D. The work output is 4 times the input.

9. Momentum is the product of.

A. Mass and velocity.

B. Mass and acceleration.

C. Velocity and acceleration.

D. Force and inertia.

10. A car initially at rest accelerates in a straight line at 3 m/s². What will be its speed after 2 seconds?

A. 0 m/s.

B. 5 m/s.

C. 3 m/s.

D. 6 m/s.

11(a). A person uses a 75-newton force to push a 51-kilogram car up a ramp. The ramp is 10 meters long and rises one meter. Calculate the efficiency. [5]

(b). Why are work and energy both measured in joules? [4]

(ci). A car starts from rest and accelerates uniformly over a time of 5.21 seconds for

110 m. Determine the acceleration of the car. [3]

(ii). State the differences between longitudinal waves and transverse waves [4]

(d). Classify each of these as a first-, second-, or third class levers:

(i) See-saw [1]

(ii) Baseball bat [1]

(iii) Door on hinges [1]

(iv) Scissors [1]

SECTION B

12(a). The motion of a body describes a 5 x 2m rectangle ABDC.
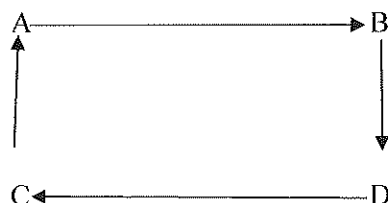
After the motion what is the:

(i) distance travelled? [2]
(ii) displacement? [2]

(iii) Convert: 120km/h into m/s [2]

(iv) Convert 15m/s into km/h [2]

(b). Define momentum and show that force may be defined as the rate of change of momentum. [4]

(c). What do you understand by the conservation of momentum? [2]

(d) Complete the table below: [6]

Property	SI unit
Volume	
Force	
Energy	
Pressure	
Acceleration	
Speed	

13(a). Explain the difference between energy and power as they are used in physics. **[4]**

(b). Simple machines can be used to obtain four different effects! Describe each effect. **[4]**

(c). In a store, two workers are lifting 5kg bags of flour onto the shelves. There are five shelves, 0.4m apart. The lowest shelf is 0.4m from the floor. Figure 1 shows the two workers.
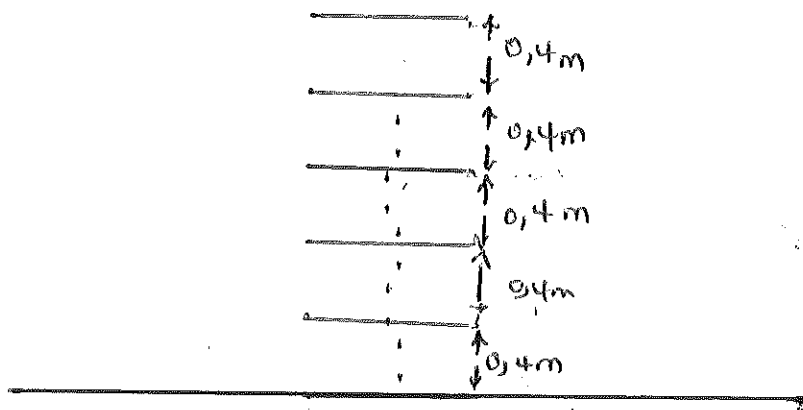

Figure 1 Shows the worker X and Y lifting a bag from the floor

Worker X lifts three bags from the floor to shelf 2. Worker Y lifts one bag from the floor to shelf 5.

(i). Which worker has done more work than the other? [2]

(ii). Use calculations of the work done to explain your answer. [5]

(d). Each worker lifts one bag from the floor to shelf 2. Worker X does this more quickly than worker Y. Which worker exerted the higher power during their lift? Explain your answer. [5]

14. A lift rises vertically from rest with constant acceleration. After 4 seconds it is moving upwards with a velocity of 2m/s. It then moves with a constant velocity for 5 seconds. The lift then slows down uniformly, coming to rest after it has been moving for a total of 12 seconds.

(a)(i). Sketch a velocity-time graph for the motion of the lift. [4]

(ii). Calculate the total distance travelled by the lift. [3]

(b). An airplane accelerates down a runway at 3.20 m/s^2 for 32.8 s until it finally lifts off the ground. Determine the distance travelled before take-off. [3]

(c). What factors affect the friction force between two surfaces? [2]

(d). A force of 70N was applied over a distance of 1230mm which lifted a load of 468N through 106mm. Determine:

(i)   VR   [1]
(ii)   MA   [1]
(iii)   Work input   [2]
(iv)   If friction was zero, what effort would be required?
        [2]
(v)   What is the effort used to overcome friction?
        [2]

End of paper