

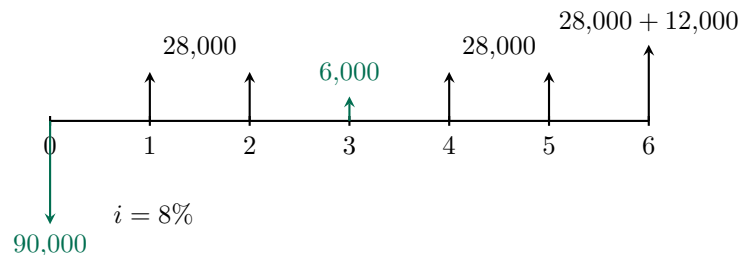
In-Class Activity 14 (Version B)

Name: _____ ID: _____ Section: _____

(25 points) *Wadi Phosphate* runs a rock supply chain: ore is mined, *beneficiated** into phosphate concentrate, and hauled from the pit to the processing plant. The firm's MARR is **8%** per year throughout. The CEO asks you to help in two engineering-economic decisions:

* *Beneficiation is the process of converting phosphate rock into phosphate concentrate.*

(a) Upgrading the beneficiation plant (13 points). A **6-year** beneficiation upgrade costs **90,000 SAR** today and raises net concentrate revenue by **28,000 SAR per year** in years 1–6. A scheduled **mid-life overhaul** at the **end of year 3** costs **22,000 SAR** (so the net flow that year is 28,000 – 22,000 = 6,000 SAR). The equipment is resold for **12,000 SAR** at the end of year 6.



Useful factors at $i = 8\%$:

$(P/A, 8\%, 6)$	$(P/F, 8\%, 3)$	$(P/F, 8\%, 6)$	$(F/P, 8\%, 6)$
4.6229	0.7938	0.6302	1.5869

- (i) **(6 pts)** Compute the **net present worth** at the MARR. State the accept/reject decision **and** explain briefly what the NPW number means to Wadi Phosphate (relative to what alternative).

- (ii) **(7 pts)** A vendor offers an alternative to option (i): for the **same 90,000 SAR** upfront, buy a **perpetual** beneficiation service that yields a net benefit of **9,000 SAR every year forever**. Find the **capitalized equivalent** of that perpetual benefit and state which option — the 6-year upgrade in (i) or this perpetual service in (ii) — creates more value for Wadi Phosphate today.

(b) **Choosing the pit-to-plant haulage system (12 points).** Rock **must** be moved from the pit to the plant regardless of choice. The firm must install exactly one of two systems (MARR = 8%):

Alternative	First cost	Annual O&M	Service life	Salvage
T — Truck haulage	50,000	26,000	4 yrs	6,000
P — Slurry pipeline	120,000	11,000	8 yrs	15,000

Useful factors at $i = 8\%$:

$(P/A, 8\%, 8)$	$(P/F, 8\%, 4)$	$(P/F, 8\%, 8)$
5.7466	0.7350	0.5403

- (i) **(7 pts)** Draw the cash flow diagram, compute the **present worth** of each alternative (replicate the shorter-lived system as needed) and state which option (T, P, or Do Nothing) is better today.

- (ii) **(5 pts)** Suppose instead the pit is now scheduled to be **exhausted in exactly 5 years**. **Without recomputing**, discuss how the analysis would change:

- what the new horizon is,
- how the first cost, O&M cost, and salvage value of each alternative change,
- why the truck haulage's salvage credit at the new cutoff would be very high.