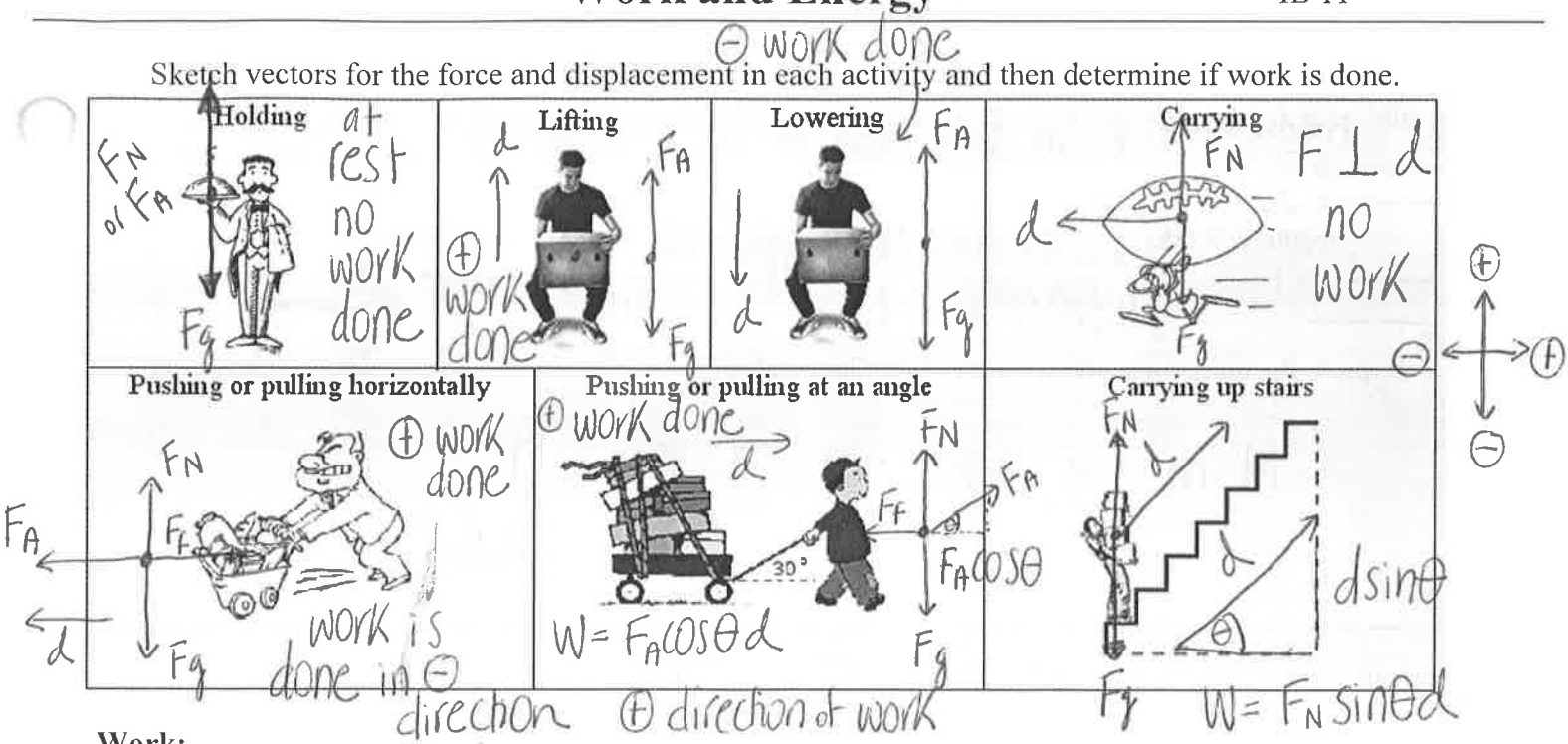
Ms. Rosenthal P.3 Fall 2018

Work and Energy

IB 11

Sketch vectors for the force and displacement in each activity and then determine if work is done.



Work:

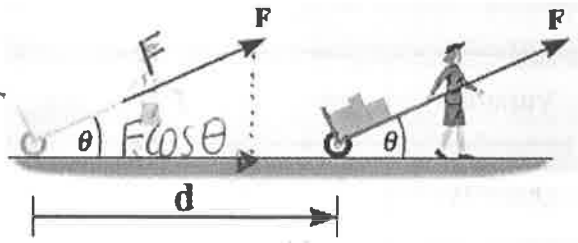
1) The product of force and the component of displacement in the direction of the force.

2) The product of displacement and the component of the force in the direction of the displacement.

Formula: $W = F \cdot d$

$W = F\cos\theta\, d$ $W = mad$

When F & d are ⊥, the $\cos\theta = 0$



Variable:	W	F	d	θ
Quantity:	work	force	displacement	angle between force & displacement
Units:	N·m = J Joule	N	m	degrees
Type:	scalar	vector	vector	scalar

1. Work is a scalar but it can be positive or negative. Explain.

Positive Work: $\vec{F}$ in direction of $\vec{d}$ = ⊕ work angle = 0° cos(0°) = 1

Negative Work: $\vec{F}$ in direction opposite of $\vec{d}$ = ⊖ work

cos(180°) = −1 angle = 180°

2. Express the units for work in terms of fundamental units.

$N \cdot m = Kg \cdot \frac{m}{s^2} \cdot m = \frac{Kgm^2}{s^2} = J$ (Joule)

Power: a) rate at which work is done

b) rate at which energy is transferred or transformed

Formula: $P = \frac{W}{t}$ Alternate Formula: $P = \frac{F \cdot d}{t} = F v_{avg.}$

Variable:	P	W	t
Quantity:	power	work	time
Units:	$\frac{J}{s}$ = Watt (W)	J	s
Type:	scalar	scalar	scalar

1. Express the units for power in terms of fundamental units.

$\frac{Kg\frac{m^2}{s^2}}{s} = \frac{Kg\,m^2}{s^3} = Watt$